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Petite Suite:
The Introduction of the Micro-computer in a CEGEP's Music School

Jean-Louis Van Veeren

A Thesis

in

The Department

of

Education

Presented in Partial Fulfillment of the Requirements for the
Degree of Master of Arts at
Concordia University
Montréal, Québec, Canada

August 1987

ISBN 0-315-37098-X

Abstract

Petite Suite:
The Introduction of the Micro-computer in a CEGEP's Music School

Jean-Louis Van Veeren

This thesis is an actual case study of the introduction of the micro-computer and/or computerized equipment in a CEGEP's Music School with the writer as a participant observer.

The case study includes needs assessment and the evaluation of the teachers' attitudes towards the computer through a survey. The lines of least resistance are discovered through a cybernetic model of the Music School.

From the findings of the survey, the cybernetic model and relevant research material is drawn a policy to introduce the micro-computer and/or computerized equipment in the Music School and provisions to evaluate the effects of the implementation.

As the Music School is owned by a religious order and under contract to provide music education at college level, it is an exceptional case.

The technical know-how of the teaching staff who will use the computer and incorporate the computer and computerized teaching machines in their classes is extremely varied and ranges from that of young teachers just graduated from university to that of nuns over the age of retirement.

Some people are already 'computer literate' whilst some are extremely frightened by the prospect of being 'replaced by a machine'. The reins of power are held by conservative and 'technology shy' teachers and administrators.

The overall philosophy of the research is that people are more important than machines and that the feelings of the people involved have to be respected.

There is nothing more difficult to carry out, nor more doubtful of success, nor more dangerous to handle, than to initiate a new order of things. For the reformer has enemies in all those who profit by the old order, and only lukewarm defenders in those who would profit by the new order, this lukewarmness arising partly from fear of their adversaries, who have the laws in their favor; and partly from the incredulity of mankind, who do not truly believe in anything new until they have had actual experience of it.

Niccolò Machiavelli

Suite: A group of self-contained instrumental movements of varying character, usually in the same key. The term is from the French *suite de pièces.*

Britannica Book of Music

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Foreword

This thesis is the outcome of four years of research on the application of educational technology in the teaching of music.

The writer has been fortunate in having a full-time teaching position in the music department of CEGEP St-Laurent where most of his newly-acquired pedagogical knowledge or skill could be immediately put to the test and applied.

He has also been extremely fortunate in having a Director who not only was understanding enough to give him moral support but who 'jumped on the band-wagon' almost immediately and made this research a part of the writer's job description.

The thesis contains extensive quotes from previous works as most of the focus of the writer's output throughout these four years has been concentrated on three major questions: Is there a need for change? why? How should that change take place?

The starting point is an idea of T. J. Gustafson (1985, p. 154) : " Too often, computers go solely to science and mathematics departments. Social sciences, physical education, home economics, art and music are left out."

There are three major parts to this work.

First, the problem is surrounded. It is put in historical perspective. A model of the Music School describes the field of operation and analyzes as much as possible the dynamics involved. The related research is explained and the state of the labor market is assessed.

Second, the problem is analysed. Some definitions are required. What constitutes 'good change?' Why do people react differently to changes in their environment? What is the present position of the teachers of the Music School toward the inclusion of computerized equipment in their working environment?

Third, a plan is drawn to resolve the problem. This plan is followed by a description of how the process of implantation took place. It includes the results of a pilot study, an attempt at explaining why little happened as it was supposed to happen and which measures where taken to adapt and adjust the plan to an ever-changing situation.

Problem Identification

Background Information

Settings

CEGEP St-Laurent is a large CEGEP with 20 departments employing 250 teachers serving 3500 students (These numbers may change from year to year).

The Music School (Ecole de Musique SAINTE-CROIX) is located at the back of the campus of the CEGEP. It is a private institution owned by a religious order (les soeurs de SAINTE-CROIX) who are under contract to teach for the CEGEP. Beside fulfilling their obligations to CEGEP students, the teachers of the Music School teach instrumental music and theory to children and adults.

Historical Perspective

In December, 1982 an article published in L'actualité [1] stated that in the near future people who did not know how to work with a computer would be considered illiterate. The public outcry was such that the provincial government took swift action to introduce the computer and computer-assisted instruction into the schooling system. In August of the same year, the Ministry of Education published: "Micro-informatique, Proposition de développement." It stated that the government of the province of Québec had decided to embark resolutely on a technological turn (virage technologique).

This, in turn, has sensitized the administrators of the CEGEPs and the Directors of the music departments of the CEGEPs to the changing conditions in their environment.

To make matters worse, over the years, the population of children of school age has been slowly dwindling. Every year, the School Boards are closing more schools. At CEGEP level this decrease in population is partly

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[1] L'actualité, MacLean Hunter Limitée, 1001, boul, de Maisonneuve ouest Montréal H3A 3E1.

counteracted by an increase in the adult student population. When the economic situation is bad and jobs are scarce, a student loan is a better income than welfare payments. Hence, the administrators of the CEGEPs and the Directors of departments are increasingly aware that the CEGEPs are competing with each other over a diminishing clientele and that the survival of their place of employment is threatened.

Response at CEGEP Level

In April 1984, the pedagogical committee of the CEGEP decided to form a committee to investigate the needs of all the departments of the CEGEP for computers and computerized equipment. This committee was formed of influential teachers, administrators and the Director of the CEGEP's computer center.

The first decisions of the committee were:

- To focus strictly on CAI
- To spend the whole budget on hardware. (10 machines for the students and 10 for the teachers).
- To spread the 20 machines on different locations across the campus to limit traveling time.
- The machines recommended were IBM PCs.

There was no formal plan for support and instruction. The teachers were supposed to learn about the new technology on their own and in their own time. There has been some formal training organized off-campus for people teaching in some key departments (electricity, mechanics and computer-assisted design).

Response at Music School Level

The Director of the Music School was asked by the committee in charge of evaluating the needs of the CEGEP to assess the needs of the Music Department. In September 1984, rather than evaluating these needs himself,

he decided to ask the writer to spend half of his workload on in-depth research into the uses of the computers and/or machines to teach music.

Why the Writer Was Suited for the Evaluation Task

The writer has been working for the Music School since 1972. First, in the capacity of a classical guitar teacher, then as a theory and ear-training teacher and finally, as the individual responsible for the ear-training and theory program of the preparatory school. In 1981, he was asked to teach classical guitar, theory and ear-training at college level.

Prior to completing a BFA with a major in music at Concordia University, he studied electronics for 3 years and has had 2 years experience repairing scientific instruments. During his BFA, he took some courses in electro-acoustic music and since 1983, has been working on a Master's in Educational Technology.

Philosophy of the Research

The writer suspects that the media and the provincial government are 'barking up the wrong tree' when they talk about 'le virage technologique'.

There is no 'technological turn'. What we face, as a society, might be a revolution, a drastic change in our way of thinking and our way of looking at the world.

One of the contributing factors to the revolution which led civilization from the darkness of the Middle-Ages to the enlightenment of the Renaissance was the invention of the printing press. Information became cheaper and available to all who could read. Most of the technological innovations which have had an impact on our civilization dealt with communications and information. The railroad, the car, the typewriter, aviation, the telephone, radio and TV have been incorporated into our lives to such an extent that they have become necessities, things that we feel we cannot go without.

In 1982, J. Naisbitt wrote in Megatrends that the United States is shifting rapidly from an industrial society to one organized around the distribution of information.

Also in 1982 David Godfrey wrote in Gutenberg Two , a book which he edited with Douglas Parkhill (p. 1): "All information in all places at all time. The impossible ideal. But the marriage of computer with existing communications-links will take us far closer to that goal than we have ever been".

Not only is the term 'virage technologique' misleading but it is also dangerous because the stress on the technological aspect implies that any individual or organization will become 'up-to-date' just with the purchase of the proper machines.

Just as much as computers will revolutionize our ways of thinking, the introduction of computers and computerized teaching machines in the classroom will drastically alter the educational system. T.J. Gustafson (1985, p. 153) writes:

> " Are the computers a threat to the basic purpose of the schools? The answer is YES. Computers are much more threatening to adults than to children. Students accept the technology and master it quickly. Most adults, on the other hand, are intimidated by the computer. Students who become competent in using the computer will have skills that open society to them. Sheer computing power will be available to them at the touch of a key. All the information in all the world's data banks will be open to them. They will possess advanced communication skills, making the current adult world obsolete. They will master the curriculum faster and more completely than any previous generation. They will indeed know more than their parents, teachers, politicians, leaders, and employers. Computer knowledge will not be the prerogative of the white race or the wealthy. If computers are to be installed in the classroom, the primary purpose of the schools must change."

In that sense, the term 'virage pedagogique' would have been much more appropriate. It is not a question of buying a few machines and training people to use them. It is a question of helping people discover that they have to change their ways and attitudes and helping them to do so.

Model of the Music School

Components

The Director has a Phd in musicology and has been groomed for his job by his predecessor, an astute sister. To help him he has appointed a school council of seven members, some sisters, some lay persons. He can call or dismiss the council at will.

The population of the Music School varies. Each year, on the average, there are 55 teachers. Most of these teachers work part-time. The student body is approximately 150. The administration and support staff consists of 9 employees.

The course is two years long. There is an optional third year devoted to arranging and composition for students who wish to specialize in 'popular music' and go straight to the labor market.

The courses taught in the first and second year are:

- Music history.
- Theory.
- Harmony.
- Ear-training and dictation.
- First and second instrument.
- Large and small ensembles.

The optional third year courses are:

- Composition.
- Arranging.
- Improvisation.

Concert performance in all years is an extra-curricular activity strongly encouraged.

Resources

The funds to operate the Music school come from the budget of the CEGEP. The building is public property and is maintained by the CEGEP's staff.

The teachers are hired or fired by the Director of the Music School. There is no union. Most teachers and staff are hired by recommendation.

The students are attracted from all over the province by the reputation of the Music School.

Boundaries

The boundaries of this model follow the 'golden rule' (Parker and Hart 1971, front cover): "Whoever has the gold, makes the rule."

The Music School is a subsystem of the CEGEP. The administration of the Music School is allocated money on a 'per capita' basis from the DSA (Direction des services administratifs.) All the decisions concerning the curriculum and the enrollment of students are made at the level of the DSP. (Direction des services pédagogiques).

On matters that deal strictly with the music curriculum there is a direct link between the Music School and the DGC (Direction générale de l'enseignement collégial).

The Director of the Music School answers to the Board of Directors of the Congregation which owns the Music School.

Since the administration of the Music School is allocated money on a 'per capita' basis and since students are attracted by the most prestigious school, the administration of the Music School has developed a very sensitive ' reputation sensing network'. The Director and the 'establishment' of the Music School are constantly aware of the status of their reputation vis-à-vis high school administrators, their students, other music schools, private teachers within a reasonable radius of Montréal, the administrators, the teachers and the students of the thirteen other CEGEPs teaching music, and university circles. That 'reputation' has never been defined nor quantified.

Objectives

The stated objective of the system is to provide students with enough musical and academic knowledge to allow him/her to gain entrance to a music faculty or department in a university. For those who take the optional third year, the objective is to give them the extra knowledge necessary to function as professional musicians in the field of 'popular music.'

The entrance requirements are clearly stated in the syllabus of the Music School. The administrators of both the Music School and the CEGEP make a genuine effort to ensure these requirements are known in the high schools and music schools of the province. The registrars of the universities also ensure that the administrators and students of the CEGEPs are well-informed of their requirements.

The content of each course is precisely described in the syllabus of the CEGEP and teachers are required to hand out course outlines which may be discussed during the first lesson.

Conflicts

For those students coming into the system expecting that a 'musical education' will encompass mostly the affective domain there is conflict because the accent is definitely on the cognitive domain.

The source of the problem is in the 'serial input' aspect of the school system as a whole (See fig. 1). What the Music School does has to be quantified in order to assess whether or not the student meets the requirements of the next subsystem.

The accent is on measuring how many bits of information have been transmitted from teacher to student, how much his/her skill has improved and how much the student has memorized. There is very little done to assess the student's aesthetic taste, to assess his/her problem solving mechanisms or the development of the student's creativity. Each subsystem of the educational system is taking the 'easy way out.' Measuring what is easy to measure and ignoring the rest.

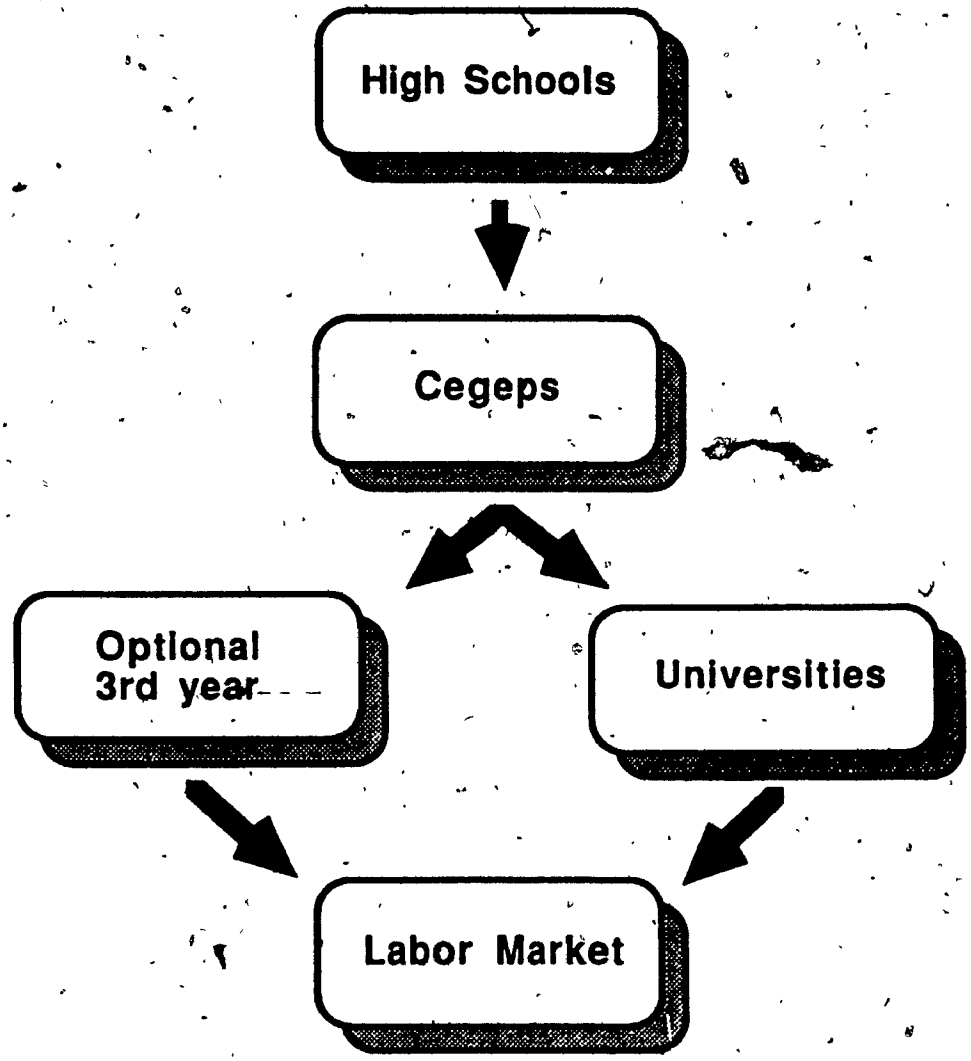

Fig 1: Music Education System

A more recent source of conflict is caused by mounting evidence of drastic and rapid changes in the working conditions of the 'studio musicians.'

Negotiation of goals

All goals are set by the DGEC and the DSP. All negotiations are made at the meta-system level.

Communications and Feed-back

The Director of the Music School controls most of the communication with the outside world. Three other persons communicate with the environment but they have limited responsibility. They are the accountant, the coordinator of students' schedules, and the teacher in charge of liaison with the high schools. In case of conflicts, these people report directly to the Director who initiates negotiations.

Variety of communication and feed-back

The communication lines with the largest bandwith are at the meta-meta and the meta-system level. The Director meets regularly with the heads of the other Music Departments of the CEGEPs of the province to discuss joint policies. He communicates frequently with the D.S.P. (Direction des services pédagogiques), the D.S.A. (Direction des services administratifs), The Director of the equipment, the A.P.I. (Aide pédagogique individuelle) and the registrar's office. The communications with the universities, the high schools and the private teachers are much less frequent and much more informal.

The communication channels can be divided into four types.

- Those that provide and receive information and feed-back for goal setting and strategies. (These are the communications at the meta-meta and the meta-system level).

- Those that scan the next level of the serial input to detect changes. (These are the communications with the universities.)

• Those that scan the lower level of the serial input to detect changes. (These are the communications with the high schools, the other music schools and the private teachers.)

• Those which control and give feed-back to the personnel and students of the Music School

Schoderbek, et al. (1975, p. 170) wrote: "Communication and decision-making are inseparable, since the decision process must rely on information. Likewise, if decisions are to be carried out, they must be communicated to the people in the organization."

Most internal lines of communication and feed-back loops pass through the Director of the Music School. Table 1 is a chart of these communication lines with the description of the category (support, administration or pedagogy), the issues of the communication (library, account or concerts) and the number of people involved. Some people see the Director very seldom, others, like the writer have reasons to talk to him often and regarding several different subjects.

Each line of communication carries its own noise and feed-back messages. The Director is at the hub of a network of over 250 channels.

Hierarchy of communications and feed-back.

Communications with the DGEC, the administrators of the CEGEP, and the other heads of music departments take precedence over all others.

Most of the communications and feed-back loops between the Director and the teachers and staff take three forms:

• Formal messages in the form of letters and memos

• Formal group-meetings.

• Formal and informal meetings on a one to one basis.

There is a feed-back loop between the Music School and the universities and another between the Music School and the high schools. It consists of controlling the amount of students either accepted by the next system in the

serial input or 'advised' to apply in one institution rather than another. This feed-back loop has never been qualified or quantified. In many cases, it is just gossip. In some instances, it is malicious gossip. Yet, two factors are predominant;

Category of communication	Topic of communication	Number of people involved
Support	Material and instruments	1
	Library	2
	Record library	1
	Night watch	3
	Accompaniment	2
	Concerts	1
Administration	Secretariat	2
	Accounting	1
	Schedules	1
	Information	1
	Council	6
Pedagogy	CAI	1
	Big ensembles	3
	Small ensembles	21
	Preparatory School	1
	Teacher's problems	55
	Student's problems	150
		252

Table 1: Internal communications and feed-back loops passing through the Director.

on the one hand, an institution tries to attract the most qualified students. On the other, an institution tries to steer the graduating students toward the next

institution in the serial input which has the best curriculum and/or teachers. Again, what is best has neither been qualified nor quantified and depends heavily on gossip.

The organization of the Music School is peculiar inasmuch as the administrator and teachers are employed by the Congregation whilst being paid from the budget of the CEGEP. No promotions, demotions, or raises are under the control of the administration of the CEGEP. All communication lines and feed-back loops are virtually cut below the level of the Director.

This cut avoids the possibility of a conflict of interest between the objectives of the CEGEP and the objectives of the Congregation. It also prevents the teachers of the Music School from getting conflicting feed-back loops. The administration of the CEGEP sets the objectives and the administration of the Music School decides the tactics.

Disturbances and control mechanisms

The main disturbances within the Music School are not pedagogical problems. There are control mechanisms both at the school level and at the CEGEP level to deal with these problems. They are not 'youth revolt' or the 'generation gap' for the same reasons. The main cause of disturbance in the Music School is the bitter in-fighting between the teachers or between the members of the support staff. The Congregation owns the Music School, all its members are equal partners and answer only to the Mother Superior, consequently, the sisters who work in the Music School have a very strong sense of personal ownership. They cannot be fired and in case of conflict they might take their problems not to the Director but to their Mother Superior. Furthermore, not only do they take their working problems home (they live together) but they also bring their personal vendettas to work.

Herbert A. Simon (1969, p. 219) writes:

"I shall not try to settle which is the chicken and which is egg: whether we are able to understand the world because it is hierarchic or whether it appears hierarchic because those aspects of it which are not elude our understanding and observation.

(p. 197) ...In a hierarchic formal organization each system consists of a 'boss' and a set of subordinate subsystems. Each of the subsystems has a 'boss' who is the immediate subordinate of the boss of the system."

The Music School is suffering from the legacy of its past. It used to be a totally independent system answering only to the Ministry of Education. The Congregation was in total control of both the strategies and the tactics. The administrators were sisters, the teachers were sisters and so was most of the support staff. All the problems brought to the community were dealt with by the community.

Since the Second World War, the population of religious communities has been steadily declining as fewer women are attracted by the religious orders and more are leaving. The Congregation has found it harder and harder to find competent teachers and administrators and is now having difficulty finding sisters able to perform secretarial tasks. As a result, more and more lay people have assumed positions of influence.

As Schoderbek et al. (1975, p. 56) explain: " Organizations unable or unwilling to adapt to take advantage of opportunities or to react to crises facing them are bound to fail." The administration of the Music School, because of a lack of requisite hierarchy suffers from a lack of requisite variety.

Another problem is caused by an extreme sense of competition between the teachers who teach instrumental music, particularly among the piano teachers. This competition is triggered in part by the fact that the 'best piano teachers' are given the most gifted students while the 'humdrum' teachers teach the average piano student or, even worse, piano as a second instrument. At times, this struggle for 'pecking position' has reached Wagnerian heights. Once more, this internal feed-back loop is neither qualified nor quantified. It is particularly loaded with malicious gossip. Again, when the problem is brought into the congregation instead of being dealt with at the level of the Music School it is prone to be blown out of proportion.

A totally different problem, possibly more damaging, is caused by the lack of requisite hierarchy. The Director has to function constantly at maximum channel capacity. D. A. Norman (1969, P. 90) explains it as such:

> "If the human observer is a reasonable kind of communication system, then when we increase the amount of input information the transmitted information will increase at first and will eventually level of at some asymptotic value. This asymptotic value we take to be the channel capacity of the observer: it represents the greatest amount of information that he can give us about the stimulus on the basis of an absolute judgment. The channel capacity is the upper limit on the extent to which the observer can match his responses to the stimuli we give him."

