E. W. ROMANIUK
and T. O. MAGUIRE
Division of Educational Research Services,
The University of Alberta,
Edmonton, Alberta

COMPUTER ASSISTED GUIDANCE*

The past decade has seen a proliferation of studies describing the application of computers to educational activities. Among the activities which has received attention is educational guidance. An early attempt to apply the computer to this area was conducted by the Systems Development Corporation (SDC) in 1965 and has been reported in various articles since then (Cogswell & Estavan, 1965; Laughery, Friesen, & Hurst, 1956; Cogswell, Donahoe, Estavan, & Rosenquist, 1966; Rosenquist, Cogswell, Estavan, & Donahoe, 1967).

The SDC researchers developed a computer program which allowed students to interact with the computer as they planned their educational programs. An attempt was made to simulate a counselor's behavior in two phases of an educational planning interview: 1) the pre-interview behavior of the counselor in the appraisal of the student's cumulative records, and 2) the counselor's behavior in the interview itself. An evaluation of the project included a comparison, the outcomes of the computer interview with the outcomes obtained from live interviews with two school counselors. The results can be summarized into three areas.

(1) Areas of no difference between the school counselor and the computer:

There was no significant difference between the appraisal behavior of the computer and two school counselors on three-quarters of the appraisal statements.

(2) Areas of difference between the school counselor and the computer:

a. In the pre-interview, the computer was generally more pessimistic in predicting the future achievement of students in the lower aptitude levels. It predicted more potential dropouts than the counselors.

b. During the planning interview the computer was more permissive than the school counselors. The students were more influenced by the counselors than by the computer in their educational plans.

c. Some of the students favored the computer interview because they felt the confidentiality of the computer was important.

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(3) Student reaction to the computer interview:

a. Twenty percent felt the computer was able to take into the consideration all of the data necessary to make adequate plans for high school.

b. Fifty-six percent had reservations about the computer assisted plans. Twenty percent had reservations about the course plans constructed with the assistance of the school counselor.

c. Six percent were bored by the computer interviews.

d. Twenty-six percent felt bothered by the fact that the computer did not express reassurance as to whether their choices were appropriate.

e. One student terminated the computer interview before making course plans.

In summary, the results showed that the computer *could* perform a significant part in transmitting the information currently done by the guidance counselor, but that a great deal of additional work must be done in order to overcome some of the drawbacks.

The purpose of the present study was to investigate the applicability of computers to educational planning interviews by developing a computerized interview which could be implemented by school systems possessing a medium-sized third generation computer. One characteristic of the program was that it be easily revised to meet changing conditions and prerequisites. This requirement implied that the program should be written in a language easily understood by technicians having only a small amount of programming experience. A second characteristic of the program was that it had to produce (in interaction with the student) educational plans satisfying to the student and not substantially different from plans that could be made by the student in consultation with the school counselor.

Development of the Computer Interview

Following the SDC example, it was decided to develop the computer interview on the basis of the behavior of a single successful counselor rather than from an abstraction of what might be called "good counseling." The counselor hereafter to be called as model counselor was an active counselor in a high school. Part of his duties was to advise incoming students in their selection of high school programs.

In an effort to gain an understanding of the model counselor's interview behavior, he was presented with five hypothetical students and asked to think out loud as he interpreted and analyzed their ninth grade academic records. Next he was asked to plan tentative tenth grade programs for each hypothetical student. It was decided to use hypothetical students rather than real students so that the model counselor could be interrupted at any point where clarification was necessary. Such interruptions in a real situation were deemed to be unfair to the student.

Tape recordings were made of the model counselor's verbalizations as he analyzed the hypothetical students. The tapes were transcribed, analyzed and a preliminary flowchart constructed which described the counselor's decision rules and his criteria in helping students plan their tenth grade programs.

A first draft of the interview program was written based on the flowchart. The programming language used was APL (Iverson, 1962; Hunka, 1967) which can be used on remote terminals. Experience at The University of Alberta indicates that with as little as four hours of instruction, teachers with no previous computer experience could develop a program such as the one used in the present project.

The programmed interview was reviewed by the model counselor, and tried out on a small sample of ninth grade students. As a result of suggestions, alterations were made. The final program is available from the authors. Rather than describing the program itself, it might be more enlightening to describe a typical student interview.

The student was seated in front of an IBM 2741 terminal which is similar in appearance to an IBM electric typewriter. The terminal was connected by telephone lines to an IBM 360/67 computer which allowed for the simultaneous use of thirty such terminals. Illustration 1 showed parts of a sample interview. The first part of the program consisted of a sequence in which the student learned how to respond to the questions asked by the computer. This part has been omitted from the illustration. A response typed by the student is shown in the line immediately following the line of asterisks.

In designing the interview it was decided to keep the student responses relatively simple (answering Y or N, or by a numeral) and to provide as much interaction as possible. All decisions were left in the hands of the students, the computer acted only as an information provider and a director of sequence.

After having received instruction on the procedure, the student was asked to type in a previously issued code number. Once the code number had been verified against a master list, the student's Easter report card marks were typed out. The interview proceeded along the lines exemplified by the model counselor. Students wishing to attend post high school institutions were asked to select one from a list. NAIT and SAIT are common abbreviations for the Northern and Southern Alberta Institutes of Technology, respectively. Upon request, a brief resume of educational requirements was provided. Those not anticipating attendance at a post high school institution, or who had not decided on a school were asked if they wanted information on apprenticeship training.

Then based on a survey by the Department of Education of the Province of Alberta, (