The Director controls all disturbance by establishing a hierarchy of priorities. Big problems are dealt with immediately. Small problems go unattended until they grow into bigger problems or until the sheer accumulation of small problems forces him to work nights or weekends.

The Hidden Structure

At first, it was the opinion of the writer that the introduction of 'high tech' tools in the Music School should start with the administration.

However, the committee in charge of evaluating the needs of the CEGEP strongly recommended to concentrate exclusively on the pedagogical needs and the Director of the Music School was, at first, endorsing that recommendation.

The apparent lack of requisite hierarchy in the Music School means that it might be necessary to wage as many battles as there are individuals strongly opposed to changing their ways.

Yet, one can remember the words of Herbert A. Simon (1969, p.197): "If we make a chart of social interactions, of who talks to whom, the clusters of dense interaction in the chart will identify a rather well-defined hierarchic structure."

Everett M. Rogers (1983, p. 25) calls it a "communication structure" and explains: "A complete lack of communication structure in a system

would be represented by a situation in which each individual talked with equal probability to each other member of the system. Such a situation might occur when a set of complete strangers first come together. But regularized patterns soon begin to occur in the communication network of the system. And these aspects of communication structure predict, in part, the behavior of individual members of the social system."

In other words, even if all the teachers are theoretically equal, some might have more influence than others. To use the words of Gary Boyd [1]; they might have greater 'relevant credibility status'.

Rogers (1983, p. 27) calls 'opinion leadership': ". . . the degree to which an individual is able to influence other individuals' attitude or overt behavior informally in a desired way with relative frequency."

Who occupies what teaching position or responsibility could reveal who is/are the most influential teacher(s).

In the Music School, few teachers teach in a classroom setting. Those who do are the two history teachers, the three ear-training and theory teachers and the arranging teacher. There is a School Council of which five members are teachers.

Since the Congregation owns the Music School, being part of it is a distinct advantage to gaining relevant credibility status. Thus, a matrix of memberships to discover 'influential teacher(s)' should include:

-1 Is that teacher part of the Congregation?

-2 Is that teacher part of the school council?

-3 Does that teacher have responsibilities other than teaching?

-4 Does that teacher teach in a classroom setting?

-5 Does that teacher also teach instrumental music?

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1 Concordia University, ETEC 606, Fall 1984

As an observer, the writer excluded himself from the matrix. Also eliminated were the Director and the accountant since they do not have teaching positions.The matrix thus formed is in fig 2.

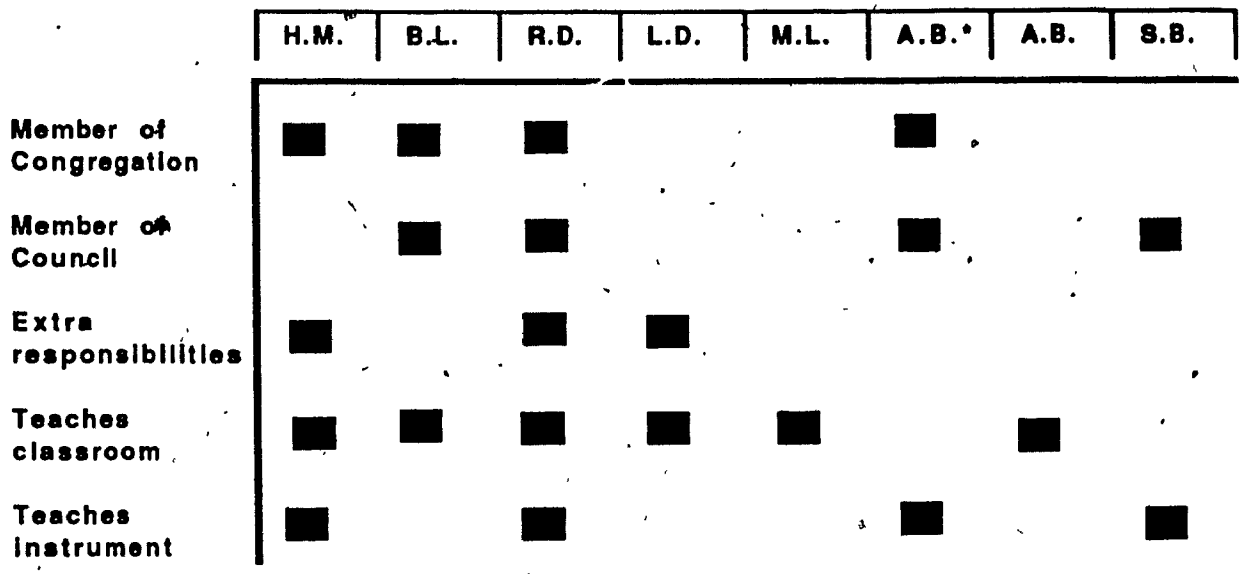

Fig. 2: Matrix of memberships within the Music School

One would have to spend hours observing the teachers and quantifying their interactions to do valid scientific research. Yet, the point is made that the teachers are not all on an equal footing. Some have more responsibilities and occupy more functions than others.

The limited scope of this model could not discover what Herbert A. Simon's defines as: " a well-defined hierarchic structure ", but it has been established that some structure is there and that Sister R. D. might have more influence than she admits.

Thus, if Sister R. D. or, for that matter, the other teachers who are influential enough to be part of the School Council and have extra administrative duties become convinced of the validity of the proposed

pedagogical changes, she or they might be capable of applying enough peer pressure to their colleagues to try these changes themselves.

The Place of the Writer in the Model

When the present Director took over, he recognized the writer's organizational qualities and gave him a full-time position shared between teaching, the organization of all concert-related activities at CEGEP level and, to provide a lay-person's point of view, a seat on the School Council. Since the beginning of the present research, the writer is also the 'official change-agent' for the Music School.

The teaching staff of the Music School is by an overwhelming majority female. The writer is the only male full-time teacher. The Director, as well as the writer are married and with two children. The Director values highly the weekly concerts and is also keenly interested in acquiring new pedagogical ideas and exchanging professional tips. This sharing of traits and values gives them many opportunities to talk, whether it is about children, the high cost of living, computers or ear-training strategies.

Literature Review

The related research has been a difficult issue. The first problem has been the time constraint considering the 'bandwidth' of the topic and unexpected and sudden changes within the Music School. A second problem has been the particularly uneven quality of the output of the research. The third problem has been caused by the dispersion of the related material across several not necessarily related fields of activity.

Michael Fullan quotes from research conducted by The Network Inc., Mass., and assisted by several other institutions, Dissemination Efforts Supporting School Improvement (DESSI) (Fullan 1982, p. 53):

> "The third important contribution of the DESSI analysis concerns the time-line of decisions. The study found that the median length of time from awareness to adoption was 9.5 months, while the median time for adoption decision to start-up was only 3.5 months. Thus, once the decision is made things happen quickly-too quickly in the sense that the short time-line provides little opportunity for planning for implementation. Or more precisely, planning for implementation is not recognized as an important component requiring more advanced attention. The DESSI study, in general, found that in several sites in which implementation began shortly after the adoption decision, serious problems arose related to the lack of needed training and materials. The transition for those with longer time frames tended to be more successful."

In the Music School, once a policy had been adopted, the attitude was: "Damn the torpedoes, full speed ahead!" The Director wanted some action, he wanted to see machines and people at work and he wanted to see it fast. Thus, practical considerations taking priority over theoretical ones, the related research was a process within a 'meta-process' which took place by leaps and bounds, and sometimes crawled.

Another factor which hindered the research is that there was what seemed like a hundred irrelevant papers for each valid research.

This is not new. In July 1945, Vannevar Bush stated in an article entitled 'As We May Think' published in Atlantic Monthly (Quoted in CD Rom: The New Papyrus , p. 3):

> "Professionally, our methods of transmitting and reviewing the results of research are generations old and by now are totally inadequate for their purpose. If the aggregate time spent in writing scholarly works and in reading them could be evaluated, the ratio between these amounts of time might well be startling. Those who conscientiously attempt to keep abreast of current thought, even in restricted fields, by close and continuous reading might well shy away from an examination calculated to show how much of the previous month's effort could be produced on call. Mendel's concept of the laws of genetics was lost to the world for a generation because his publication did not reach the few who were capable of grasping and extending it; and this sort of catastrophe is undoubtedly being repeated all about us, as truly significant attainments become lost in the mass of the inconsequential.
>
> The difficulty seems to be not so much that we publish unduly in view of the extent and variety of present-day interests, but rather that publication has been extended far beyond our present ability to make real use of the record. The summation of human experience is being expanded at a prodigious rate, and the means we use for threading through the consequent maze to the momentarily important item is the same as was used in the days of the square-rigged ships."

For one, the writer would disagree with the notion that we are not publishing too much. As an example, the author read what appeared like well-designed research conducted at Arizona State University with 33 students in two freshman eighteenth-century theory classes (Journal of Computer-based Instruction, February, 1980, Vol. 6, No. 3, 91-98). The subject of investigation was, among others, the optimal drill and practice time on the computer to learn ear-training. The maximum drill and practice time was 25 minutes three times a week.

Although the author made a thorough quantitative analysis of the data, from a musical point of view the research is meaningless. One cannot generalize from a sample of students who enrolled in a class about eighteenth century music theory to a population of music students any more than one could generalize from students enrolled in a course on avant-garde

composition techniques. There is, a priori, an aesthetic bias which confounds the purpose of the directional hypothesis. Furthermore, the writer who has worked extensively with remedial students in ear-training finds a time limit of 25 minutes three times a week ridiculously low. Should this research have been published? How did it pass through the editors? Did the editors know about music?

A third obstacle is well described by Sherry Turkle (1985, p. 219) who writes inThe Second Self about 'hackers' (hobbyists who love the computer and programming):

> "There is a strong music culture within the hacker community. Yet, it is one where preferences rarely move out of the Baroque. The hacker's computational aesthetic with its emphasis on intricacy of structure carries over to musical taste. Musical hackers are intrigued by contrapuntal complexity many see as 'mathematical', by the purity of compositional forms that depend less obviously on tonal color and drama for their effect."

A strong music culture can also be found among psychologists, educators, instructional designers. After all, isn't it one of the objectives of many middle and upper-class mother that her little girl or boy will one day play the piano?

Not only are there papers about music education in the journals specialized in school music, but one finds articles about music in journals devoted to such specializations as psychology, education, computer-assisted or computer-based instruction etc.

To demonstrate the width of the net necessary, the work of John Chowning, who conceived and developed FM synthesis, was published in an audio–engineering publication (Journal of the Audio Engineering Society, vol. 27, No 4, 1979). At the other end of the spectrum, Notes, the quarterly journal of the Music Library Association , announces in the issue of March 1987 (Vol. 43, No. 3, P. 564) the publication of a Directory of computer-assisted research in musicology compiled by Walter B. Hewlett and Eleanor Selfridge-Field from the Center for Computer Assisted Research in the Humanities in Menlo Park, California. Thus, the exploration of the possible

uses of the computer in a Music School streches from audio–engineering to the humanities, with little side trips into psychology, sociology, education, acoustics and/or computer science.

Computerized Searches

A review of existing literature from two computerized searches through the Educational Resource Information Center and one through Research In Computer Education brought the following:

Computer and music education

There are many articles on the uses of computers in music education in the Music Educators Journal [1], in the Journal of Research in Music Education [2] in Educational Technology [3] and once a year, the Journal of Computer-based instruction [4] devotes a complete issue to the uses of computers to teach music.

In the Music Educators Journal of February, 1969 is published an article written by Nancy B. Reich and entitled: " The Subject is Computers". In that article she mentions the pioneering works of Kuhn and Allvin on the use of computers for the teaching of ear-training and sight-singing published as far back as the 1967 winter edition of the Journal of Research in Music Education.

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[1] Music Educators Journal, 1902 Association Drive, Reston, Virginia 22091

[2] Journal of Research in Music Education, NEA Center 1201 Sixteenth St. N.W., Washington, D.C. 20036.

[3] Educational Technology Publication Inc., 720 Palaisade Av., Englewood Cliffs, New Jersey, 07632.

[4] Journal of Computer-Based Instruction, 215 South Main, Clarion, Iowa 50525

Introduction of computers in a school system

The second search was disappointing. Most of the material yielded was, in the opinion of the writer, either too specific or so general as to be inconsequentially shallow specially considering the comprehensive textbooks which have been written on that topic (Rushby 1979, Coburn et al. 1982, Patterson and Patterson 1983, Chambers and Sprecher 1983, Pantiel and Petersen 1984, Gustafson 1985, Cheevers et al. 1986).

Evaluation of existing software to teach music

The third search also was a disappointment. By the time a piece of software has been thoroughly analyzed and evaluated, much more material has been put on the market. Some of the machines on which that software is running might have undergone drastic changes or might have even completely disappeared. The field of micro-electronics is changing so fast that the publishing process does not seem to be capable of following the pace.

Reading of Periodicals

Much knowledge has been gained by reading periodicals and magazines devoted to computers, to music and to music education.

Computer magazines

The strong music culture mentioned by Sherry Turkle (1985, p. 219) is reflected in most magazines dealing with computing. All software developed to compose or edit music is carefully reviewed in magazines like; A+Magazine [1], InfoWorld [2], or in French MICRO MAG [3], even in very

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[1] A+ The Independant Guide for Apple Computing, 11 Davis Drive , Belmont, CA 94002

[2] InfoWorld, 1060 Marsh Road, Suite C-200, Menlo Park, CA 94025.

[3] MICROMAG, 1057, av. Laurier ouest, bureau 301, Outremont, QC H2V 2L2.

authoritative magazines like Byte [1] which published in 1982 the Byte Book of Computer Music [2]. The whole issue of BYTE in June '86 was devoted to computers and music. Some magazines (Computing Now, [3] The MACazine [4]) have a computer music column regularly. Finally, even High Technology [5] will publish an article on a particularly interesting piece of hardware or software.

Music journals and magazines

As mentioned earlier, there was interest in computer-assisted music education as far back as 1967. However, this interest was somewhat of a curiosity. Over the years, there have been more and more articles about the uses of computers to teach music. A whole issue of the Music Educators Journal (January, 1983) was entirely devoted to the issue of computers in music education. Most of the articles in this issue are listed in ERIC. The level of the computerization of the field of music education can be easily assessed by the increase of publicity and ads for computer software, computer-literacy courses and books on the uses of computers to teach music which appear in journals specialized in music education.

Yet, the true assessment of the state of the art in musical composition and performance is most evident in the magazines dealing with rock-and-roll

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[1] BYTE: The Small Systems Journal, 70 Main Street, Peterborough, New Hampshire 03458.

[2] The Byte Book of Computer Music, MacGraw Hill Publications, 1221 Av. of the Americas New York; N.Y.

[3] Computing Now!, Mooreshead Publications 1300 Don Mills Road, Don Mills, Ont. M3B 3M8

[4] The MACazine, ICON CONCEPTS CORPORATION, P.O. Box 1936, Athens, TX 75751

[5] High Technology. High Technology Publishing Corporation, 38 Commercial Wharf, Boston, MA 02110.

and popular music. The dissonance between the established music education world and the reality of the 'labor market' is staggering.

The catalog of selected doctoral dissertations from University Microfilms International which deal with research on music lists 186 entries about keyboard music. Not one dissertation steps out of the boundaries of piano technique, piano repertoire, pianistic interpretation or classical organ. There are 34 entries about Jazz and popular music, none deals with the synthesizers and/or computerized equipment. Yet, the main title of the December '85 issue of KEYBOARD [1] is:" Endangered Species? " The premise being that as the introduction of the piano itself displaced the harpsichord, the louder violin displaced the viola, the newer synthesizer will in turn displace the piano. This might prove true.

The same catalog lists separately 37 entries about computers and computer applications. 13 researches are investigating the use of computers for ear-training drill and practice in one form or another. None deal with real-time performance or sound synthesis.

Not so long ago, computerized music was the exclusive domain of research centers of the universities which could afford computer-time for music. The emergence of the micro-computer, the increase in the sophistication of musical software and the steady decrease in the price of equipment have brought electronic music within the reach of everybody. The kids love the synthesizer, love the gadgetry, love the power and are the ones who flock to the newsstand to buy Electronic musician [2], Music and Sound

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[1] KEYBOARD, 20085 Stevens Creek, Cupertino, CA 95014.

[2] Electronic Musician, Mix Publications Inc. 2608 Ninth Street, Berkeley, CA 94710.

Output [1], Keyboards Computers and Software [2] and Electronics & Music Maker [3]. The authoritative Computer Music Journal [4] which lists famous names like C. Abbott from the Xerox Palo Alto Research Center, M. Battier and Pierre Boulez from IRCAM in Paris, W. Buxton from the Computer System Research Group in the University of Toronto, John Chowning from the Center for Computer Research in Music and acoustics at Stanford University, Marvin Minsky from the media laboratory of MIT and others among its editing staff is now sold on some newsstands.

The 'electronic musicians' have always been the mavericks, the ones who dared re-question every aspect of music theory, the ones who proposed the abolishion of the well-tempered keyboard. If their ideas find a fertile soil in the minds of the younger generation, some unholy alliance might rock the musical establishment. The pun was intended.

Books on computers and music

It does not matter very much whether or not the origin of electronic music began with Edgar Varèses' proposal for more collaboration between engineers and musicians in 1920 or from the design of the first synthesizer in 1955. There is a vast body of knowledge accumulated on the uses of computers and/or electronic music. Before the appearance of the micro-computer, Mathews (1969) wrote The Technology of Computer Music. The bibliography of The Development and Practice of Electronic Music (Appleton ed. 1975) lists already 74 books and 64 articles on this subject. Deutsch (1976) wrote Synthesis: An Introduction To The History, Theory

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1 Music & Sound Output, Output International Publications, Inc. 220 Westbury Avenue, Carle Place, NY 11514.

2 Keyboards, computers & software, Keyboards, computers & software, Inc., 229 Main Street, Northport, NY 11768.

3 Electronics & Music Makers, Music Makers Publications, Alexander House, 1 Milton Road, Cambridge CB4 1UY.

4 Computer Music Journal, 55 Hayward Street, Cambridge, MA 02142.

and Practice Of Electronic Music. David Ernst wrote in 1977: The Evolution of Electronic Music.

More recently, the book review section of Notes, the quarterly of the Music Library Association , lists in September 1986 (p. 53-54) four new books on the uses of computers for music in one year.

Once more, the writer would like to remind the reader that the students of the Music School who learn about electronic music are after jobs. Since December 1982, the musicians working on the labor market have wholeheartedly embraced the MIDI protocol. Although the editors of the Computer Music Journal publish occasionally an article on MIDI and review in each issue the latest hardware and software which has appeared on the market, their target audience is definitely not 'popular musicians.'

There are books and articles about MIDI. They are not listed yet in the academic channels but they appear on the shelves of the professional studios and on the bookshelves of the stores which sell synthesizers and electronic equipment to make music. Jock Baird (1986) has edited Understanding MIDI: How to buy it, how to set it up and how to run it, a very good introduction to the MIDI phenomenon. Craig Anderton (1986) has written MIDI for Musicians which might be one of the best known books about MIDI. David Crombie (1986) wrote The New Complete Synthesizer . There is emphasis on the word 'new' because the market completely changed between the first edition in 1982 and the second. The most recent book is Music Through MIDI by Michael Boom (1987). Other listings can be found in the reference section.

Convergent Technologies

A Different Way of Looking at the Evolution of Music

Even the least musically-inclined person will acknowledge that music is not a static art form. What attracts the youth of one generation is awful to their parents. A little later the tables have turned and the generation which idolized 'The Beatles' finds 'Boy George' or 'Madonna' 'revolting'.

From the Gregorian chants which filled the Gothic cathedrals of the Middle Ages, through the dance music of the Renaissance, the cantatas of J S Bach, Mozart's sonatas, Haydn's string quartets, Beethoven's symphonies, Wagner's operas, Debussy and Ravel's expressionism, Schoenberg's dodecaphonism, and the present electro-acoustic compositions, music has been a reflection of the ways people lived, the ways people conceived the world and their place in the universe.

Alvin Toffler (1980) who separates the evolution of civilization into three major waves has this to say about the evolution of music:

> "Even in the arts, we find some of the principles of the factory. Instead of working for a patron, as was customary during the long reign of agricultural civilization, musicians, artists, composers, and writers were increasingly thrown on the mercies of the marketplace. More and more they turned out 'products' for anonymous consumers. And as this shift occurred in every Second Wave country, the very structure of artistic production changed.
>
> Music provides a striking example. As the second Wave arrived, concert halls began to crop-up in London, Vienna, Paris and elsewhere. With them came the box office and the impresario-the businessman who financed the production and then sold tickets to culture consumers.
>
> The more tickets he could sell, naturally, the more money he could make. Hence more and more seats were added. In turn, however, larger concert halls required louder sounds-music that could be clearly heard in the very last tier. The result was a shift from chamber music to symphonic forms.

Says Curt Sachs in his informative History of Musical Instruments, "The passage from an aristocratic to a democratic culture, in the eighteenth century, replaced the small salon by the more and more gigantic concert hall, which demanded greater volume." Since no technology existed yet to make this possible, more and more instruments and players were added to produce the necessary volume. The result was the modern symphony orchestra, and it was for this industrial institution that Beethoven, Mendelssohn, Schubert, and Brahms wrote their magnificent symphonies.

The orchestra even mirrored certain features of the factory in its internal structure. At first, the symphony orchestra was leaderless, or the leadership was casually passed around among the players. Later, the players, exactly like workers in a factory or bureaucratic office, were divided into departments (instrumental sections), each contributing to the overall output (the music), each coordinated from above by a manager (the conductor) or even, eventually, a straw boss farther down the management hierarchy (the first violin or the section head). The institution sold its product to a mass market-eventually adding phonograph records to its output. The music factory had been born."

This society does not need to add instruments and players to fill a concert hall, technology has caught up. A small band, backed up by a few amplifiers and loudspeakers, can produce enough sound power to be heard by hundreds of thousands of spectators in an open field. Conversely, the softest note played by Vladimir Horowitz in concert in Moscow was heard simultaneously anywhere in the world equipped to receive a television signal by satellite.

In every era, musical instruments have represented the highest technological achievement of the time. The organ, although it was known in antiquity, was perfected during the Middle Ages to fill the great cathedrals. Which instrument can better represent the Renaissance than this intricate piece of woodwork; the lute. The harpsichord was the key instrument of the Baroque but the violins made in Cremona are still the most valued bowed instruments to this day. Improvements in metallurgy allowed the invention of a metallic frame capable of withstanding tremendous tension, the piano was born.

Although some instruments were created to fill a gap in the musical environment, most new instruments had to compete with the already existing technology and the existing musical establishment. The flute made of metal replaced the Baroque flute which had replaced the recorder. Against the better judgment of the musicians of the time, Louis the XIVth favored the loud but vulgar violin, it replaced the viola da gamba. The piano made the harpsichord obsolete. Closer to home, the main title of the December 85 issue of KEYBOARD is: "Endangered Species?"

The place and the role of the music teacher has also been subject to changes according to the culture he or she lived in. In the Middle Ages, it was unheard of that a musician would teach and not perform or compose himself. Throughout the Renaissance, the increasing importance of instrumental music led to the virtuoso and, as the first agricultural wave gave way to industrialization, specialization and the division of labor, it became a cultural necessity to have specialized people to teach instrumental music, specialized people to teach theory and composition and even a specialized institution in which the teaching would take place. Not only was Alvin Toffler's 'music factory' born, so was the conservatory, a place were the 'workers' and the 'managers' of the industrial music would get their training. In this place, the overt curriculum is music, the covert curriculum is discipline, order, conformity and uniformity in an atmosphere of intense rivalry and competition. The best will become virtuosi or conductors, the others will be cogs in the machine.

Thus, not only is the form and the language of music a reflection of the culture in which it takes place, but musical instruments are representative of the highest technological possibilities of the time and music education, the music curriculum and how it is taught reflects the priorities of the society.

The Present Situation in the Music School

At the present, 18 CEGEPs have a music major. Only 4 of them are teaching popular music. This third year option which is supposed to qualify the students to go straight to the labor market is in great demand. Most music departments would like to be allowed to teach arranging and jazz composition to boost their student body. It has reached the point where

individual Directors of music departments are 'playing' with course numbers and resorting to elaborate administrative schemes to give students the options they want.

Knowing that changes are on the horizon, the 13 directors of the Music Departments of the province are lobbying the Ministry of Education to operate in Phase A. It means that the representatives of the Ministry of Education would examine suggestions from the administrators of the CEGEPs and the directors of the appropriate departments and that the entire curriculum could be re-evaluated and eventually modified.

The administrators of the music departments where popular music is being taught find themselves in an awkward position. Over the years, through public pressure they have been forced to teach popular music when the system was best designed to teach the kind of classical music mentioned by Alvin Toffler. Their survival might depend on how well they fulfill a mission for which they are little equipped. Furthermore, because of their academic bias, they are looking up to the universities for guidance although the universities are in the same boat and following the same course. They have little or no communication with the system for which they are supposed to prepare their students -the labor market. While the institutions which teach music are still reflecting the second wave and second wave attitudes, musicians performing or composing popular music have resolutely entered the computer age.

The State of Popular Music

Never has there been so much difference between the 'music of the masses' and the 'music of the elite'. Even in antiquity, one finds a difference between the Apollonian music of the intellectual elite of the times and the Dionysiac music of the people yet, this is the first time that this difference threatens to encompass two completely different ways of thinking.

The standard concert repertoire of the piano is the same as the one of 1920. The textbook used at CEGEP St-Laurent for music theory was written in 1872 and revised in 1929. The music teachers use the same pedagogy which infuriated Debussy. In the meanwhile, influenced by the United States,

the students are taping cassettes of 'rock music' in their rooms using the latest technology they can afford and longing for the time when they will make video-clips.

The record "Switched-on Bach" by Walter Carlos and Benjamin Folkman[1] played on an analog synthesizer created by Robert Moog [2] was the start of an era. Computer-assisted composition, the synthesizer[3] and electro-acoustic music[4] were not new[5] but that record triggered the imagination of the 'hackers' of the time and the existence of a relatively cheap synthesizer, thanks to the progress of the transistor, had put electronic music within the reach of everybody.

In December 1982, the first synthesizer equipped with a MIDI interface was produced. It was the Prophet-600. In January, 1986 Jim Aikin. associate editor of Keyboard magazine , wrote:

> "Three years ago, MIDI was no more than a proposal for a specification to allow the keyboard of one synthesizer to drive the sound generator of another synthesizer-even when they were built by two different manufacturers. Studio players had been layering their parts for years to fatten up the sound, and if MIDI

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[1] W. Carlos, & B Folkman (1968). Switched-on Bach. Columbia Records, MS 7194.

[2] Robert Moog worked towards the conception and the development of the analog synthesizer since the early sixties.

[3] The first synthesizer was developed by Harry Olson and Herbert Belar for the RCA lab. in Princeton, New Jersey in 1955.

[4] In 1926, at the chamber music festival of Donaueschingen in Germany it was suggested for the first time that the recording technology could be used for musical composition. Two years later a research program was instituted at the Hochschule für Musik in Berlin.

[5] Around 1920, Varèse was already in favor of greater cooperation between musicians and engineers.

had done no more than simplify this process and bring it on stage, it would have been newsworthy, but certainly not earth-shaking.

Today, MIDI has evolved far beyond that first conception. While there are still a few wrinkles to be ironed out (aren't there always?), the specification has proven broad and flexible enough to give birth to a host of new applications never envisioned by those who wrote it. MIDI has become the glue that binds together a new kind of modular music system."

Further, he adds:

" During the next decade, MIDI is sure to worm its way into just about every nook and cranny of musicians activities, making life both simpler and more complicated....

If you'd like a vision, though, here's one: Today, electronic bulletin boards around the country offer public-domain software. You call the bulletin board on your modem and load the software into your computer, getting a program that might do any of a number of nifty things for no more than the price of a phone call. Now imagine a library of public-domain MIDI sequencer files that can be accessed the same way. Once some enterprising soul has loaded an entire Brandenburg Concerto (or an original tune for that matter) into a sequencer, you and I will never again need to worry about playing the notes themselves. We can devote all our attention to orchestrating the public-domain piece, adding pitch-bends and rubato phrasing, perhaps embellishing certain sections or adding a counter-melody...You get the idea. One of the things MIDI might do is help swing electronic music away from its rigid, robotlike roots and toward a flowering of individual expression."

These words do not announce an evolution in the world of music, they announce a completely different way of working, a completely new way of looking at music, a completely new way of thinking. In other words, a revolution. It is not MIDI per se which is the precipitating factor of that revolution, the advances in technology have been so fast that the digitization of sound and the digitization of pictures have become both practical and affordable.

Three powerful technologies have been slowly converging over the years and that merging is giving to each of them new and fantastic possibilities.

It is in the areas where the disciplines are merging that the changes are taking place, where new instruments are being created, where new techniques are being used. At the center, where all three are overlapping is MIDI (See fig. 3). The union of music, recording and computer science. Of course, some people will object to such a basic classification and talk about all the research which is being done in university

laboratories and which does not include MIDI at all, but we are concerned with the state of 'popular music' and the labor market.

It is not a passing fad. In the July '86 issue of Keyboard , Lyle Mays, a well-known American jazz composer says: " I'm still trying to catch up with instruments I got one or two years ago, and trying to write music in the meantime. It gets embarrassing, because there are all these kids who can read raw MIDI data."

In the meanwhile, David Mash, Chairman of the Music Synthesis Program at the Berklee School of Music, has set up a music LAN of 14 work stations based on the Apple Macintosh and a 70 Mb hard drive. Each station includes a computer and some of the most sophisticated musical hardware on the market. His plans are to increase the network to 36 work stations by September, 1987 (MacWorld, June 87, p 109).

How Will Changes Affect Music Education?

Technological changes

Four major technological innovations could drastically affect the world of music and the teaching of music.

-A The evolution of MIDI

The complexity as well as the flexibility of MIDI are such that more and more people do not talk anymore about the 'MIDI protocol', but are talking in terms of a full-fledged computer language. MIDI is not a static

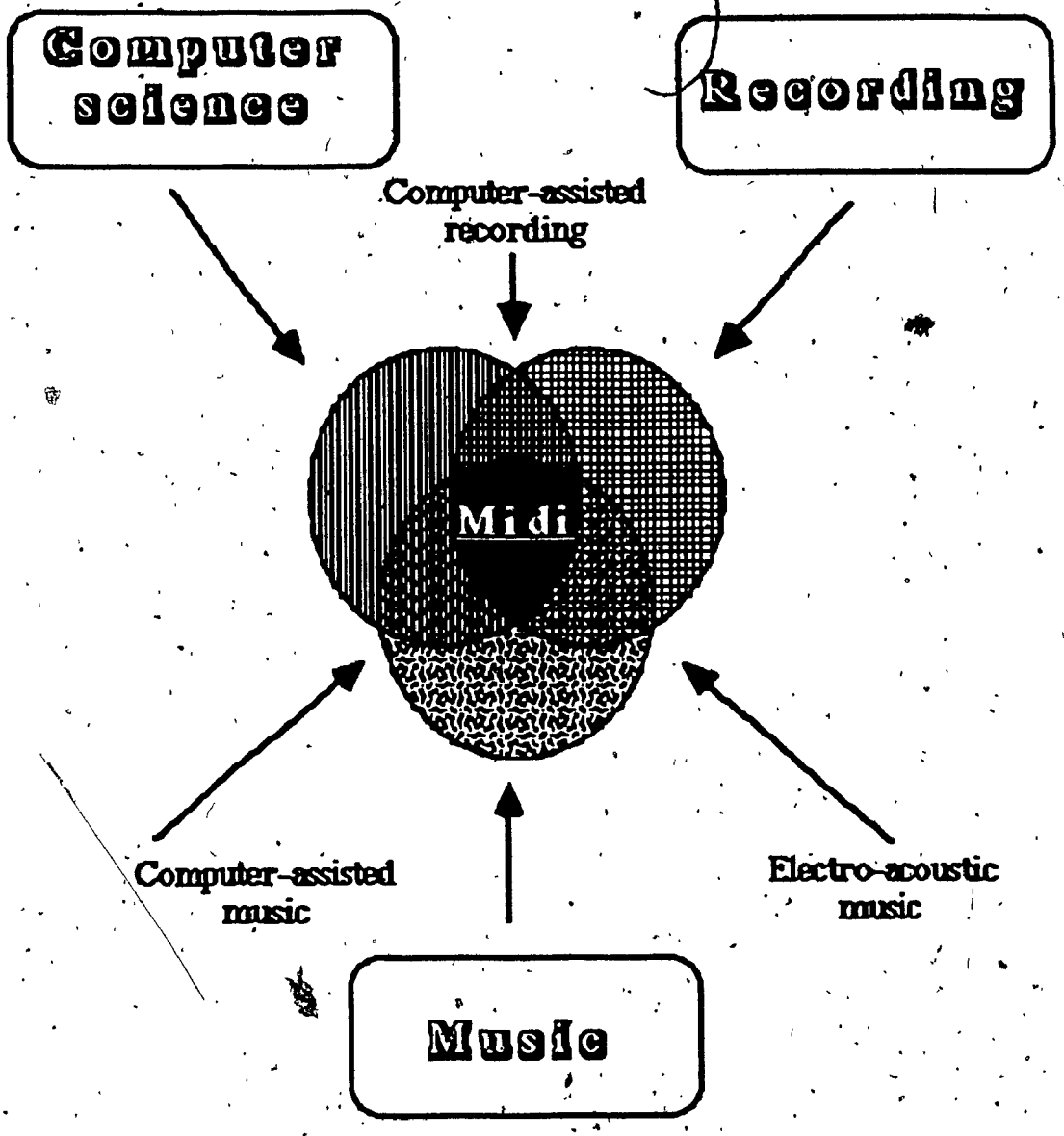

Fig 3: Merging of disciplines

institution. Some companies like Roland , [1] one of the major manufacturers of computerized musical instruments in the United States, are making every effort to make the MIDI more and more transparent to the user. People like Jim Cooper, who was instrumental in making different manufacturers all over the world agree on a common protocol [2], are constantly in touch with musicians and with manufacturers to prepare the next version of MIDI. It is possible that MIDI could become a tool common to all musicians whether classical or popular.

-B The compact disk and the integration audio-video

More and more, music is recorded and transmitted as a digital signal. The compact disk does not dominate the market yet because of the high cost of the machine needed to read the signal. This is partly a marketing strategy and prices are dropping steadily. The interactive video-disk which uses a similar technology is not very much used except in industry and in the armed forces. Right now, the compact-disk and the video-disks are read-only. However, the manufacturers of disks have been working on a medium which could record data more than once as well as read them and, according to the observers, a break-through could happen very soon in Japan [3]. The use of the compact-disk for the storage of numerical data could be the factor which would increase the size of the market, increase competition among the manufacturers and reduce the cost [4].

The transmission and/or the storage of music as a digital signal requires a tremendous bandwidth but the changes in the world of micro-computers are such that each year they are a little closer to mini-computers.

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1 Roland Corp. US, 7200 Dominion Circle, Los Angeles, CA 90040.

2 IMA the international MIDI Association. 8426 Vine Valley Drive, Sun Valley, CA 91352.

3 Byte magazine May 1986.

4 MacWorld. PC World Communications, Inc., 555 De Haro St. San Francisco, CA 94107. February, 1986.

Pretty soon they might have enough memory and speed to go even further than the junction computer/video-disk which is at the heart of the interactive video-disk system. They could allow what the Americans call "hypermedia"[1], the control of several means of communication simultaneously. With the hypermedia there could be an explanation on musical analysis or musical form on an interactive video-disk while the sound would be produced by a high quality compact-disk reader all under the control of the same computer. Or, going even one step further, if the computer is equipped with a midi interface, it would be possible to drive several FM modules. The student would have control not only over each specific frame of the video-disk, he would also have control over each individual musical note.

Such a 'dream system' would allow a student to look at an opera with the music sheet as an overlay. The learner could browse freely from one section to another or ask to listen and watch the same part several times. There could be on one of the audio tracks of the video-disk some important facts on that particular opera, while on the other track there could be a translation of the words of the opera from the German or the Italian to English. In the case of a theory or composition course, he would be able to manipulate the FM modules to highlight a part, remove a voice or assign different instruments to the voices to make his understanding easier.

-C Telecommunications

Brian Mulroney maintains, not without reason, that the survival of French as a language in Quebec depends on the amount of software available in French in the networks of the province [2].

A study made by "la Commission de la Protection de la Langue Française" in February, 1986 revealed that 70% of the 1647 micro-computers used by the provincial government are operating in English . This is against provincial laws and in some cases in the very offices of the people

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[1] MacWorld March 1986.

[2] La Presse, Montreal, vendredi 7 février 1986.

in charge of preventing the slow but steady encroachment of English in the lives of the French-speaking Quebecois.

To repeat the words of Carole Thibaudeau[1]: "L'anglais doit-il demeurer la seule langue des logiciels?"

This situation is particularly critical as a great part of the curriculum of an educational system might be controlled by the good will and the decisions of the suppliers of educational material. On this subject, Elliot Eisner (1985, p 31) writes:

> "The textbook and its partner, the workbook, provide the curricular hub around which much of what is taught revolves. Their utility is straightforward. First they provide a level of content expertise that few teachers possess. Second, they organize that content around topics that usually have some logic; in other words, the task of sequencing the material for educational purpose is largely done- or at least believed to have been done.Third, the textbook provides both teachers and pupils with a kind of security: It lays out the journey that students and teachers will take; one knows what follows and where it all ends. The coverage of this content becomes important because implicit in the textbook is the idea that if the children do not cover all of the material they are being cheated. Fourth, the textbook which usually has a teacher's version, gives teachers the questions they should ask students, provides test items they can use, suggest activities students can engage in, and provide teachers with the correct answers. The workbook that frequently accompanies the textbook provides a simple way to keep children engaged, and if the culture of the classroom is such that using a workbook is an expected aspect of the school day, it is not likely that the teacher will meet with much resistance."

Further, he writes:

> " Textbooks not only define a substantial proportion of the content, sequence, and aims of the curriculum. They also influence the way in which certain topics will be regarded. The most obvious illustration of this is found in the ways in which textbooks have treated women's and minorities' rights and other controversial issues. The kind of biases subtly conveyed to young children about

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[1] La Presse, Montreal, vendredi 28 février 1986.

sex roles and minority groups have been so egregious that some states require that all state-provided texts be specifically screened for biases with regard to sex, race, ethnic group, religious orientation, and the like. Awareness of sex stereotyping and racial bias as far as white middle-class Americans is concerned is relatively recent. Thirty years ago one did not hear much about the covert message in Dick and Jane. We have to thank the courage of vocal men and women who raised our consciousness regarding these matters. The initiation of change did not emanate from publishers, but from the kind of social pressure that groups supporting human rights brought to bear on the consciousness of America."

Michel Cartier, Director of the Laboratoire de télématique at the Université du Québec à Montréal forecasted that in the near future, only part of education will take place in the schools, the rest, will take place at home and elsewhere through the services of the networks. The abandonment of yet another part of French culture to the Americans would represent a serious danger.

-D Expert systems

For most people, the mention of artificial intelligence brings immediately to mind HAL, the psychotic computer of the movie 2001 by Stanley Kubrick after the book of Arthur C. Clark. Yet, musicians should follow with interest some of the experiments taking place in the laboratories of the Massachusets Institute of Technology in Boston.

On the 3rd of January, 1986, the writer saw on the CBC news at 18h00 a short news clip showing a young violinist accompanied by a computer. The sound was an acceptable piano sound and the computer was following the changes in speed and volume so closely that the human ear was incapable of detecting the changes.

These experiments are in their infancy, but the writer would like to remind the reader that in many instances the function of an accompanist is to simulate the orchestra. Once a computer can be programmed to follow any changes in the playing of a soloist even sudden changes, any musician of any age or skill level could enjoy the thrill of playing with the accompaniment of a complete symphonic orchestra any time and any place the FM modules and

the computer can be transported. Those who want to play late at night need only to plug the earphones in the mixer's output. It would even be possible to mimic the sound or the style of a specific orchestra or conductor.

This is not Science Fiction. Morton Subotnick (Keyboard June 87, p 62) is working on what he calls a 'score follower', where, in his words: " ... a Macintosh computer is following the score that is being played by the cello, piano, and whatever, and starting and stopping, locating places in the sequence." He describes how the computer anticipates the score: "... by knowing the score ahead of time, and learning by rehearsal what happens on a statistical basis most of the time."

At the present there are 'expert systems' to help doctors diagnose their patients and 'expert systems' to help businessman in their investments. It is not unreasonable to assume that in the near future, an 'expert system' could help a young musician to select which chord would best fit a melody or remind him that this note is unfortunately out of the range of the instrument he selected.

There is already a way to equip an ordinary piano with a MIDI output. In February '86, the writer wrote: " In the near future, it will be possible for a piano teacher to play a piece on the instrument, that interpretation subsequently being the reference against which the student will match his own skill." In July, Roland[1] announced that, in its new line of musical educational software, there is a package for MIDI equipped piano or synthesizer which does the following; The student plays the melody which is displayed on screen and the computer tells the student which notes were wrong, where the attacks were either too soon or too late.

The scourge of music education is the student who, with the best of intentions, practices the same mistake again and again until it has become a conditioned reflex. Any software which detects errors as soon as they take place and prevents students from practicing mistakes is a blessing for both teacher and student.

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[1] Roland Users Group Magazine, published by Roland Corp US.

To some readers, some of this might seem far-fetched or hypothetical but in 1965, the Rand Corporation published a report by the philosopher Hubert Dreyfus. It compared artificial intelligence with alchemy and stated that it would be impossible to program a computer to play chess. Ten years later, Dreyfus was soundly defeated by a computer. Today, there are many inexpensive and challenging chess programs running on just about every micro-computer.

Non-technological changes

Not all changes which might affect the lives of musicians are technological innovations.

At the present, Canada is negotiating 'free trade' with the United States. This seems, at first glance, only to affect the recording, the instrumental and the music-sheet industry. However, Emil Subirana, president of the Montreal Guild of Musicians, is afraid that some other barriers will be included in the bargain including some concerning work restrictions. He quoted the figure of 20,000 American musicians working in Canada in 1984 when there were only 3,000 Canadian musicians working in the United States [1].

The competition for Canadian musicians is stiff both at home and abroad. This situation could become intolerable if the training of the Canadian musician is inferior.

How Will These Changes Affect Music Teachers?

Difference between real and observed needs

Sherry Turkle (1984, p. 90) writes: "Here is a machine that goes beyond all others in its promise to reflect human competence. It is not always welcome. For some, its challenge may be felt as an alien contest. For others as a long-awaited chance to finally test one's worth."

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[1] La Presse, Montréal, vendredi 23 mai 1986.

Through the media, the teachers of the Music School have been subjected to a bombardment of information about computers and the place of computers in the society of tomorrow. Some of this information is accurate, some is not and some is grossly sensationalistic or misleading. Consequently, they have already formed an opinion about their needs for computer, CMI and CAI.

It is possible at the present to evaluate these needs but that evaluation would be based either on the 'feelings' of the teachers about the subject or, it would be based on the knowledge of a resource person.

T. J. Gustafson (1985, p 155) writes: " Every major study on effective school innovation has shown that teachers either make or break the innovation. An enthusiastic teacher can carry a mediocre project to completion. But by the same token, a negative teacher will sabotage the best of all methods."

The evaluation of the needs of the Music School should not be based on the 'gut-reaction' of the teachers. At the same time, they cannot be left out of the decision-making process as they are the ones who will either make it or break it.

Assessing the present needs of the Music School based on the teachers opinions would yield 'observed needs' which might differ quite considerably from the 'real needs' which can only be measured after the teachers have received some form of 'computer-literacy' training.

Administrative needs

T. J. Gustafson writes in Microcomputers and Educational Administration: (1985 p 24):

> " Although numbers cannot always be applied across the board, some school administrators have demonstrated a 50 to 70 percent reduction in the time it takes to generate the files needed to run a school when computers are used. Even if these numbers turn out to be overly optimistic, any significant improvement would surely be welcome by site administrators."

Further, he writes about word processing (p. 61):

"Word processing is truly one of the most important labor-saving uses of the computer. It can turn time-consuming, tedious writing into a manageable, even pleasurable experience. Just ask any secretary with word processing experience about the former pleasures of using a standard typewriter. Word processing means no more retyping of draft after draft, no more white-out, no more retyping the same letter simply for the sake of changing a name. Although estimates vary, it is believed that anywhere from 50 to 80 percent of the time currently spent writing formal documents could be saved through word processing."

The administrators who made the decision at CEGEP level to limit the use of the computers to CAI were afraid that the machines would not be available where, in their opinion, they are needed the most; the math and science departments.

On this topic, T.J. Gustafson sugests (1985, p 154):

"The proposal suggesting the adoption of computer technology should be broad enough to encompass many elements of the school. Any operational definition must include something for everyone. If one element is left out, resentment, resistance and hostility follow. Too often, computers go solely to science and mathematics departments. Social science, physical education, home economics, art and music are left out. So are administrators, secretaries, and janitors. This should not be the case. Computers can perform important tasks for these departments and people, and all should be allowed to share the wealth. In one respect it is just good strategy to bend over backward to ensure that these departments and other, more traditional faculty members see some benefit to their classes. These are the individuals who must be sold on the innovation. Math and science teachers are already supportive. If every constituent is involved in the planning stages, the likelihood is greater that they will become involved when computers arrive on campus."

The Music School would benefit immensely by computerizing its administration.

Needs for CMI

Most of the remarks made about the administrative functions of the computer can be made about Computer Managed Instruction. The computer can be used as a word processor to prepare classes. Graphics can be made and then turned into transparencies for the overhead-projector. Student records can be filed, grades kept, attendances kept. The computer can be used to keep banks of material and, through the use of authoring systems, the computer can even be used to ask questions, correct the answers and grade the students.

Just as much as a secretary can gain immensely by not having to re-type the same material over and over again, the teacher can gain immensely by choosing among a bank of questions which ones will be downloaded to the printer or by not having to re-type a course plan every time he or she wants to make a small change in the content of his or her course.

Another useful aspect of computerizing the Music School could be the instantaneous access it would give to the teachers to all the data-banks. The ear-training teachers would gain access to the research which has been made on strategies and tactics to improve their pedagogical arsenal, the music history teachers would gain access to thousands of research papers on musicology. The composition and arranging teacher could use the network to download compositions or disseminate the efforts of his students to a wider audience.

Needs for CAI

Ear-training and theory

The existing software to teach music ranges from little music drill and practices on inexpensive home micro-computers to sophisticated courses in theory and ear-training distributed through the services of American networks. Among the best of the crop are; an excellent computerized teaching machine in French named 'Exercette'[1] and a computerized machine

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[1] EXERCETTE, Editions AD LIB. 970, Avenue Salaberry, Quebec, QC Canada, G1R 2V3.

to practice rhythms in an atmosphere of contemporary music named the 'TAP MASTER RHYTHMIC SIGHT READING SYSTEM'.[1]

Students entering the Music School have different levels of skill and experience in ear-training and theory. Some of them have perfect-pitch, some of them cannot take the easiest of dictation. Yet, at the end of their studies and unless they quit the field of music, they will either take the entrance test in a university or have to function in the labor market.

The individualization of ear-training could be achieved through a computerized lab equipped with machines like the exercette which can tell a student whether or not he or she is singing off pitch and equipped with machines like Tap which help a student practice rhythm. It would allow the students to progress at their own pace and devote as much time as necessary to develop the skill to take the university entrance test successfully. Students could be followed individually, they would receive instant feed-back and would not be allowed to practice out of pitch.

As far as theory is concerned, the students do their homework, hand it in and receive some feed-back the next week. It is well-known that the laziest students copy the work of the students who are regularly up to date. Somehow, it is again the people who need the most practice and help who are doing the least.

A computer lab with some decent tutorials and drill and practice software would allow the individualization of instruction, would allow self-pacing, would provide instant feed-back and would allow students;

- To hear what they just wrote if their ear-training is deficient,
- To edit without penalty,
- To dump their homework to the printer or a hard disk.

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[1] TAP MASTER RHYTHMIC SIGHT READING SYSTEM, Temporal Acuity Products, inc., Building 1, Suite 200/300, 120th Avenue N.E., Bellevue, Washington 98005.

Music history

The content of the curriculum of music history is divided into two years. The first year students are taught the history of music from antiquity to the classical period. The second year, students are taught music history from the romantic period to the present. Each year is divided in two shifts. Consequently, the classes are huge by Music School standards (up to 35 students). Attendance is mandatory. The teacher stands in front of the class and states facts and figures while the students are taking notes. They can also doodle, write their mail or do their theory homework as long as they do not create a disturbance.

For the sake of the students who are sick or who have a major reason to miss a class, the course is taped and, with the permission of the teacher, these students can go to the record library and listen to the lesson they have missed.

The expositive method has been described as: " A process by which the content of the teacher's textbook is transferred to the notebook of the student without passing through the heads of either."

The course could be made much more attractive through the use of a video-tape recorder in conjunction with some courseware developed with a good authoring system (There is no software available in French for interactive videodisk). There are some outstanding videos made about music history available through the National Film Board[1] most of which have been dubbed in French. If most of the facts are on an interactive piece of courseware, the teacher might have much more time to spend on the concepts and on alternate pedagogical strategies.

The computer could provide some individualization of the course and make it more attractive, but the biggest gain for both students and teachers could be to access the data banks. As an example, the Dialog Information

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[1] National Film Board of Canada, Complexe Guy-Favreau, 200 Dorchester Blvd. West, East Tower, Room 102, Montreal, Quebec H2Z 1X4.

Service [1] contains the Repertoire International de Literature Musicale based in City University, New York and which lists 46,200 records containing abstracts of all significant literature on music drawn from over 300 journals.

- Instrumental music

- Classical music

With a MIDI compatible piano or a synthesizer and a sequencer, a teacher could keep track of a student's progress over a period of time, save on a floppy disk every note a student has played during a lesson. A student could compare his performance against that of his teacher and save part or the whole of a practice session for further comments by the teacher. A complete improvisation session could be stored on diskette or printed on the printer. Needless to say, this capability could be invaluable to students who want to compose or arrange.

- Popular music

The record industry is using synthesizers and 'sound sampling' because it is cheaper to hire one keyboard player who can synthesize strings or brass than to hire an orchestra.

The 'popular musicians' performing on stage are using synthesizers and computerized equipment extensively.

The students of the Music School want to use the same equipment that the 'Rock stars' are using and the equipment they will be using in the studios.

There is no doubt that the computer or computer-driven hardware is now part of the standard equipment of the younger generation of musicians.

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[1] DIALOG Information Services, Inc., 3460 Hillview Avenue, Palo Alto, CA 94304.

Composition and arranging

Every description of the advantages of word processing applies directly to the software which allows the edition of musical notation. Very few musicians are like Mozart or Ravel who could hear the whole of a musical composition in their heads and put it down on paper with hardly any mistake or correction. Most are like Beethoven who literally tore through the paper to correct his mistakes.

With a 'music processor', the student whose ear-training is a little deficient can hear what he or she writes. The composer can change key or time signature and the computer will adjust the composition to fit the new parameters. The computer verifies the accuracy of the number of beats per bar, turns a piano score into an orchestra score and vice-versa. When the composition is completed, it can be stored on a floppy disk, printed in musical notation on the printer or sent by modem to another party.

In other words, the computer can do now all the tasks that composers and arrangers hate most and that wealthy musicians pay somebody else to do.

Conclusion

In 1985 the Ministère de L'éducation du Québec stated: [1]

" La revolution informatique interpelle le système scolaire , et donc les élèves, sous deux aspects particulièrement importants: L'aspect professionnel et l'aspect culturel.

1) Nous devons préparer les citoyens à vivre dans un monde où le travail humain subit des transformations importantes. Les jeunes qui sortent des écoles et les moins jeunes qui viennent y chercher des compléments de formation doivent

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[1] Micro-informatique: Proposition de développement. Gouvernement du Quebec, Ministère de l'éducation, Bibliothèque nationale du Québec, 3e trimestre 1983.

Micro-informatique: Plan de développement. Gouvernement du Quebec, Ministère de l'éducation, Bibliothèque nationale du Québec, 2eme trimestre 1985.

recevoir une formation professionnelle adaptée au contexte changeant de la pratique des métiers et des professions.

2) Nous devons en même temps, et d'une façon encore plus attentive, nous assurer que les élèves intègrent dans leur formation de base la culture technologique qui sous-tend la révolution informatique, afin qu'ils puissent non seulement s'y adapter et la maîtriser, mais éventuellement l'orienter et la dominer par leur savoir-faire et leur intelligence.

Ce second besoin est multiforme; il doit se conjuguer avec le premier, tout en restant largement autonome en raison des dimensions particulières de la personne qu'il met en cause et de l'ensemble des autres besoins de formation de base auxquels il doit s'intégrer".

More than in most other professions and because of the agreement of the manufacturers of electronic and computerized musical instruments over a common protocol which makes for almost total compatibility between machines, musicians and specially the ones dealing with popular music are living in an environment which is changing rapidly and dramatically sometimes within a matter of weeks.

Roger A. Kaufman and his co-workers (1972, p. 37) suggest a 'utility continuum' as a referent for needs assesments (See fig. 4).

Symbols: > Greater than
= Equal
< Smaller than

Consumption > Production	Consumption = Production	Consumption < Production
Dependant Survival Zone		Contribution Zone

Δ

Independant Survival

Fig 4: Utility Continuum after Kaufman, Corrigan, and Johnson

It has a variable midpoint which is fixed by society. That variable midpoint can be changed by society at any time. Any individual at any time is somewhere on this continuum. He can be at the 'independant survival point' (where production meets consumption). He can be in the 'contribution zone' (where production exceeds consumption). He can also be in the 'dependant survival zone' (where production is inferior to consumption). Production being measured in terms of monetary income.
Such a model of 'individual utility' would indicate that within a short time some of the clientele of the music schools of the province could suffer from such a drastic difference between what they are learning and the reality of the labor market that they would have to 'recycle' themselves as soon as they leave school. To fulfill the objectives of the Ministry of Education, the entire curriculum of 'popular' music should be reconsidered and there should be a massive investment to provide the students with the technology they need.

Information technology will change drastically the role of the teacher. It will also change the role of the student.

In a setting where access to any data bank is almost instantaneous and in which electronic mail is used extensively, the teacher role is no longer to supply or help gather information, it becomes to help limit the excess of unnecessary data. If the CAL packages and the 'expert systems' are handling more and more factual knowledge, the role of the teacher will shift from the cognitive to the affective domain . The teacher no longer needs to be the source of information. He becomes a mentor, a resource person, a guide.

The technology to enjoy the best of both individualized and group instruction is available. Liberated from the drudgery of endlessly preparing classes and correcting exams and quizzes, teachers would have more time to spend catering to the needs of individual students. There would be more time for group activity, group projects and ensemble music.

The student will learn to be more self-reliant, more autonomous, and have more of a say in his education.

There are two major obstacles in the way of these changes.

First and foremost. This technology is expensive. A decent MIDI laboratory is in the range of $ 50,000. Yet, the situation is clear cut. Without this equipment, the students who are entering the labor market are not prepared adequately and could not compete with musicians trained in the United States. Decisions have to be made at a political level.

Next, changes as drastic as moving from the Industrial Age to the Age of Information do not happen without hurt, without resistance and without conflicts.

Problem Analysis

The Meaning of Educational Change

What the future holds and how technological and social changes will affect people's lives is the subject of many books (Toffler 1980, Deken 1981, Friedrichs and Schaff 1982, Parkhill et al. 1982, Pask 1982). Each of these authors includes the future of education and/or the education of the future in their field of investigation. Experts on Artificial Intelligence feel concerned about how their work will affect society at large and the acculturation of our youth (Weizenbaum 1976, Schank 1984). Since its foundation, it is part of the multidisciplinary aspect of cybernetics to be concerned how science and technology affect society (Wiener 1950, Simon 1969). Philosophers explore how the new technologies will affect how people know, understand and learn (Haugeland 1981, Dennett 1985, Dreyfus and Dreyfus 1986). The investigation is not only restricted to what the computers can do for us but also to what the computer is doing to us (Turkle 1984).

Other texts, restrict their topic to education itself (Rushby 1979, Coburn et al 1982, Chambers and Sprecher 1983, Pantiel and Petersen 1984). Some see the computer as a totally new pedagogical opportunity (Papert 1980), some fear the computer is being misused (Snyder and Palmer 1986).

Some authors define their area of expertise as 'educational administration' (Gustafson 1985, Cheevers et al. 1986) or even limit their writing to the process of introducing the computer in schools (Patterson and Patterson 1983).

None of them define what constitutes 'good,' 'worthwhile' or 'meaningful educational change.'

One writer has addressed this issue. It is Michael Fullan's (1982) in his book; The Meaning of Educational Change.

One of the first statements in the book is (p. 4): "If we broaden the term 'innovation' to include all educational changes through legislation, new and revised curricula, and special projects-in short, any practice new to the

person attempting to cope with an educational problem-it is clear that change is common fare for school people. Implicit, but rarely recognized, is the confusion between the term change and progress. Resisting certain changes may be more progressive than adopting them, but how do we know?"

The particular strength of this book is that Dr Fullan considers the meaning of change not only in a theoretical framework, but also its practical implications, what he calls "organized common sense" or "the integration of the general and the specific."

He points out that all real changes always involve loss, anxiety and struggle.

It is also important to consider how much the meaning of change overlaps attitudes and opinions as personal constructs and what is the daily subjective reality of teachers.

According to Fullan there is no reason for the teachers to believe in change. And (p. 29): "When change is imposed from outside, it is bitterly resented. When it is voluntarily engaged in, it is threatening and confusing."

Fullan makes the observation that there are two possible sources of error in the subjective realm of change. What he calls 'false clarity' and 'painful unclarity.'

(p. 28) "... false clarity occurs when people think they have changed but have only assimilated the superficial trappings of the new practice. Painful unclarity is experienced when unclear innovations are attempted under the conditions which do not support the development of the subjective meaning of the change." In other words, teachers should develop their own 'personal knowledge' about the change, what is expected of them and how it will affect them.

On the objective reality of educational change, he points out: "Reality is always defined by concrete individuals and groups. But individuals and groups interact to produce social phenomena (constitutions, laws, policies, educational change programs) which exist outside any given individual. There is also the danger that the objective reality is only the reflection of the

producers of change and thus simply a glorified version of their subjective conceptions." He states that the answer lies in a double question: "What is the existing conception of reality on a given issue?" followed by "says who?"

In practice, according to him, this leads to at least three components or dimensions in implementing innovation (p. 30). They are:

- Possible use of new or revised material
- Possible use of new teaching approaches
- Possible alteration of beliefs and theories

Who controls the material, who controls the teaching approaches, who controls the beliefs and theories is well debated by Elliot Eisner (1985) in The Educational Imagination.

Michael Fullan goes on analyzing the causes and process of adoption. He lists (p. 42) 10 factors associated with the adoption of new technology or practices.

-1	Existence and quality of innovation
-3	Advocacy from central administration
-4	Teacher pressure/support
-5	Consultants and change agents
-6	Community pressure/support/apathy/opposition
-7	Availability of federal or other funds
-8	New central legislation or policy (federal/state/provincial)
-9	Problem-solving incentives for adoption
-10	Bureaucratic incentives for adoption

He sees 15 factors affecting implementation of the adopted innovation (p. 56).

A. Characteristics of the Change

-1 Need and relevance of the change
-2 Clarity
-3 Complexity
-4 Quality and practicality of program (material etc.)

B. Characteristics at the School District Level

-5 The history of innovative attempts
-6 The adoption process
-7 Central administration support and involvement
-8 Staff development (in service) and participation
-9 Time-line and information system (evaluation)
-10 Board and community characteristics

C. Characteristics at the School Level

-11 The principal
-12 Teacher-teacher relations
-13 Teacher characteristic and orientation

D. Characteristics External to the Local System

-14 Role of government
-15 External assistance

According to him, there are also 5 factors which affect the continuation of the change process (p. 77):

-1 Degree of implementation
-2 Attitude toward innovation
-3 Impact (a) students' benefit
(b) teachers' benefit
(c) organizational benefit
-4 Continuation or institutionalization
-5 Attitude toward school improvement

His conclusion is (p. 79):

> "Single-factor theories of change are doomed to failure. Arguments that product quality is more important than teacher attitude, or that external factors are more important than internal ones, or that teachers are more central than administrators are pointless. Effective implementation depends on the combination of all four set of factors described in this chapter. The characteristics of the nature of the change, the make-up of the local district, the character of individual schools and teachers, and the existence and form of external relationships interact to produce conditions for changes or non-change. It takes a fortunate combination of the right factors-a critical mass-to support and guide the process of resocialization which respect the maintenance needs of the individuals and groups and at the same time facilitates, stimulates, prods people to change through a process of incremental- and decremental fits and starts on the way to institutionalization or discontinuing the change in question."

Fullan himself admits that the simultaneous manipulation of fifteen variables (and their subsets) so that they work smoothly together in a social setting is mindboggling.

Although he does not state a clear definition of what constitutes 'good or 'bad' change, Michael Fullan makes a clear dichotomy between them.

The writer does not consider that Fullan's dichotomy good-bad is satisfactory. If a change has the power to enhance or impede the survival chances of the Music School the same way that evolution or mutation can increase or decrease the chances of an organism to survive then, an extra category should be added. Changes that are neither good nor bad in normal circumstances. Thus, if we can borrow an anthropological classification there are 'adaptive', 'maladaptive' or 'non-adaptive' changes. These can be or not be implemented. This leaves us with 6 possibilities and the consequences of their implementation.

Type of Change	Implementation	
	Yes	No
Adaptive		
Non-adaptive		
Maladaptive		

This division into more categories is not yet satisfactory. There can be adaptive, non-adaptive or mal-adaptive changes for the institution itself, for the administration of the Music School, for the teachers, for the students or for the support staff. The resulting division into categories yields a 5-3-2 matrix.

Object of change	Type of change					
	Adaptive		Non-adaptive		Mal adaptive	
Implemented	Yes	No	Yes	No	Yes	No
The institution						
The administration						
The teachers						
The students						
The support staff						

As an example, the installation of a coffee machine in the teachers' lounge could improve the working conditions of many people (the teachers, the administrators and some of the support staff). It would probably leave the students indifferent. It might mean a serious loss of business for the owner of the cafetaria.

Everett Rogers (1983, p. 371-413) analyses the consequences of innovation in much more detail. Although he remains with the 'good change versus bad change' paradigm (in his words: "desirable versus undesirable consequences"), he adds the concept of direct versus indirect consequence (5-3-2-2 matrix) and the concept of anticipated versus unanticipated consequence (5-3-2-2-2 matrix). At this point, charts are unmanagable.

Wilbert E. Moore (1963, p. 29) clarifies the situation: "Of course, in a world that is evil in its complexity, simplifying dichotomies are likely to be

plagued by mixed cases and by interaction between internal and external change, but the distinction may still be useful as a starting point."

As a starting point and for the purpose of this research, a good change is one which benefits the many without causing undue harm to the few. The benefit to the students is to make them more able to reach their personal objectives, whether it is gaining entrance into the university of their choice, finding a better job in the 'labor market' or just becoming a better musician. A 'good change' also means making their stay at the Music School and learning more enjoyable. A good change, is a change which makes a teacher more competent, more effective either in preparing his/her classes, correcting homework or in the classroom. A good change makes the administration more efficient, faster and more accurate so more time can be spent on human interrelations and individual problems. A good change means an increase in the reputation of the Music School and more high-school students applying to gain entrance at college level. That increase in reputation implies, one way or another, a modification of beliefs or new beliefs in the worth of the education the Music School dispenses. In other words, a 'good change' is one which increases survival chances of the Music School in the face of a changing environment.

The administration of the Music School must implement adaptive changes. It cannot afford the expense of repairing damage caused by implementing maladaptive changes. Neither can it afford the luxury of implementing non-adaptive changes.

Personal Knowledge

Kaufman and English state (1979, p. 72): "Change in our world is inevitable; the only question is whether we will be the masters or the victims of change."

Why do people react differently to change?

G. W. Allport (Zimbardo et al. 1977, p. 19) has stated that the concept of attitude is "the most distinctive and indispensable in American Social Psychology." Yet, according to James Chaplin and T. S. Krawiec (1974, p. 667): "Very few researchers have concerned themselves with attempting to validate the definition of an attitude or the assumed relationship between behavior, cognition and affect".

L. S. Wrightsman (1972, p. 258-259) in his textbook on Social Psychology quotes different author's definitions for the concept of 'attitude':

Bruvold: "An attitude may be defined as a 'positive or negative affective reaction toward a denotable abstract or concrete object or proposition".

According to Krech, Crutchfield, and Ballachey attitude is: "An enduring system of positive or negative evaluations, emotional feelings, and pro and con action tendencies with respect to a social object".

Rokeach defines attitude as: "A relatively enduring organization of beliefs around an object or situation predisposing one to respond in some preferential manner".

In Influencing Attitude and Changing Behavior, Zimbardo, Ebbesen and Maslach (1977, p. 20) give this definition : "Attitudes have generally been regarded as either mental readiness or implicit predisposition that exert some general and consistent influence on a fairly large class of evaluative responses. Attitudes are thus internal, private events whose existence we

infer from our own introspection or from some form of behavioral evidence when they are expressed overtly in word or deed".

Wrightsman (P. 258) writes: " Attitudes possess three central characteristics: they always have an object; they are usually evaluative; and they are considered to be relatively enduring".

Zimbardo, Ebbesen and Maslach (p. 20) consider that: "In studying attitude change it helps to conceptualize attitudes as having three components: affect, cognition, and behavior. The affective component consists of a person's evaluation of, liking of, or emotional response to some object or person. The cognitive component has been conceptualized as a person's beliefs about, or factual knowledge of, the object or person. The behavioral component involves the person's overt behavior directed toward the object or person". They include operational definitions of these three main components : " The affective component could be measured by physiological responses or verbal statements of like and dislike, while the cognitive component might be measured by self-ratings of beliefs or by the amount of knowledge a person has about some topic. The behavioral component could be measured by direct observation of how the person behaves in specific stimulus situation. In addition, attitudes are seen as enduring predispositions, but ones that are learned rather than innate. Thus, even though attitudes are not momentarily transient, they are susceptible to change".

Wrightsman (p 262) makes the distinction between simplex and multiplex attitudes. As the names suggest, a simplex attitude is a very straightforward attitude while a multiplex attitude may contain all sorts of nuances and modifiers.

He defines (p 258) the behavioral component: " The conative component refers to one's policy orientation toward the attitude object". He also differentiates attitude as a subset of values: "Attitudes differ from values, which are broader and more abstract. Values also lack an object, which gives essence to an attitude".

Thus, at least for the psychologists and the social psychologists, there seems to be a general consensus on some key elements. These elements are:

- Affective component(s)
- Cognitive component(s)
- Behavioral component(s)
- Some evaluation mechanism
- An object to which the behavior is applied

Clearly, the behavioral component is the outcome of the affective and the cognitive components. Which of the affective or cognitive components influences the other is less clear. Do I eat spinach because I like it, or do I like spinach because I eat it, is the object of much debate and research in social psychology.

Karl Popper (1972) clarifies a few interesting points about affective versus cognitive knowledge.

In an attack on the 'commonsense' theory of knowledge and the 'tabula rasa' hypothesis, he writes (p. 71): " As I have argued, the tabula rasa theory is absurd: at every stage of the evolution of life and of the development of an organism, we have to assume the existence of some knowledge in the form of dispositions and expectations".

(p. 108) "My first thesis involves the existence of two different senses of knowledge or thought: (1) knowledge or thought in the subjective sense, consisting of a state of mind or of consciousness or a disposition to behave or to react, and (2) knowledge or thought in an objective sense, consisting of problems, theories, and arguments as such. Knowledge in this objective sense is totally independent of anybody's claim to know; it is also independent of anybody's belief, or disposition to assent; or to assert, or to act. Knowledge in the objective sense is knowledge without a knower: it is knowledge without a knowing subject."

Michael Polanyi (1962, p. vii) rejects the ideal of scientific detachment. He regards "knowing as an active comprehension of the things known, an action that requires skills."

At the same time, he is careful to specify that although there is "personal participation of the knower in all acts of understanding", it does not make understanding subjective. He writes: "Comprehension is neither an arbitrary act nor a passive experience, but a responsible act claiming universal validity. Such knowing is indeed objective in the sense of establishing contact with a hidden reality; a contact that is defined as the condition for anticipating an indeterminate range of yet unknown (and perhaps inconceivable) true implications."

He calls this fusion of the personal and the objective "personal knowledge."

The writer designed a concept map of 'personal knowledge (See fig. 5).

Unexpected bedfellows support this point of view. In a textbook on memory and attention and from the angle of information processing, Donald A. Norman (1969, p. 41) explains that it is impossible to recognize whether or not the human brain is working bottom-up, that is data-driven or top-down, conceptually driven. He writes: "... the human processing system cannot be explained by either system alone; both processes are essential. Both top-down and bottom-up processing must take place simultaneously, each assisting the other in the completion of the overall job of making sense of the world."

From the point of view of the psychology of consciousness, Robert Ornstein is categorical (1986, p. 69): "The environment is different for each organism, so that the information that is appropriate for each organism is different to a greater or lesser extent. Insofar as perception is successful, it responds directly, as does a radio, to the specific features of the world it is designed to pick up."

He writes (p. 79): "... it is inaccurate and misleading to say that different people have different 'attitudes' concerning the same 'thing.' For the 'thing'

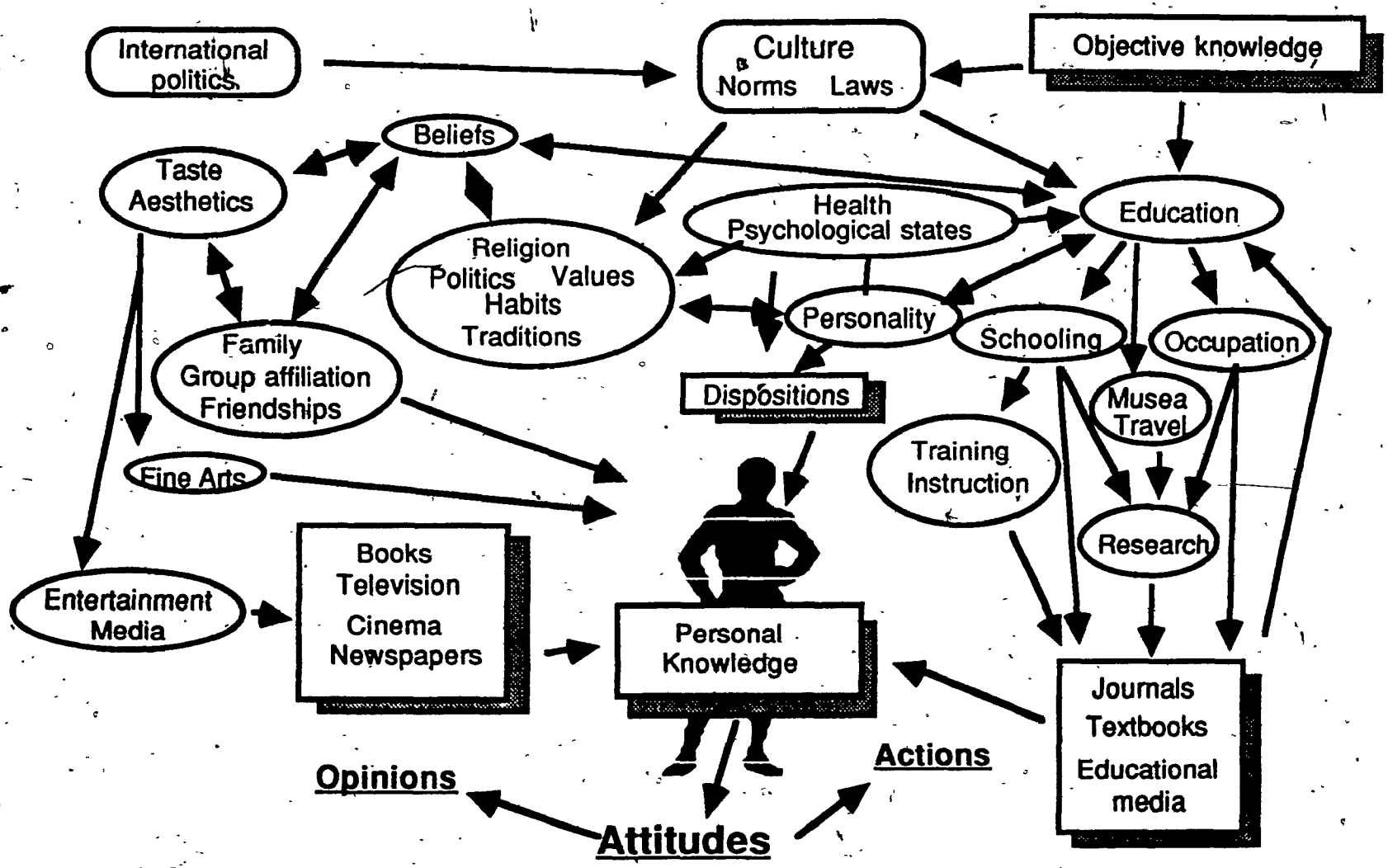

Fig 5: Personal Knowledge

simply is not the same for different people whether the 'thing' is a football game, a presidential candidate, communism, or spinach."

He also has the support of Ludwig von Bertalanffy (Quoted by Ervin Laszlo in Introduction to Systems Philosophy, p. xix) who wrote: "Knowledge is not a simple approximation to 'truth' or 'reality', it is an interaction between knower and known."

Marvin Minsky (1986) goes much further. Not only does he support the notion that reality varies from person to person (p. 110): " The only path from the world to the brain are bundles of nerves like those that come in from the eyes, ears and skin. How do the signals that come through those nerves give rise to our sense of 'being in' the outside world? The answer is that this sense is a complicated illusion. We never actually make any direct contact with the outside world. Instead, we work with models of the world that we build inside our brains."

He also states (p. 302) that 'knowing' and 'believing' is not "a single stable thing" and that knowing might mean different things for a single individual according to the context or the occasion. He explains: "The truth is that a person's mind holds different views in different realms. Thus, one part of an astronomer's mind can apply the common view of sunrise to down-to-earth affairs, regarding the sun as like a lamp that wakes us up and lights our way. But at the same time, that astronomer can apply the modern physical view to technical problems in astronomy."

He also explains why people set themselves 'beliefs', it is: "... because we have to force ourselves into clear-cut, action-oriented states of mind in which most of our questions are suppressed. As far as everyday life is concerned, decisiveness is indispensable; otherwise we'd have to act so cautiously that nothing would get done. And here lies much of what we express with words like 'guess,' 'believe,' and 'know.' In the course of making practical decisions, we use such words to summarize our various varieties of certainty."

Further in the direction of various varieties of certainty, J. P. Chaplin and T. S. Krawiec (1974, p. 671) write: "Whatever their special interest, all

social psychologists recognize the fact that attitudinal and value orientations embodied in a culture provide the individual with important expectancies and perspectives about the world in which he lives. Because attitudes and values are not only characterized by beliefs or expectancies but by affective and action components as well, they serve to motivate the individual to preserve or sustain certain aspects of his environment, and to modify others. Traditions preserve what is considered culturally desirable, and aspirations function as motives to modify and improve conditions for the future."

Nowhere is this 'personal knowledge' more apparent than in the results of a survey made to assess the opinion of the teachers concerning the introduction of the computer and computer-assisted instruction in the Music School.

A few have been totally negative. When asked to answer a Likert-like questionnaire about the possible uses of the computer in the teaching of music, one teacher burst into hysterical laughter and refused to answer. Another stated flatly that: "computers steal jobs". Some teachers have been totally positive (It's the future!) even if they did not know at all how computerized equipment would affect their working conditions. These are attitudes based on prejudice.

At the other end of the spectrum, two persons in the Music School have had practical experience with computers or computerized equipment. One teacher has been for a long time working part-time as a telephone operator. She finds the computer dehumanizing and on that ground does not want it in her classroom.

Another person has been working part-time doing word-processing, although she expresses exactly the same dehumanizing element in the use of computerized equipment as the teacher who worked for the telephone company, she blames the employer rather than the computer. She can see the advantages of the uses of the computer in the Music School and is very interested in 'data-banks' and 'desk-top' publishing.

Other teachers wanted to know lots more about the machines before committing themselves to an answer.

These are attitudes based on 'personal knowledge', they are the outcome of "personal participation of the knower in all acts of understanding" (Polanyi 1962, p. vii)

Survey of the Teachers

Method

The research design is a needs assessment made through a survey with an in-house Likert-like type questionnaire concurrent with an interview.

Target Population

The writer conducted a census of the teachers of the Music School. Of the 55 questionnaires distributed, 45 were returned and 4 of these were largely incomplete. 41 [75%] questionnaires were tabulated.

The 25% non-response introduces an element of error in interpreting the results from this study. As a consequence, the writer will take care not to generalize beyond the responses of this group to the population of the teachers of the Music School as a whole.

Research Design

As stated by Borg and Gall (1983, p. 494) complete participation in an ethnographic study might in some instances bring insights which could not be revealed by other methods yet, it has also some problems.

These strong points or problems can be identified by following the criteria quoted by them and which have been developed by Louis Smith to judge the validity of ethnographic research. They are:

- Quality of direct on-site observation,

The writer has been working in the Music School for such a long time that it would be very difficult for the people involved to 'mask' what is really going on.

- Freedom of access,

The writer has total access to the school and the people.

• Intensity of observation,

Since August, 1985 part of the workload of the writer has been devoted to this research.

• Qualitative and quantitative data,

The writer is in a position to collect both.

• Triangulation and multimethods,

Both a questionnaire and direct observation to assess the attitude of the teachers have been used.

• Sampling of data,

The whole population has been surveyed.

• Unobtrusive measures,

This is probably where the experience and the knowledge, which the writer has accumulated by working in this setting for so long, proves to be the most useful. On the one hand, since he is in charge of the organization of the concerts and because of his position as member of the School Council, the writer has frequent contacts with all the teachers. He knows what to expect as 'normal' behavior from every teacher in the Music School and he is able to detect and take note of any changes without the subject being aware that he or she is under observation.

Still referring to the chapter of Borg and Gall (1983, p. 492) on ethnographic research, these points should also be mentioned:

• Phenomenology,

The writer does not have to adopt the point of view of an insider, he is an insider.

• Holism,

The writer is well aware of the working of the Music School as a system, but also of the place of the Music School in its environment and its relationships with the meta-systems.

• Nonjudgmental orientation,

The writer has to dispel any pretense of scientific objectivity because the successful implantation of the computer and/or computerized machine in the Music School will further his career. Also, the Director of the Music School has contributed to this bias by selecting to evaluate the needs of the school, the most vocal advocate of pedagogical and technological changes. He could have biased the research the other way by selecting for the research his most conservative teacher or he could have evened the odds by forming a committee which would have included both proponents and adversaries of educational changes.

• Contextualization,

Considering this bias and considering how unique the population of the teachers of the Music School is, the writer would not venture to generalize the findings of this research to any other population. However, it could provide other researchers with some useful information.

Unfortunately, there are no standardized tests in French to assess the 'computer literacy' of music school teachers. The experimenter has built his own questionnaire following the recommendations of Borg and Gall and after a suggestion of Gustafson (1985, p. 91).

The topics selected are:

-A Previous experience with a computer or teaching machines.

-B Level of knowledge about CAI.

-C Attitude toward CAI.

-D Level of knowledge about CMI.

-E Attitude toward CMI.

-F Attitude toward designing and producing courseware.

-G Attitude toward computer-assisted music instruction.

-H Attitude toward computer-managed music instruction.

See appendix A for the final version of the questionnaire including the letter of transmittal. See appendix B for the data.

Procedure

The questionnaire was handed out personally by the writer with a request to answer it on the spot.

If the teacher refused to answer on the spot, the writer asked him/her for a date at which the questionnaire would be returned.

A discreet number was penciled on the back of the questionnaire. This procedure would also allow the writer to compare a teacher's opinion about his/her needs with his own assessment.

Analysis

Egon G. Guba writes in Criteria for Assessing the Trustworthiness of Naturalistic Inquiries (1981, p. 76): "Chief among the paradigms that have been utilized in support of disciplined inquiry are the rationalistic and the naturalistic. There is no basis for choosing one of these paradigms over the other in each and every inquiry situation. Rather, each rests on certain assumptions that must be tested in the context of application. Just as it is proper to select that analytic statistic whose assumptions are best met by a set of data, so is it proper to select that paradigm whose assumptions are best met by the phenomenon being investigated."

He writes about the nature of reality (p. 77): "The naturalistic paradigm rests on the assumption that there are multiple realities, that inquiry will diverge rather than converge as more and more is known, and that all 'parts' of reality are interrelated so that the study of any one part necessarily influences all other parts."

He states: "Social/behavioral phenomena exist chiefly in the minds of people and there are as many realities as persons."

This does not mean that the rationalistic methodology should be rejected outright in favor of an lesser and untrustworthy method. There is no need for conflict (p. 78): " Rationalistic practitioners have preferred

quantitative methods while naturalistic practitioners have preferred qualitative methods. This predisposition is so intense that the conflict between the two paradigms has been frequently been mistaken for a conflict between quantitative and qualitative methods, a mistake in logic that has led to the generation of a great deal more heat than light. But of course these two dimensions are orthogonal; there is no inherent reason why either paradigm cannot accommodate, and be contributed to, by either methodology."

Even within the paradigm of the naturalistic inquiry there are dangers of slipping further away from 'the truth' rather than getting nearer.

Guba (p. 84) explains that one of the ways to increase the credibility of a naturalistic inquiry is, among many others, prolonged engagement at a site but he warns against the danger of "becoming over involved with the respondents-what the anthropologists call 'going native.'

There has been recent evidence that Margaret Mead might have been misled and that some of her observations about 'Growing Up in Samoa' are a practical joke played on the observer by the 'not so stupid' natives. It might be true, it might not. Either way, it would have been much harder to 'pull the leg' of an insider.

From the point of view of a 'native,' some answers are revealing. One person known to have trouble operating a cassette-deck expressed an interest in programing!

Another point of interest are the comments that people wrote on the questionnaire beside the questions or the answers. They reveal all kinds of emotions which have to be taken into account.

Last but not least, as the model of the Music School demonstrates, some teachers have more 'credibility status' than others. Not only do some teachers have more influence over the others, but some have more leverage over the Director.

Also, in designing the questionnaire, the writer kept in mind the recommendations of the committee in charge of evaluating the needs of the

CEGEP to concentrate all the resources on the pedagogical applications of the micro-computer.

This did not 'mesh' with the writer's directional hypothesis as stated in the thesis proposal: "... When the teachers of the Music School know what the computer and/or computerized machines can do for them and their students, they will be more willing to include them in their pedagogical strategies."

It seems that the CEGEP administrators were more concerned about what the computer could do for the students than what it could do for the teachers.

Neglecting the interest of the teachers is, according to the writer's research (Kaufman and English 1979, Fullan 1982, Rogers 1983, Chambers and Sprecher 1983, Gustafson 1985, Cheevers et al 1986), one of the sure paths to failure.

Group Response

The philosophy which underlies the research is to make the results as obvious as possible. The writer's thesis proposal stated: ". . . the Director or any other official of the CEGEP would not be convinced with a .05 statistical significance achieved through the most powerful statistical technique. To achieve the degree of practical significance needed, the evidence will have to be overwhelmingly clear by descriptive statistics alone."

Of the teachers who felt competent to answer the questions about computer-assisted instruction, 34% would use a tutorial. 28% would use a drill and practice package. 27% would use a simulation. 28% would use a game. Yet, 31% would use a word processor. 50% would use a music-editing package. 65% would use a data bank to keep track of their students. 71% would use a data bank to keep track of their material. 48% would use a statistical package. 36% would use a 'quiz' or 'multiple choice' to evaluate their students (See fig. 6).

For reasons which will be discussed later, there are many missing answers concerning the use of machines in ear-training or instrumental music. Yet, 89% of the teachers who answered, find that a machine which

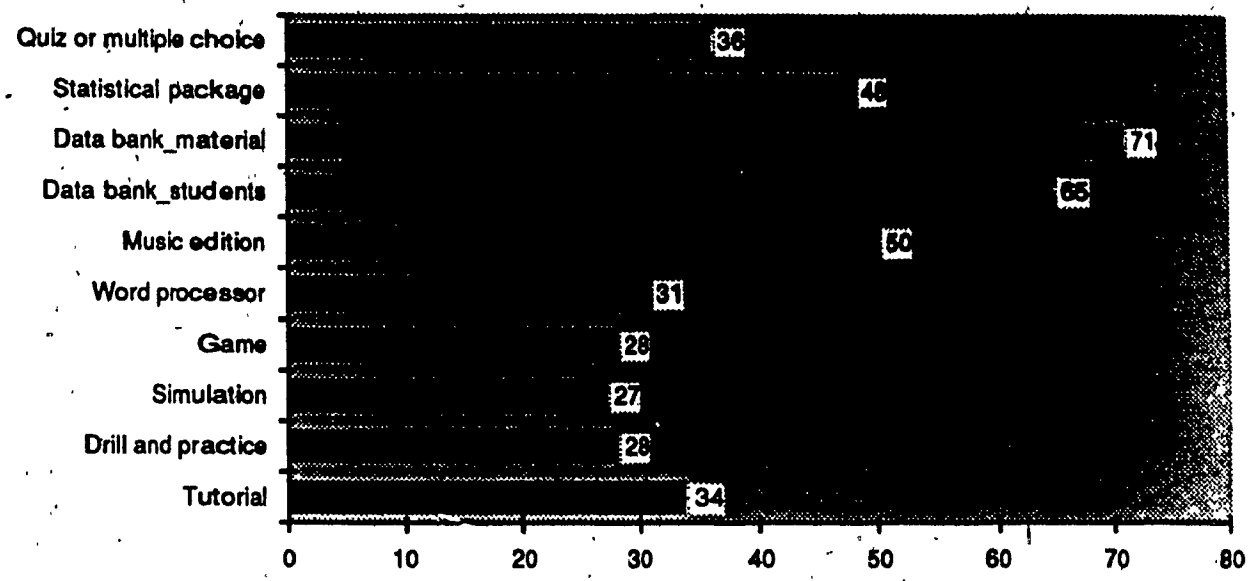

Fig. 6: Percentage of positive responses per type of software

corrects a student's rhythm is helpful in ear-training. 82% of the teachers find that it is helpful in instrumental music. 92% of the teachers find that a machine which corrects the intonation of the students is helpful in sight-singing. Only 68% find it helpful for instrumental music. This last answer is unexpected and will be discussed later. 77% of the teachers find a machine which writes music 'helpful.' 92% of the teachers find 'helpful' a machine which prints music. Only 68% of the teachers who responded qualify as 'helpful' a
machine which records everything a student plays within a certain span of time. This answer too is unexpected. Fig 7 is a graph of the results.

Some results speak for themselves. 90% of the respondents would like to have more information about these machines. 78% of the teachers want to know more about word processing. 83% want to know more about 'music processing.' 93% of the 41 teachers who answered the questionnaire want to know more about data-banks (See fig. 8).

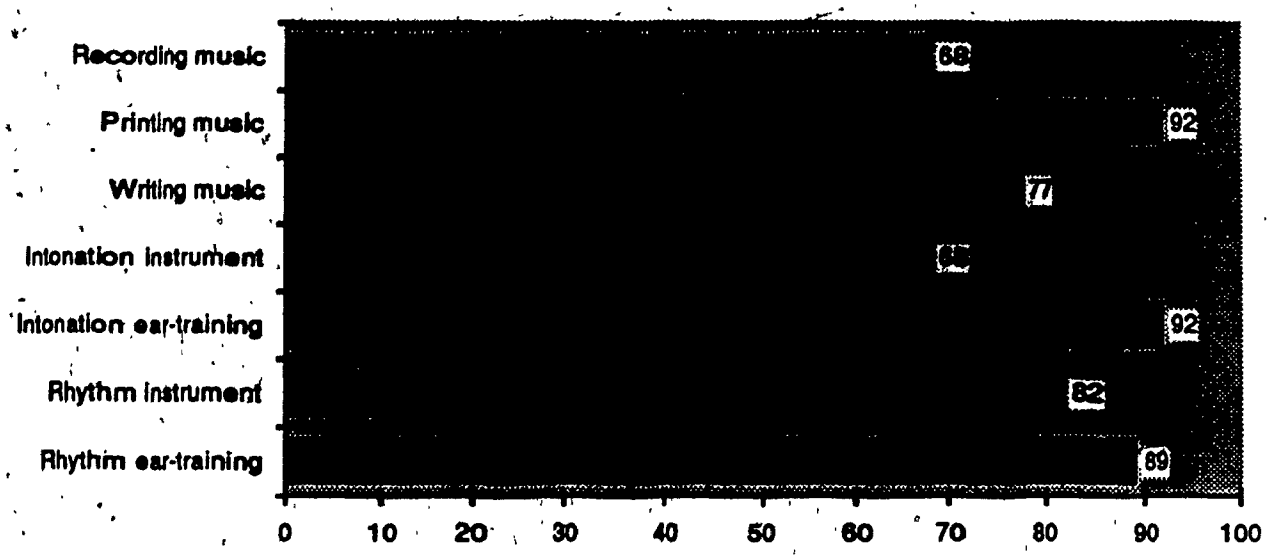

Fig. 7: Percentage of positive responses per type of music-dedicated machines

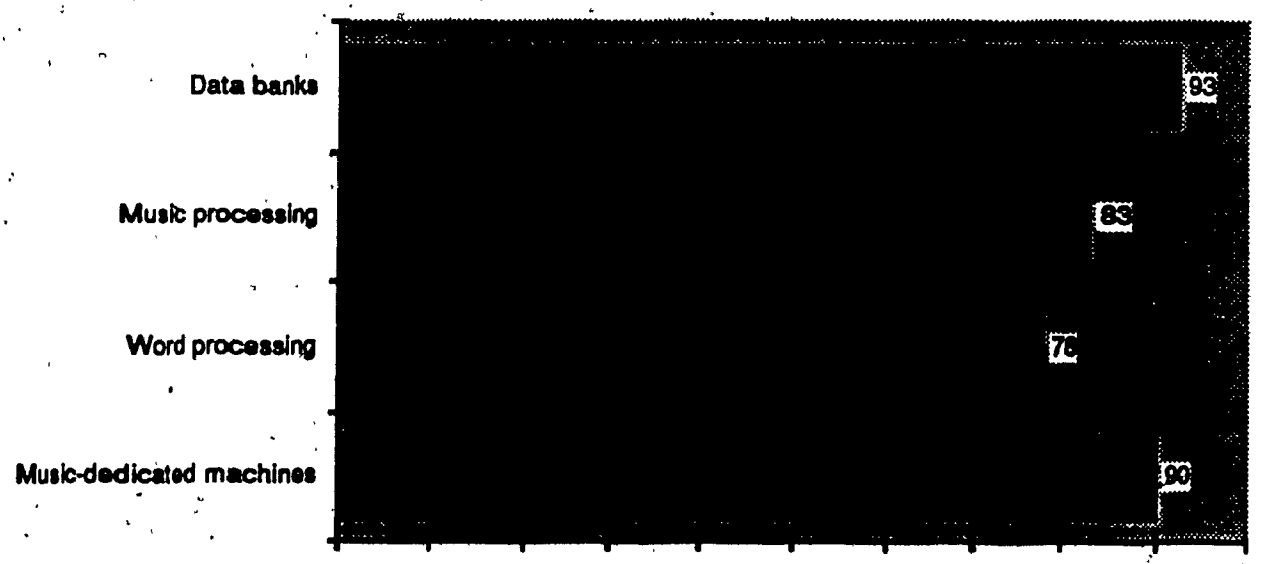

Fig 8: Maximum percentage of expressed interest

It would be wrong to generalize from the survey of the population of the teachers of the Music School to the population of the CEGEP teachers. But, at this point, the writer can safely state that the recommendations of the committee responsible for evaluating the needs of the CEGEP might not be in

the best interest of the Music School. From the results of the questionnaire and without sampling error, it can be said that the teachers of the Music School, within the boundaries of their present knowledge about the computer, CAI, CMI, word-processing, data-banks, computer-assisted music, show more interest in computer-managed instruction than in computer-assisted instruction.

Individual Responses

Cross-tabulating items disclosed some vital information.

Comparing the incidence of people who never had hands-on experience with the computer with the other questions reveals:

1 person who has never touched a computer knows about CAI.

9 people who never had hands-on experience know 'a little.'

5 people who have never used a computer would use a tutorial.

14 would use drill and practice software.

3 persons who have never used a computer would use a simulation.

7 would use a game.

6 people without previous experience would use a word processor.

9 people who have never used a computer stated that they would use a 'music editor.'

15 people who have never touched a computer stated that they would use a data-bank to keep track of their students.

18 teachers would use it to keep track of their books and records.

Of the 38 people who would like to know more about data banks, 23 never had any experience with a computer before.

About statistical packages, the inexperienced teachers of the Music School are divided. 12 in favor, 12 against.

9 people who have never used a computer would use a quiz or multiple choice to evaluate their students.

11 people who have never used a computer stated an interest in being capable of programing their own material.

11 would like to be able to prepare their own instructional material.

11 would like the help of a specialized resource person.

24 people without any previous experience with the computer would like to know more about the machines which correct a student's rhythm or intonation, the machines which write or print music and, the machines which keep track of a student's playing.

These answers were also cross-checked against the level of knowledge about CAI as stated by the respondents.

4 people who admitted no knowledge about computer-assisted instruction stated that they would use a tutorial in their classroom.

2 would use drill and practice.

2 people who stated that they had no knowledge about CAI answered that they would use a simulation.

5 said they would use a game.

The discreet numbers written in the back of the questionnaire were used to find out if the positive or negative answers were consistently coming from the same people.

The mode is 4 positive answers. 2 people who have never used a computer answered positively up to 12 times.

Not each topic was received equally favorably by the people without previous knowledge of the computer. Table 2 compares the topics of the questions with the amount of positive answers.

Some people who have had no experience with the computer are prejudiced positively toward some aspects of the computer and/or computer software. It has been possible to identify these people.

Type of software	Positive answers
Tutorial	5
Drill and practice	4
Simulation	3
Games	7
Word processing	6
Music processing	9
Data-banks for CMI	15
Data-banks for personal use	18
Statistical package	12
Computerized evaluation	9
Programming	11
Preparation of educational material	11
External support	11

Table 2: Amount of positive respondants in regard with question from people with no prior experience with computers

Analyzing the data of the people who have had previous experience with the computer also shows that the population of the teachers of the Music School have formed opinions about their needs. How accurate that opinion is is another story. One teacher who has had her hands on a Commodore 64 a few times and watched a lot of educational television about computers feels she could answer 'yes' to the question "do you know about CAI?" Another teacher who owns a computer and has had extensive experience with word-processing, data-banks, and is 'on-line' regularly felt he could only answer 'a little' to the same question because he never took a course on the subject. Here again we are dealing with multiple realities.

It is harder yet to identify people negatively prejudiced because it is not clear, with the exception of the 2 persons who consistently answered 'I could use it but I'd rather abstain,' whether 'I do not need it' is a true assessment of that person's situation, or if 'I do not need it' has been a convenient shelter.

Rogers (1983, p. 173) differentiates between 'active rejection' which consists of considering the adoption of an innovation before rejecting it and 'passive rejection' which consists of never even considering the use of the innovation.

Introducing computerized equipment in the Music School elicits on the part of some people negative emotional reactions. As an example, when the writer approached the teachers and asked them to answer the questionnaire, one said: "The computer steals jobs!" and refused to answer. Another burst into hysterical laughter and stated: "The idea that a computer could replace me is preposterous!" There is no way to measure accurately to which extent the amount of non-answer is due to covert hostility.

The same way, it is difficult to assess the amount of negative prejudice involved in the response, 'I do not need it.' Is it a 'true' assessment of the situation? Does it mean; "I do not need it because I have no information on how such a software or machine could fulfill any of my needs"? Does it mean; "I do not need it because I do not want to need it"?

Five questionnaires were analyzed in every detail. They belong to 'key players' in the process of implanting changes in the Music School. The teachers who, in the writer's opinion, could make the most of computers and computerized equipment.

Two Sisters teach music history. By Music School standards, their classes are huge (up to 35 or more).

Computer software could dispense factual knowledge about music history. They could use simulations and games to address the affective domain and motivate their classes. There could be quizzes organized on computer. They could use an idea-organizer and a word-processor to prepare their classes. If the Music School is computerized, they could use a data-bank to keep track of their students and their attendance. The record library and the library, if they are computerized, could help them to prepare and hand out up-to-date discographies and bibliographies without any trouble. They could use a statistical package to detect in advance who needs special attention and to better prepare effective tests. An easy interactive

authoring-system could even help them prepare pedagogical material themselves. They have no use for machines which write or print music other than a good pen and a photocopier.

The first teacher has never had any experience with a computer. However, she feels she knows a little about CAI and answered; 'I do not need it for my classes' to all questions related to computer-assisted instruction. She does not need any software related to computer-managed instruction. She did not answer any of the questions about the worth of machines to help the students with rhythm or intonation or the machines to write, print or manipulate musical data. She answered positively to all questions pertaining to the acquisition of more information.

The second teacher has never had hands-on experience with a computer and feels she does not know CAI. She is interested in knowing more about word-processing and about music edition. She would use a data-bank both to keep track of her students and to keep track of her books and records. She would like to know more about data-banks. She would also use a statistical package. She would rather abstain from using a computerized quiz and would not consider using the results of such a quiz for the final grade of her students. Yet, she is interested in being capable of preparing such quizzes herself, would like to know how to program and would like to be able to count on a hired consultant to help her. She finds that a machine which could write and/or print music would be 'most helpful.'

Another area where the computer could be helpful is ear-training and theory. This would be the forte of any good drill and practice package. The students have to practice intervals, scales, arpeggios and be able to sing any melody on-sight. Any possible way which would correct their errors before they become conditioned reflexes would be invaluable. Any package which would present to them theory problems, correct their mistakes and suggest ways to solve them would be very helpful.

The student body is divided into eight levels of sight singing aptitude. The results of each sight-singing test could be normalized against the mean of the school. This way, a student would know exactly what are his chances of success when competing with his peers to gain access to the university of his

choice. At the present, one student with perfect pitch sings melodies with complex modulations or take chords in dictation in one class while in another somebody else cannot sing a perfect fifth or can barely take 'three blind mice' in dictation. Both might get the same grade!

There are three ear-training and theory teachers. The first one insisted on taking the questionnaire home and never returned it even after several reminders.

The second teacher has never used a computer. She states that she knows the possibilities of computer-assisted instruction. About the use of tutorials, drill and practice, simulations and games, she writes on the questionnaire: "I do not know these techniques." She does not feel the need for data-banks or statistical packages. She would use a quiz to test her students but she refuses to take that mark into account for their final grade. Yet, she would like to be able to prepare her own quizzes and is interested in having outside help. She states that machines which would help the rhythm or the intonation of the students are very helpful in sight-singing but does not answer the part concerned with instrumental music. She finds that a machine to write music is useless and one which prints music only a little helpful. She answers positively to all the questions concerning further information about any of the machines or techniques.

The third ear-training teacher states that she has had experience with the computer and that she knows about CAI. She would use a tutorial, a drill and practice and a simulation but reserves judgment about games. She does not answer the question about word-processing but answers favorably about music-processing. She does not feel the need for data-banks or statistical packages. She does not state whether she would use quizzes or multiple choices nor does she say whether she would take such a quiz or multiple choice into account for the final grade of her students. She does not state if she would like to be capable of preparing quizzes herself. She is however interested in computer-programing and would like the help of an expert. She finds machines to help a student with his/her rhythm or intonation very helpful. Like her colleague, she does not rate machines to write or print music very highly. She also would like more information about machines or software packages.

The technological changes which are revolutionizing the music industry affect one teacher more than any other. He teaches arranging and composition to the third year students. His students go directly from the Music School to the 'labor market.'

He has never used a computer and has no knowledge of computer-assisted instruction but he would use tutorials, drill and practice packages, simulations and he would use games. He would use a word-processor but would rather abstain from using a music-editor. He would use data-banks, statistical packages, quizzes and multiple choices. He would like to know elements of programing and would like to be able to prepare quizzes and multiple choices. He would like to have the help of a specialist. He finds machines which help correct the rhythm or the intonation of a student in sight-singing a little helpful and a lot respectively. He does not state an opinion about their worth in instrumental music. Machines which write, print or record music are rated very helpful. He is interested in acquiring more knowledge about these machines or techniques.

Discussion

As stated earlier, the outcome of the analysis suggests that the teachers of the Music School have a more favorable attitude toward the 'traditional' uses of the computer than toward computer-assisted instruction. They are the most favorable to data-banks and machines which write or print music. In other words, teachers are very interested in the technology which would ease their class preparation. The response toward the acquisition of more information in that direction is overwhelmingly positive.

This demonstrates clearly what Tom Snyder and Jane Palmer (1986) write in In Search of the Most Amazing Thing :

> "Suppose someone were to walk up to a teacher, all smiles, as if announcing a big prize, and say, "You're in luck! There's a revolution coming on and because of it, you're going to teach in a whole new way." That teacher would probably say, "Get lost! And don't come back until you have something that will help me teach the way I do now." Teachers, like all adults, are creatures of habit, and although they have been commendably open to the new technology, they're not

going to change how they teach, any more than they would how they walk or drive a car, not unless it's proven that the new tools and methods of educational computing will make what they do a little easier or better."

Some teachers did not wait for 'proof' that the new tools and methods of educational computing will make what they do a little easier or better. They have endorsed the new technology without having had hands-on experience themselves. Little is known if this prejudice is due to intense media coverage or to speaking with other people who have had positive experience with computers and/or computer-assisted instruction.

This positive prejudice could prove an asset to the introduction of the computer in the Music School. It could also prove a double-edged weapon when people who have had great expectations and who have 'overadopted' (Rogers 1983, p. 236) the innovation feel that they have been 'let-down' by 'media hype.'

Many Apple II, Commodore 64 and Atari computers have been bought by people who wanted to do their home budget on a computer, keep lists of phone numbers, cooking recipes, books or records in a data bank. As soon as their owners realize that by the time the computer has been 'booted-up' and the program 'loaded' they could have done the work by hand, the computer becomes, at best, an expensive toy to play computer games.

There is also negative prejudice, sometimes obvious. One person (Questionnaire #21) answered negatively to each question.

Sometimes that negative prejudice is less overtly stated but apparent nevertheless. One person (Questionnaire #55) has never used a computer, she feels she knows a little about CAI. She does not need or would rather abstain from using most of the software mentioned. She does not want to know about word-processing, data-banks, music edition etc. She finds the machines to help students with their rhythms useless. Also useless are the machines to help the students with their intonation and the machines which write music or keep track of a student's playing.

In many instances, it is impossible to pinpoint negative prejudice but for apparent contradictions or discrepancies in the answers. One teacher

(Questionnaire #1) answered positively to all questions except one where he answered "I could use it but I would rather abstain." Of course, the software from which he would rather abstain is the one which might be most useful to him.

Two teachers (Questionnaires #26 and 30) have never used a computer yet they feel they know about CAI. When prompted about different techniques of computer-assisted instruction, they answer with a question mark or 'I do not know these techniques.'

One teacher (Questionnaire #19) answers 'yes' to the question "Would you use software to edit music". He answers 'no' to the question "Would you like to know more about software to edit music?" He also states that machines which would write music, print music or keep track of what a student has played would be most helpful. Yet, he answers 'no' to the question "Would you like to know more about these machines?"

The analysis of the questionnaires reveals to which extent the computerization of the Music School is a personal thing and a threat to some individuals. One teacher (Questionnaire #13) would rather abstain from using a computerized quiz or multiple choice to evaluate her students. She would not take that quiz into account for the final grade of her students but she would like to know how to prepare such quizzes or multiple choices. Maybe she would be more inclined to use a computerized quiz and take the results into account when she has prepared the quiz herself?

The analysis of the questionnaire also reveals to which extent each person has understood each question in a personal way.

The writer was extremely surprised by the amount of non-response to the questions concerning the use of machines to correct the rhythm or the intonation of a student. Then he noticed that there was a pattern to this non-response. Many teachers of instrumental music felt they could not 'stick their necks out' and answer out of their domain. For the same reason, the ear-training teachers, the music history teachers and some others, felt they could not answer on behalf of the teachers of instrumental music.

The writer then noticed that the teachers of instrumental music who double as theory and ear-training teachers for the preparatory school answered both parts of the question.

This is a sad example of maladaptive division of labor and compartimentalization of music. Musicians need their musical ears each time they perform a musical act whether this musical act is to play instrumental music or compose a symphony. Two teachers wrote a sarcastic note next to the question pertaining to the use of a machine to help the intonation of a student (Questionnaires #48 and 52). The first one answered 'pas du tout' and then added 'à clavier ??' The second also answered 'pas du tout' and added between brackets (piano). Without ear-training how does one notice that his/her piano is out of tune? Even worse, one of the respondent happens to have to tune his harpsichord to just intonation each time he plays. How could he do that without ear-training?

Many people who negated the worth of machines to help a student keep and correct his/her rhythm use a metronome on a regular basis. Some people who do not find a machine which helps a student correct his/her intonation helpful have a tuning fork in their instrument case.

Another area of unexpected response has been the worth of a machine which would keep track of what a student is playing within a certain time span, each teacher but one who is involved in the teaching of Jazz music rated it 'most helpful' (6 out of 7 answers). One of them (Questionnaire #8) checked the appropriate space twice (√√) because there was no provision for higher rating. 24 people answered positively, out of which 13 have never used a computer before and 17 are classical musicians. This number is abnormal but it is not abnormally low, it is abnormally high!

The Director expected the outcome of the questionnaire to be practical recommendations. The analysis of the data is most helpful to form recommendations for a policy specifically tailored to the Music School. The analysis of the individual responses is of vital importance for the selection of target audiences, the design of a concrete plan to act upon the policies which have been adopted and the proper tactics to suit the audiences which have been selected.

Problem Resolution

Plan of Implementation

In February 1984, the writer submitted a policy paper to the Director of the Music School.

It stated: "The writer's role as an initiator of a new order of things or that of a 'change agent' means that the teachers of the Music School should be provided with the opportunity to have "actual experience' with the computer and with all the information they need.

The policy paper stated that the 'real' needs of the Music School were impossible to evaluate at this time because each teacher had a personal idea of his/her needs and also about the needs of the other teachers. These ideas being mostly based on gossip, newspapers and television. A 'true' assessment of the needs of the Music School from the teacher's point of view could only be made after a period of information for all and a period of training for those who expressed a desire to learn.

The report mentioned that the only software in French to teach music worth considering at the time was an ear-training system named EXERCETTE.

It warned against the dangers of acting too hastily and stated that an equal amount of money should be devoted to software and training as the amount allotted for hardware. A strong point was made to the effect that the worst situation would be the purchase of machines which nobody knows how to operate or machines which nobody wants to operate.

Remembering Odiorne (1981, p. 250): "The best option for change is one created by the people who must implement it, or one for which the implementer can claim ownership." Kaufman and English (1972, p. 1): "The key to educational success lies in people, and any process can only be as good as the people who use it." Or Fullan (1982, p. 29): "The extent to which proposals for change are defined according to one person's or one group's reality (e.g., the policy maker's or administrator's) is the extent to which

they will encounter problems in implementation." The writer insisted that the implantation of the micro-computer in the Music School is not a technical problem but a social one.

He stated again, in bold face: "Il faut que ce soient les professeurs eux-mêmes qui décident s'ils veulent introduire l'ordinateur dans leur pédagogie et l'administration de l'École de Musique qui décide de la politique à suivre."

The writer suggested starting by training the staff and resource persons with the computer easiest to use, the Macintosh from Apple.

The report included a comprehensive list of the possible uses of the computer in the music school (After Louise Dubuc,1982).

This list was followed by a four-stage plan.

First, the training of the resource persons. Second, the training of the teachers. Third, a re-evaluation and re-assessment of needs. Last, full-fledged implantation. The general policy recommended was: Long-term planning, progressive implantation, constant revision and re-evaluation.

The materiel requested was 2 Macintosh micro-computers and a variety of business software.

The writer down-played the importance of the synthesizers and computer-assisted music for two reasons. First, the teachers who felt a need to include this type of material in their professional life had not waited for him. Second, he was very concerned that once some synthesizers had been installed in a studio, the Director would consider that enough of a 'virage technologique' had taken place.

It was felt that the effort and the energy of trying to implement changes should be directed at some specific targets.

Selection of the Targets

J. A. Chambers and J. W. Sprecher (1983, p. 32) write: "No one is more supportive of CAI than a dean or principal with a micro-computer on his or her desk."

Fullan (1982, p. 65) adds: "Teachers and others know enough now, if they didn't fifteen years ago, not to take change seriously unless central administrators demonstrate through actions that they should." even though (p. 8): "Nothing in the process of change is more agreed on and less understood than the role of the principal."

T. J. Gustavson (1985, p. xii) concurs with them: " The very role of the school manager demands that he or she becomes involved with computer technology in an active, positive way. "

He warns that a 'knowledge gap' can develop between the teachers and the administrators if they do not receive the same amount of training (p. 2):

> "To date, emphasis has been on classroom usage of computers. The school administrator is charged with making decisions about the specific equipment, programs, and usages of computers in his or her school. Yet very little has been done to equip administrators with computer background and data so that they can make sound decisions in these areas. Many times, the teachers themselves know more than the site administrator about what the computer can and cannot do in a classroom. Many teachers have their own machines and even write their own programs.
>
> Since it is the administrator who is responsible for a school's operation, including instruction, efforts should be made to conduct both preservice and inservice training appropriate to the school manager. While the administrator should be a curriculum pioneer-the leader of an innovation-when it comes to computers, this is rarely the case. The proven capability of the computer to expedite routine office chores is an indication that these machines should be installed in the school's front office, but even this does not occur on any large scale. To carry on their responsibilities, school administrators must become active participants in the computer age."

This is supported by Pantiel & Petersen (1984, p. 109): ". . . of prime importance, administrators must be active participants in whatever program they establish. It would be very difficult to evaluate teachers effectively using computers without a solid understanding of what these educators are doing in their classroom based on the training they received.".

First target:

If the head administrator of the Music School does not understand the problems which are inherent in the uses of computerized equipment, the individual teachers might be deprived of a considerable source of support.

In the case of computerized equipment or software for music composition or performance, a technology which is far more complex to use than a word processor or a spreadsheet, a lack of support or understanding could be catastrophic.

Thus, in order to obtain the strong infrastructure needed for permanent changes, it will be vital that the Director of the Music School becomes himself 'computer literate'.

Second target:

The sister who was singled out as the one with the most 'requisite credibility status' among the members of the Congregation will be the second target.

Third target:

The writer has used for the selection of his third target a strategy which has already been successful in a previous hypothetical work about the rebuilding of an audio-visual department in a large CEGEP (ETEC 654, 1984 unpublished manuscript).

This strategy is that of 'triage'; that is to divide the teachers into different categories according to their likes or dislikes for a technique or technology and according to their previous experience.

The teachers can be divided in 6 different groups

Inexperienced with computers

Group A Against
Lack of information causes anxieties toward the machine

Group B In favor
Adventurous people ready to try new experiences

Group C Indifferent
Will use new technology if available and/or not too much effort

Experienced computers

Group D Against
Previous aversive experience with the computer

Group E In favor
Already using the computer and/or computerized equipment

Group F Indifferent
Does not have a need for it

The third target will be the group most likely to change voluntarily, group B, the inexperienced teachers who are positively prejudiced toward the computer or computerized equipment.

Why waste time and energy on people who have decided to maintain the status-quo at any cost. Why force people who have had hands-on experience with the computer and decided that they do not like it to repeat an aversive experience or, why spend time and energy on people who will do very well by themselves anyway.

Thus, there will be 3 prime targets in the plan of implementation:

- The Director, to provide the plan with a solid supportive base
- The most influential sister
- The teachers who are the most likely to change

Overall Strategies

Antoine de Saint Exupéry tells how the fox wanted the little prince to tame him (1946, p. 69):

> "Si tu veux un ami, apprivoise moi!
>
> -Que faut-il faire? dit le petit prince.
>
> -Il faut être très patient, répondit le renard. Tu t'assoiras d'abord un peu loin de moi, comme ça, dans l'herbe. Je te regarderai du coin de l'oeil et tu ne diras rien. Le langage est source de malentendus. Mais chaques jours, tu pourras t'assoir un peu plus près. . ."

The strategies underlying the plan of implementation can be described with five items:

- High visibility
- Peer pressure
- Snowball effect
- Constant re-evaluation
- Adaptability

High visibility

Fullan (1982, p. 135) writes: ". . .one of the best indicators of active involvement is whether the principal attends workshop sessions with teachers."

Since the administrative aspects of the computer are included in the plan of implementation, it would be beneficial that the secretaries, the teachers and the students see a high prestige model writing letters, memos or drawing posters on the computer.

As much relevant information as possible will be gathered and distributed to the teachers concerned in the hope that some 'objective knowledge' will help them see what the proposed changes can do for them in their everyday life.

Rogers (1983, p. 168) suggests: "Change agents could perhaps play their most distinctive and important role in the innovation-decision process if they concentrated on how-to knowledge, which is probably most essential to clients at the trial and decision stage in the process."

Kazdin (1975, p. 59) writes from the behaviorist's point of view: "...behavior modification is used all of the time by virtually everyone. The principles of operant conditioning suggest that behavior is always controlled even when they are not deliberately applied. Everyone reinforces, punishes, and extinguishes behaviors of others with whom they are in contact each day even though no explicit attempt may be made to control behavior."

Hence, a maximum amount of support will be given to the people who show an interest in exploring the new machines.

Peer pressure

Once a few people with 'high credibility status' have been seen using a computer, there will be peer pressure on the others to try the new technology themselves. As Wrightsman explains (1972, p. 551): "...there is a substantial body of research that suggests one of the most important sources of influence is our peer group. Our hair style, clothes, mode of speech and much of what we do is in step with what our peers (or some subgroup of peers) do."

Snowball effect

The more people adopt the changes or just consider that these changes are a 'normal' part of the scenery of the Music School, the more peer pressure there will be on others to change their attitude. Zimbardo et al explain (1977, p. 105): "The support of even one person weakens the powerful effect of a majority opinion on an individual."

Rogers (1983, p. 234) calls this the 'diffusion effect' and defines it as: ". . . the cumulative increasing degree of influence upon an individual to adopt or reject an innovation, resulting from the activation of peer networks about an innovation in a social system."

Constant re-evaluation

It will be of the utmost importance to evaluate the effectiveness of the plan of implementation every step of the way. As Zimbardo et al (1977, p. 223) points out: "... the rule is that any laws of attitude change involve complex sets of interactions among a host of variables." They also write (p. 224): " Attitudes are formed and maintained because of need for information (cognitive clarity and consistency), for social acceptance by other people, or for ego protection from unacceptable impulses and ideas... Information per se is probably the least effective way of changing attitude and behavior. It must be part of a general approach, which sees the individual as more than a rational information-processor..."

Adaptability

Constant re-evaluation of the plan would be useless if the master plan itself did not include a maximum amount of flexibility. Miyamoto Musashi wrote in 1645: "Attitude in strategy on a larger scale is called 'battle array.' Such attitudes are all for winning battles. Fixed formation is bad." Napoleon won wars because he could move his artillery faster than anybody else to take advantage of opportunities. Rommel's Blitzkrieg consisted in total maneuverability and adaptation to a fluid situation. Patton was feared by his opponents because he never hesitated to throw 'the book' out the window. Just as a good judoka 'flows' with his opponent but is instantly ready to block and counter an attack without any pre-conceived plan, so should the change agent be ready to take advantage instantly of a given opportunity or to discard a tactic which does not guarantee success.

The book The Change resisters: How they Prevent Progress and what Managers can do about them by George S. Odiorne (1981) has profoundly influenced the writer in deciding the strategies which will be used to implement changes in the Music School. It is a detailed and comprehensive

analysis of what kind of resistance a manager can expect and practical hints on how to circumvent that resistance.

Tactical Considerations

The writer turned to social psychology for some principles on attitude change. Most textbooks were long on theory but short on practice. Interestingly enough, a very practical book was written by Malcolm Fleming and Howard Levie (1978), a team of instructional designers. Their recommendations cover source credibility, message content, appeal to emotion or reason, attitude change via behavioral change etc. . . The writer selected the prescriptions which, he felt, are applicable in this particular instance.

Even more detailed is:Influencing Attitudes and Changing Behavior: An Introduction to Method, Theory, and Applications of Social Control and Personal Power by Zimbardo, Ebbesen and Maslach (1977). It contains a chapter on 'becoming a social change agent which is devoted to practical tips in point form from 'preparing for the initial contact' to 'getting the commitment and terminating the contact.' That chapter is as suited to the tactical considerations of this research as Odiorne's remarks were suited to the strategical principles underlying the process of implementing changes in the Music School (p. 221-233).

Overall Evaluation

Rogers (1983, p. 212) states: "It is the receivers' perceptions of the attributes of innovations, not the attributes as classified by experts or change agents, that affect their rate of adoption."

The writer does not consider that counting how many computers have been introduced into the Music School or how often the computers are being used is enough of an indication of a change of attitude on the part of the teachers.

The overall evaluation will be whether or not the teachers are using the computers and/or computerized machines to their benefit and the benefit of their students. As Kaufman and English (1979, p. 319) put it: "What should

be remembered is that the final criterion of the effectiveness of staff development must be an improvement in pupil learning."

The evaluation of the attitude of the teachers after they have had hands-on experience with the computer should be made through what Eisner (1985) calls an 'evaluational landscape' which includes:

- How many computers and/or computerized machines have been introduced into the Music School.

- How often and how long the machines are being used.

- How many people are using these machines.

- How many people have included the machines in their courses.

- How many students are being affected by the 'computerization' of the Music School.

It also includes:

- A quick interview with the teachers to compare past and present attitudes.

- Are some people showing an interest in trying new software?

- Are the people talking to each other about their experiences with the computers?

- Are they proud of the work they have done on the computer?

- Have they changed or modified their ways of teaching?

Some circumstantial evidence could be valid proof that 'things' are changing in the Music School. These could take the form of a teacher displaying a poster she has made on the computer, the Director who was lukewarm towards 'high-tech.' taking a computer home with him over a holiday or, two former 'opponents' arguing about access-time.

The evaluation of the effectiveness of the changes implemented for the benefit of the students of the optional third year is easier to evaluate.

At the end of the optional third year, all the students who have graduated should be able to:

-A operate the equipment of a standard MIDI studio,

-B explain the electronic and/or psycho-acoustical principles upon which such a studio is based

to the satisfaction of a prospective employer.

The Change Process

School Year 1985-1986

At the beginning of the school year 1985-86, with funds provided by the CEGEP, the Music School bought 2 Apple Macintosh and some business software. Included were a word-processor, a spreadsheet and a graphic package. Also included was some software which either demonstrated the worth of the computer as a teaching tool (Typing tutor II), or software which the teachers could use to prepare instructional material without learning to program (Video Work). For the most adventurous, LOGO was available.

Ear-training

Early in the term, the Director received a phone call from the marketing Director of Ad lib, the company which manufactures the ear-training dedicated computerized machine EXERCETTE. He offered a demonstration of the newest version of the machine.

The Marketing Director said that the machines had been considerably improved with new software, a full-screen monitor and the addition of a 'MELOCAPTEUR,' which is an interface which samples the human voice, prints the pitch of the voice on the screen in musical notation.

A date was set for a demonstration. All three ear-training teachers were invited.

After the demonstration, the ear-training teachers were very positive about the worth of such a machine to help their students. The Director canvased their opinion again a few days later, all three were still positive that the machine was worth purchasing and that they would use it in their classrooms.

2 EXERCETTEs with the MELOCAPTEUR were bought. The machines were put in the record library in private listening booths usually used for another tape-based ear-training course. The writer was given the

task of familiarizing himself thoroughly with the equipment before training the other teachers. A sample of 8 students, the lowest achievers of the freshman class, was gathered as a pilot project to study the machines and ascertain how to include them in the general curriculum. In October everything was up and running.

By the second week of the installation of the EXERCETTEs, all students had met with the writer, individual programs had been set and the students had settled in some sort of routine which suited him/her best. Attendance on the machines was high.

In September, the mean of the attendance to the tape-based system was 113 minutes for the month. In October, the average time was 131 minutes per student on the tape-based system and 190 minutes per student on EXERCETTE.

Not everybody worked equally hard. One student logged 550 minutes of individual practice in October, another one totalled 35 minutes of practice over the whole month. The students who practiced hard were encouraged, the low achievers suffered through a 'pep talk.'

In November, the mean of the attendance was 123 minutes per student on the tape-based system and 178 minutes on the computer-based system. Some students had developed a preference for one system over the other. One student who was working extremely hard was getting fairly frustrated with himself while another student who had logged 670 minutes on both machines had made a quantum leap and was beaming with self-satisfaction.

At the end of November, the experimenter selected five fairly complex melodies and told the students: "This is your end of term examination, I might pick any of these and ask you to sing it."

A few days later, the experimenter met one of the students in the corridor and asked: "How is the exam going? Are the melodies too difficult? Am I too tough on you guys?" The answer was: "I have asked my regular teacher which percentage of my final grade your exam would count for and she said that she is not going to take it into account at all. I stopped practicing your exam, you've got to understand, I have enough work as it is!"

Each ear-training teacher confirmed that they would not take the exam of the remedial class into account for the regular grade. The Director refused to enter in conflict with the ear-training teachers. The mean attendance dropped to 150 minutes for both machines in February, to less than 55 minutes for both machines in March and remained at that low for the rest of the school year. From the moment the teachers decided not to include the remedial class in their grading scheme the pilot project was dead.

For a statistical analysis of the pilot study, see appendix C.

However, this poorly designed and unscientific 'pilot study' brought some interesting light on the situation. First, enough evidence has been brought up to justify a full-fledged and well-designed investigation to assess the worth of an individualized and computer-assisted ear-training course. Most investigations, at the present, are still comparing the computer versus the teacher. Few studies evaluate the worth of the computer as repetitor and/or teaching assistant.

Second, the behavior of the ear-training teachers contradicts the statement they made which indicated an interest in learning more about the machines which help a student correct his/her rhythm or intonation. It also contradicts the statements they made to the Director, statements which prompted him to buy 2 EXERCETTEs.

For the remainder of the school year, it was part of the writer's job description to help the ear-training teachers to familiarize themselves with the EXERCETTEs. Two teachers made an appointment and were given a thorough explanation on how the machine works. One practiced a few times and became frustrated, the other could never find time to practice. The third teacher would not have anything to do with the machines. When the Director demanded a written report on the possible inclusion of EXERCETTE in the classroom, she sent a student to explore the machine for her. She then took the students' report and handed it to the Director.

It is unfortunate that the teacher who first refused to include the grades of the remedial class for the final grading of her students had been singled out as one of the writer's major targets.

It was the hope of the writer to introduce an element of de-synchronization and individualization in the teaching methods of the Music School. That hope was not going to be fulfilled easily.

Administration

The Director saw immediately the advantages of word-processing and data-banks. He was shown the operating system of the machine, how to use the word processor and how to make posters with Macpaint and Macdraw.

The occupancy of the classrooms was put on a specialized data-bank called Frontdesk. From then on, the reservations for the concert hall or the major classrooms were centralized and a secretary could tell within a few minutes which room was available.

There are two secretaries, both are sisters, one works part-time in the morning and the other part-time in the afternoon. One secretary felt she was too old to learn new tricks. The other was very eager but felt that the writer's recommendations only applied when he was looking. A lot of mistakes were made and when she lost all of the Director's work by simply turning the computer off instead of 'booting down' first, the cup was full. The Director suggested that, the next year, the writer should officially be responsible for the training of the secretarial staff.

CMI

One computer was placed in the secretary's office, the other in one of the private booths in the record library. This ensured maximum visibility in one case and maximum privacy in the other.

Posters were placed. People were told. It was made extremely clear that there was a computer available and a resource person whose function it was to help the teachers of the Music School to become computer-literate. According to the survey, 32 people wanted to know more about word-processing, 34 people wanted more information about a music-editor, 38 people wanted to know more about data-banks.

5 people made an appointment. Of these five there were 3 teachers. The record librarian was very eager to learn the new machine because she felt that sooner or later her job will become computerized. One of the part-time librarians felt the same.

In a year, the record librarian has explored most of the business software purchased by the Music School including a spreadsheet. Her knowledge of the computer is such that she is, at the present, unofficially a back-up resource person.

One teacher (She teaches instrumental music and will probably very seldom have any use for CMI) has been shown word-processing and a graphic package.

One teacher learned how to make programs for the concerts she organizes with a graphic package. She also learned proficiently how to use a word-processor.

The writer convinced the sister he singled out as an influential person in the Music School to come and see how a spreadsheet could help her manage her grading. She saw how the computer adds and calculates averages in a fraction of a second. She decided that it was too powerful a tool for the size of her classes and that she would rather do it by hand. Later, she attempted to make lists of students with the spreadsheet; the writer suggested that it might not be the appropriate tool for this task. She insisted that she did not have any time to learn yet another piece of software.

Everett Rogers (1983, p. 166) quotes Hassinger who argued that: ". . . individuals will seldom expose themselves to messages about an innovation unless they first feel a need for the innovation, and even if such individuals are exposed to the innovation messages, such exposure will have little effect unless the individual perceives the innovation as relevant to his needs and as consistent with his attitudes and beliefs." He calls this phenomenon: "Selective exposure."

Another phenomenon is called by Rogers: "Selective perception." It is: "The tendency to interpret communication messages in terms of one's existing attitudes and beliefs."

He concludes (p. 167): "Does a need precede knowledge of a new idea, or does knowledge of an innovation create a need for that new idea? Perhaps this is a chicken-or-egg problem. In any event, available research does not provide a clear answer to this question of whether awareness of a need or awareness of an innovation (that creates a need) comes first."

At Christmas, the writer handed the Director a report explaining the failure of the pilot study. The report was very critical of the state of the ear-training program in the Music School. It pointed out that the obvious pedagogical objective of the teachers in question was to satisfy the lowest common denominator instead of preparing the students for university. It re-questioned the rationale for having as many as eight levels of ear-training. It also suggested remedies to give each student a more accurate idea of his/her chances of getting accepted into the university of his/her choice. This report was shown by the Director to the ear-training teachers and, needless to say, it was not accepted with grateful humility.

In a second report, handed at the end of the school year, the writer stated that the computerization of the administration was proceeding slowly but surely. It admitted that teaching computer-literacy to the teachers who had expressed a desire to learn could not be considered successful.

The report stated that there had been no interest whatsoever on the part of teachers toward getting information about alternate teaching methods even though some changes could be beneficial to the students:

The last part of the report consisted of an analysis of the dissonance between the state of the labor-market and the pedagogical objectives of the optional third year. It suggested several scenarios to update the curriculum to make the Music School more competitive.

A list of requirements needed for a rudimentary MIDI studio was handed to the Director. Again, training the teachers was the top priority.

Revision of the Process

Throughout the process of implantation, the writer and the Director had frequent meetings during which problems were brought up and solutions were suggested.

A new policy was agreed upon for the 1986-87 season. The Director thought that the ear-training teachers had had their chance to learn how to operate the new equipment and should no longer need a resource person to demonstrate the machine and help the students. Henceforth, the writer would not have anything to do with ear-training anymore.

The efforts of the writer would be re-directed at two specific targets. First, the computerization of the administration and mostly the training of the secretaries. Second, the implantation in the Music School of a MIDI studio as soon as the CEGEP granted the funds.

School year 1986-1987

Negotiations took place throughout the summer and shortly after the beginning of term, the Music School was equipped with a master-keyboard, a synthesizer DX7, an expander TX416, a signal processor, a drum machine, a basic mixing board and a sound system.

The writer had also hoped for a sampler and an analog synthesizer but there was not sufficient funds.

Arrangements were made with a well-known MIDI expert to come and instruct the 'popular music' teachers every Friday morning.

In the next few days, before the arrangement was completed, the expert phoned the Director and told him that he was about to sign a contract with an important client and that he would be in Los Angeles until Christmas. The course was postponed until the second session.

In the meanwhile, the writer was teaching the secretarial staff how to use the business software.

Administration

The writer helped the Director to set up a form in Microsoft File 1 to keep a record of all the names and addresses of the students. Since the students move frequently at the beginning of the school year, the possibility of editing the data-bank and reprinting another student list is a huge saving in labor.

While the students and the staff of the Music School were settling in the routine of a new school year, the writer started to do a task analysis of the operating system and the most commonly used business software. Using an outline processor he broke down the processes of using the computer to the most minute click of the mouse.

The resulting behavior prescriptions (Romiszowski 1981, 1984) were then printed, each secretary and the Director received a copy. Each secretary was taught how to work with the computer in a very strict and sequential manner. This method was very much appreciated by all parties.

Before Christmas, the writer told the secretaries that there would be a test in the following days, he then gave them a word-processing assignment. Upon completion of the assignment, each secretary received a certificate of computer-literacy.

In a conversation which took place sometimes in the middle of the term, the Director expressed how he had always wanted to make a pamphlet advertising the courses available in the preparatory school. The writer praised the superior quality of the output of the laser-printer, explained that some machines, set up in computer stores, could rent for as low as a dollar a page and explained the advantages of desk-top publishing (Ulick 1986). The Director decided to try.

It was hard and slow going because he did not know the software, the art work was not ready and he did not understand at first the rationale for

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[1]Microsoft Canada inc., 6300 Northwest Drive, Mississauga, Ont., L4V 1J7.

breaking his text into simple elements which could then be manipulated individually.

With time he became more confident and completed the project. In the process he learned more about how to operate the computer than he had learned since the computer was first removed from its box. The completion of this advertisement was a turning point in the computerization of the Music School. Since then, the Director seldom uses the writer as a resource person. Quite often they have conversations about software using fluently jargon which was alien to him before he completed this project.

At the beginning of the second term, the writer got in touch with the expert on MIDI and the course was scheduled to start. All the teachers involved in 'popular music' and/or jazz were invited and prompted to attend.

The expert arrived and sat up the elements of the studio to his satisfaction. The first lesson was a success. All the students were very impressed with what could be achieved with a computer and some MIDI equipment.

The trainees were supposed to practice with the equipment during the week. Nobody did. In the following weeks, the expert dutifully showed up on Friday morning and talked while people took notes or asked a few questions. Nobody practiced anything between lessons, attendance was getting lower. One Friday in the middle of the term, the expert was absent. Later he phoned to say that he had been sick and that his doctor had ordered him rest. Formal tuition was postponed until further notice. He promised to hold an intensive course as soon as he was feeling better.

Despite his lack of experience, the writer decided to keep the course going. Concentrating on one specific machine, the DX7, he analyzed the functions of every button from a technician's point of view. The trainees were handed sheets of behavioral prescriptions, each new concept was immediately applied and tried, everybody had hands-on experience under supervision. It was a great success. One teacher commented that he needed a concrete systematic hands-on approach and that the course should have taken place like that from the very beginning.

After the school year, another training session took place, three mornings a week for two weeks. It was successful.

Preparing the Future

Administration

There is much more to be done to help the administration. The possibilities offered by the data-bank have just been scratched. Mail-merge would be an enormous saving in time, not only to send routine communications to the home of the students or teachers but also for communicating with and billing the many people who use the services of the preparatory school.

The spreadsheet has not yet been used. The Director would save many hours in the preparation of his budget. The accountant could use a decent accounting system. The salaries of about 50 to 55 teachers with different pay scales have to be calculated. Expenses have to be kept. The parents of the students of the preparatory school have to be billed.

At the present, the computer is under-exploited in a reactive capacity. Making the day to day 'grind' a little more efficient and more pleasant. The writer hopes that the computer will one day be exploited as a pro-active control, doing financial modeling, providing statistical forecast, mail-merging bills at the right time.

Pedagogy

There is not much hope that any pedagogical change will take place in the Music School as long as the 'temperamental conservatives' (Odiorne 1981, p. 151) hold the key teaching positions.

At the end of last summer, a teacher was replaced by a young man back from studying music in Los Angeles. He was introduced around, saw one of the computers and asked for access-time. He learned the Macintosh in an hour and did all his course preparation on the computer in three days.

As older people leave and younger people move in, the potential for change is there. What is needed is first a political will to exploit the change

and second, a provision to help and nurture the change process. Denise Walsh wrote in her thesis (1984, p. 97): "for true education to take place, the educatee must "intend" to be educated and in some ways this insures that the process towards rational understanding and a sense of self has already begun in the individual and the educational technologist is merely the ENABLER who assists and furthers the process." This could be rephrased: "For true change to take place . . ."

While the teachers of institutionalized music resist change, the Director keeps on acting upon the recommendations of the writer's second report. Negotiations are taking place to update a recording studio which would be shared by three departments, music, cinema and electrical engineering.

The MIDI studio will be part of the curriculum as of September 1987. It will be mandatory for the students who are enrolled in the option 'popular music' and optional for the others.

There is a political will to establish and maintain channels of communication between the Music School and the 'labor market.' The Director has agreed that the money which wasn't spent in salary to the expert who came to teach how to operate a MIDI studio would be spent to send the writer on an 'internship' in an actual professional studio. Contacts have been made with the representatives of manufacturers of electronic equipment to make music. Contacts have been made with user groups. Magazines specializing in computerized music are being read. The key to intelligent change is adequate intelligence.

Afterword

Both the investigator and the respondents have changed over the course of the research. These changes have taken different forms.

The secretaries have learned to do some of their work on the computer. A few teachers have acquired 'personal knowledge' about the computer and/or computerized equipment to make music and are now more capable of assessing their own needs. Some others are further entrenched in their positions.

Two players have learned probably more than anybody else. The Director has been sensitized to the need to adapt the Music School to a changing environment. Much more than the writer, he has to deal with 'temperamental conservatives.' It is a reflection of his talents as an administrator and as a diplomat that he finds a clear path and maintains the peace between temperamental conservatism and radical innovation.

In the process of helping people to learn how to use the computer and adjust their ways of working, the writer is discovering that there is a major difference between a 'hit-and-run needs assessment' and the real-life process of being change agent.

In the meanwhile, the Music School is little by little adjusting and adapting to technological and demographic changes.

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Appendix A

Questionnaire

Cégep de Saint-Laurent

Chers Collègues,

Comme vous le savez, je suis en train de faire une recherche sur les possibilités de l'emploi de machines et de l'ordinateur dans l'enseignement de la musique.

Vous m'aideriez beaucoup à évaluer les besoins de l'école de musique en remplissant le questionnaire ci-joint.

Il vous suffit de cocher la bonne réponse. (une seule réponse par question s'il-vous-plaît). Si vous ne comprenez pas la question, n'y répondez pas. Si la question n'est pas pertinente dans votre cas, cochez la mention: " je n'en ai pas besoin dans mes cours".

Je vous remercie d'avance

Jean-Louis Van Veeren.

625, boulevard Sainte-Croix, Saint-Laurent H4L 3X7, Qué. Tél.: (514) 747-6521

1.- Avez-vous déjà utilisé un ordinateur?

OUI ( ) NON ( )

2.- Etes-vous au courant des possibilités de l'Enseignement Assisté par Ordinateur?

OUI ( ) NON ( ) UN PEU ( )

3.- Si les machines et les logiciels * étaient à votre disposition, utiliseriez-vous les techniques suivantes?

A) TUTORIEL

- Je m'en servirais ( )
- Je pourrais m'en servir mais je préfère m'abstenir ( )
- Je n'en ai pas besoin pour mes cours ( )

B) EXERCICES REPETITIFS

- Je m'en servirais ( )
- Je pourrais m'en servir mais je préfère m'abstenir ( )
- Je n'en ai pas besoin pour mes cours ( )

C) SIMULATIONS

- Je m'en servirais ( )
- Je pourrais m'en servir mais je préfère m'abstenir ( )
- Je n'en ai pas besoin pour mes cours ( )

* Un logiciel est un programme

D) JEUX EDUCATIFS

- Je m'en servirais ( )
- Je pourrais m'en servir mais je préfère m'abstenir ( )
- Je n'en ai pas besoin pour mes cours ( )

4.- Vous serviriez-vous d'un "traitement de texte" pour préparer vos cours?

- Je m'en servirais ( )
- Je pourrais m'en servir mais je préfère m'abstenir ( )
- Je n'en ai pas besoin pour mes cours ( )

5.- Etes-vous intéressé (e) à en savoir plus sur les possibilités du"traitement de texte"?

OUI ( ) NON ( )

6.- Vous serviriez-vous d'un logiciel d'édition de musique pour préparer vos cours?

- Je m'en servirais ( )
- Je pourrais m'en servir mais je préfère m'abstenir ( )
- Je n'en ai pas besoin pour mes cours ( )

7.- Etes-vous intéressé(e) à en savoir plus sur les possibilités offertes par un logiciel d'édition de musique?

OUI ( ) NON ( )

8.- Vous serviriez-vous d'une "banque de données" pour emmagasiner les noms, numéros de téléphone, adresses et résultats de vos élèves?

- Je m'en servirais ( )
- Je pourrais m'en servir mais je préfère m'abstenir ( )
- Je n'en ai pas besoin pour mes cours ( )

9.- Vous serviriez-vous d'une "banque de données" pour cataloguer vos disques, vos livres ou vos partitions?

- Je m'en servirais ( )
- Je pourrais m'en servir mais je préfère m'abstenir ( )
- Je n'en ai pas besoin pour mes cours ( )

10.- Etes-vous intéressé(e) à en savoir plus sur les "banques de données?"

OUI ( ) NON ( )

11.- Vous serviriez-vous d'un logiciel de statistiques pour évaluer le progrès de vos élèves?

- Je m'en servirais ( )
- Je pourrais m'en servir mais je préfère m'abstenir ( )
- Je n'en ai pas besoin pour mes cours ( )

12.- Vous serviriez-vous d'un "Quiz" ou d'un"choix multiple" fait sur ordinateur pour évaluer les connaissances de vos élèves?

- Je m'en servirais ( )
- Je pourrais m'en servir mais je préfère m'abstenir ( )
- Je n'en ai pas besoin pour mes cours ( )

13.- Tiendriez-vous compte de ce "Quiz" ou "choix multiple" pour l'évaluation finale de vos élèves?

OUI ( ) NON ( )

14.- Seriez-vous intéressé(e) à connaître des éléments de programmation dans un langage simple qui vous permette de préparer des dictaticiels * pour vos élèves?

- Je m'en servirais ( )
- Je pourrais m'en servir mais je préfère m'abstenir ( )
- Je n'en ai pas besoin pour mes cours ( )

15.- Seriez-vous intéressé(e) à être capable de préparer des "Quiz" ou des "choix multiples" pour vos élèves?

- Je serais intéressé(e) ( )
- Je préfère m'en abstenir ( )
- Je n'en ai pas besoin pour mes cours ( )

* Un didacticiel est un logiciel éducatif.

16.- Seriez-vous intéressé(e) à ce que quelqu'un d'autre, spécialisé dans le domaine, prépare du matériel didactique spécifiquement pour vos cours?

- Cela m'intéresse ( )
- Cela pourrait s'appliquer à mes cours mais je préfère m'en passer ( )
- Cela ne s'applique pas à mes cours ( )

Les machines suivantes pourraient-elles aider vos élèves?

17.- Une machine capable de vérifier et de corriger la justesse du rythme d'un élève?

- EN SOLFEGE

FORT ( ) UN PEU ( ) PRESQUE PAS ( ) PAS DU TOUT ( )

- A L'INSTRUMENT

FORT ( ) UN PEU ( ) PRESQUE PAS ( ) PAS DU TOUT ( )

18.- Une machine capable de vérifier et de corriger l'intonation des élèves?

- EN SOLFEGE

FORT ( ) UN PEU ( ) PRESQUE PAS ( ) PAS DU TOUT ( )

- A L'INSTRUMENT

FORT ( ) UN PEU ( ) PRESQUE PAS ( ) PAS DU TOUT ( )

19.- Une machine capable d'écrire des partitions de musique?

FORT ( ) UN PEU ( ) PRESQUE PAS ( ) PAS DU TOUT ( )

20.- Une machine capable d'imprimer des partitions de musique?

FORT ( ) UN PEU ( ) PRESQUE PAS ( ) PAS DU TOUT ( )

21.- Une machine capable d'imprimer sur papier, en notes de musique, tout ce qu'un étudiant a joué dans un certain laps de temps?

FORT ( ) UN PEU ( ) PRESQUE PAS ( ) PAS DU TOUT ( )

22.- Etes-vous intéressé (e) à en savoir plus sur le fonctionnement de ces machines?

OUI ( ) NON ( )

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Appendix B

Results

Appendix B

Results

Of the 55 questionnaires distributed 45 were returned. Of the returned questionnaires 4 were discarded because there were blank or largely incomplete. The remaining 41 questionnaires were tabulated.

Question 1

Avez-vous déjà utilisé un ordinateur?

Base: 41

Oui	37%	(15)
Non	63%	(26)

Question 2

Etes-vous au courant des possibilités de l'Enseignement Assisté par Ordinateur?

Base: 41

Oui	20%	(8)
Non	46%	(19)
Un peu	34%	(14)

Question 3

Si les machines et les logiciels étaient à votre disposition, utiliseriez-vous les techniques suivantes?

-A Tutoriel

Base: 29

Pas de réponse		(12)
Je m'en servirais	34%	(10)
Je préfère m'abstenir		(0)
Je n'en ai pas besoin	66%	(19)

-B Exercices répétitifs

Base: 32

Pas de réponse		(9)
Je m'en servirais	28%	(9)
Je préfère m'abstenir	06%	(2)
Je n'en ai pas besoin	66%	(21)

-C Simulations

Base: 30

Pas de réponse		(11)
Je m'en servirais	27%	(8)
Je préfère m'abstenir		(0)
Je n'en ai pas besoin	73%	(22)

-D Jeux éducatifs

Base: 35

Pas de réponse		(11)
Je m'en servirais	28%	(10)
Je préfère m'abstenir	09%	(3)
Je n'en ai pas besoin	63%	(22)

Question 4

Vous serviriez vous d'un 'traitement de texte' pour préparer vos cours?

Base: 36

Pas de réponse		(5)
Je m'en servirais	31%	(11)
Je préfère m'abstenir		(0)
Je n'en ai pas besoin	69%	(25)

Question 5

Etes-vous interessé(e) à en savoir plus sur les possibilités du 'traitement de texte?'

Base: 41

Oui	78%	(32)
Non	22%	(9)

Question 6

Vous serviriez-vous d'un logiciel d'édition de musique pour préparer vos cours?

Base: 38

Pas de réponse		(3)
Je m'en servirais	50%	(19)
Je préfère m'abstenir	08%	(3)
Je n'en ai pas besoin	42%	(16)

Question 7

Etes-vous interessé(e) à en savoir plus sur les possibilités offertes par un logiciel d'édition de musique?

Base: 41

Oui	83%	(34)
Non	17%	(7)

Question 8

Vous serviriez-vous d'une 'banque de données' pour emmagasiner les noms, numéros de tel., adresses et résultats de vos élèves?

Base: 40

Pas de réponse		(1)
Je m'en servirais	65%	(26)
Je préfère m'abstenir	05%	(2)
Je n'en ai pas besoin	30%	(12)

Question 9

Vous serviriez-vous d'une 'banque de données' pour cataloguer vos disques, vos livres et vos partitions?

Base: 41

Je m'en servirais	71%	(29)
Je préfère m'abstenir	02%	(1)
Je n'en ai pas besoin	27%	(11)

Question 10

Etes-vous interessé(e) à en savoir plus sur les 'banques de données'?

Base: 41

Oui	93%	(38)
Non	07%	(3)

Question 11

Vous serviriez-vous d'un logiciel de statistiques pour évaluer le progrès de vos élèves?

Base: 40

Pas de réponse		(1)
Je m'en servirais	48%	(19)
Je préfère m'abstenir	07%	(3)
Je n'en ai pas besoin	45%	(18)

Question 12

Vous serviriez-vous d'un 'quiz' où d'un 'choix multiple' fait sur ordinateur pour évaluer les connaissances de vos élèves?

Base: 39

Pas de réponse		(2)
Je m'en servirais	36%	(14)
Je préfère m'abstenir	13%	(5)
Je n'en ai pas besoin	51%	(20)

Question 13

Tiendriez-vous compte de ce 'quiz' ou 'choix multiple' pour l'évaluation finale de vos élèves?

Base: 35

Oui	23%	(8)
Non	77%	(27)

Question 14

Seriez-vous intéressé(e) à connaitre des éléments de programmation dans un langage simple qui vous permette de préparer des didacticiels pour vos élèves?

Base: 39

Pas de réponse		(2)
Je m'en servirais	46%	(18)
Je préfère m'abstenir	05%	(2)
Je n'en ai pas besoin	49%	(19)

Question 15

Seriez-vous intéressé(e) à être capable de préparer des 'quiz' ou des 'choix multiples' pour vos élèves?

Base: 38

Pas de réponse		(3)
Je m'en servirais	42%	(16)
Je préfère m'abstenir	05%	(2)
Je n'en ai pas besoin	53%	(20)

Question 16

Seriez-vous intéressé(e) à ce que quelqu'un d'autre, spécialisé dans le domaine. prépare du matériel didactique spécifiquement pour vos cours?

Base: 39

Pas de réponse		(2)
Je m'en servirais	44%	(17)
Je préfère m'abstenir	05%	(2)
Je n'en ai pas besoin	51%	(20)

Les machines suivantes pourraient-elles aider vos élèves?

Question 17

Une machine capable de vérifier et de corriger la justesse du rhythme d'un élève?

En solfège?

Base: 27

Pas de réponse		(14)
Fort	56%	(15)
Un peu	33%	(9)
Presque pas		(0)
Pas du tout	11%	(3)

A l'instrument?

Base: 34

Pas de réponse		(7)
Fort	62%	(21)
Un peu	20%	(7)
Presque pas	06%	(2)
Pas du tout	12%	(4)

Question 18

Une machine capable de vérifier et de corriger l'intonation des élèves?

En solfège?

Base: 24		
Pas de réponse		(17)
Fort	67%	(16)
Un peu	25%	(6)
Presque pas		(0)
Pas du tout	08%	(2)

A l'instrument?

Base: 34		
Pas de réponse		(7)
Fort	56%	(19)
Un peu	12%	(4)
Presque pas		(0)
Pas du tout	32%	(11)

Question 19

Une machine capable d'écrire des partitions de musique?

Base: 39		
Pas de réponse		(2)
Fort	72%	(28)
Un peu	05%	(2)
Presque pas		(0)
Pas du tout	23%	(9)

Question 20

Une machine capable d'imprimer des partitions de musique?

Base: 40		
Pas de réponse		(1)
Fort	80%	(32)
Un peu	12%	(5)
Presque pas		(0)
Pas du tout	08%	(3)

Question 21

Une machine capable d'imprimer sur papier, en notes de musique, tout ce qu'un étudiant a joué dans un certain laps de temps?

Base: 37

Pas de réponse		(4)
Fort	65%	(24)
Un peu	03%	(1)
Presque pas	11%	(4)
Pas du tout	21%	(8)

Question 22

Etes-vous intéressé(e) à en savoir plus sur le fonctionnement de ces machines?

Base: 41

Oui	90%	(37)
Non	10%	(4)

Appendix C

Pilot Study

Appendix C

Pilot Study

Rationale for the study

Most research about the use of computer for ear-training practice aims at finding if a stand-alone computer-system is superior to traditional instruction. This is the wrong approach. Rightfully, Robert Bernard (CJEC, summer 1986, p. 147-151) points out that the constant comparison between the human teacher and the computer is unfair because it compares apples with oranges. The writer would go further and state that it compares orange-orange with apple-orange interaction.

From the onset of the research, the policy of the Music School was that any computerized equipment should be intended to supplement traditional instruction, not to substitute for it. The objective of the research was to discover by trial and error strategies and/or tactics by which the teachers of the Music School could take full advantage of the possibilities offered by the machines. There was no intention "to generalize outside of the specific circumstances of the testing site."

Method

Design and Subjects

The design was imposed on the writer. It consisted of what Campbell and Stanley (1963, p. 6) call the "one-shot case study." There was no pretest, no control, the posttest would include, on the one hand an empirical evaluation by the teachers whether or not the students had progressed beyond what was expected of them, on the other hand, an interview with each student to assess his/her attitude toward the new machines and suggestion(s) on how it could help them more. The overall policies and strategies would be decided

Material

The material consisted of the 2 EXERCETTEs equipped with a good quality microphone and a MELOCAPTEUR each. Also available was a tape-based ear-training system designed by Leo Horacek and Gerald Lefkoff from West Virginia University (1970). The tape-based system was available immediately in September, the EXERCETTE were not ready until October.

Procedure

The 8 students were part of a remedial class which met officially each Monday at 9.00 AM. At the first lesson, the students met with the experimenter who told them the 'rules of the game.' The students were told that they could gain access to the instructor whenever he was free or by appointment. The Monday morning classes were to be kept for group activities or exceptionally for individual meetings.

Subsequently, the students went to work individually or in small groups in the different booths. The instructor went from student to student, interviewing them, assessing their problem(s), helping them decide on reasonable personal objectives and suggesting specific techniques and/or exercises to overcome their weakness. The aim was total de-synchronization and individualization.

They were told that there would be a final examination and that their final grade would depend on a combination of how hard they had worked, what part of their personal objectives they had been capable of achieving and the final exam.

The record librarian kept an accurate log-book on each student, when he/she practiced, which system he/she worked on, what exercise he/she choose and how long he/she practiced. An office was set for the experimenter in one of the private booths. There was at all times a maximum of help available.

Description of events

By the second week, all students had met with the instructor, individual programs had been set and the students had settled in some sort of routine which suited him/her best. Most stopped showing up for the Monday morning class. Yet, attendance on the machines was high.

In September, the mean of the attendance to the tape-based system was 113 minutes for the month. In October, the average time was 131 minutes per student on the tape-based system and 190 minutes per student on EXERCETTE.

Not everybody worked equally hard. One student logged 550 minutes of individual practice in October, another one totalled 35 minutes of practice over the whole month. The students who practiced hard were encouraged, the low achievers suffered through a 'pep talk.'

In November, the mean of the attendance was 123 minutes per student on the tape-based system and 178 minutes on the computer-based system. Some students had developed a preference for one system over the other. One student who was working extremely hard was getting fairly frustrated with himself while another student who had logged 670 minutes on both machines had made a quantum leap and was beaming with self-satisfaction.

At the end of November, the experimenter selected five fairly complex melodies and told the students: "This is your end of term examination, I might pick any of these and ask you to sing it."

A few days later, the experimenter met one of the students in the corridor and asked: "How is the exam going? Are the melodies too difficult? Am I too tough on you guys?" The answer was: "I have asked my regular teacher which percentage of my final grade your exam would count for and she said that she is not going to take it into account at all. I stopped practicing your exam, you've got to understand, I have enough work as it is!"

Each ear-training teacher confirmed that they would not take the exam of the remedial class into account for the regular grade. The Director refused to enter in conflict with the ear-training teachers. The mean attendance

dropped to 150 minutes for both machines in February, to less than 55 minutes for both machines in March and remained at that low for the rest of the school year. From the moment the teachers decided not to include the remedial class in their grading scheme the pilot project was dead.

The data of the students' attendance were submitted to a repeated measure analysis of variance. A post-hoc analysis was conducted to single out specific differences. September was eliminated from the analysis because the machine EXERCETTE had not been set up yet and the students had not quite settled into the schools' routine. December, January and May were eliminated because of the length of the school holiday.

Results

Data for the attendance to the tape-based system

Sum of scores	October	November	February	March	April
in minutes	1045.00	985.00	875.00	250.00	245.00

Analysis of the data of the tape-based system

Summary table

Source	SS	df	MS	F	
A	79800.00	4	19950.00	4.252	*
S	235320.00	7	33617.14		
AxS	131380.00	28	4692.14		

The F ratio reached statistical significance F (4,28)=4.252, p=.0082.

A post-hoc analysis did not show a statistical significance between the students' attendance to the tape-based system during the first term and attendance during the second term F crit. (scheffé)=10.840, F (1,28)=9.996. There is however a significant difference between the attendance in the month of October, November and February versus the attendance in March and April F (1,28)=16.611

Data for the attendance to the computer-based system

Sum of scores in minutes	October	November	February	March	April
	1520.00	1425.00	235.00	175.00	190.00

Analysis of the data of the computer-based system

Summary table

Source	SS	df	MS	F	
A	243696.25	4	60924.06	12.690	*
S	130579.37	7	18654.20		
AxS	134423.75	28	4800.84		

The F ratio reached statistical significance F (4,28)=12.690, p=.0001.

A post-hoc analysis showed a statistical significance between attendance to the computerized equipment during the first term and attendance during the second term F crit. (scheffé)=10.840, F (1,28)=50.593.

Discussion

The writer was curious to know why attendance to the tape-based system had not significantly dropped in February. An interview with the record librarian revealed that all three ear-training teachers had scheduled several tests organized around the tape-based system that month.

As Campbell and Stanley (1963) point out, the "one shot-case study" has almost no scientific value. Furthermore, there might be some 'common sense' logic to experiment with a machine or a new teaching method on the worse possible subjects on the ground that; "If it can help them it will help anybody!" but this logic is not shared by educational researchers. This experiment has no scientific value whatsoever.

It must however be noted that the attendance of these students when they had objectives, supervision and they knew that they would be tested is

statistically different than their attendance on a voluntary basis. When they were going to be graded they found up to 1 hour a week to spend on the machines. Without the pressure of test and grading they could not even spare 1 hour a month.

Conclusion

A poorly designed and unscientific 'pilot study' brought some interesting light on the situation. First, enough evidence has been brought up to justify a full-fledged and well-designed investigation to assess the worth of an individualized and computer-assisted ear-training course. Most investigations, at the present, are still comparing the computer versus the teacher. Few studies evaluate the worth of the computer as repetitor and/or teaching assistant.

Second, the behavior of the ear-training teachers contradicts the statement they made which indicated an interest in learning more about the machines which help a student correct his/her rhythm or intonation. It also contradicts the statements they made to the Director, statements which prompted him to buy 2 EXERCETTEs.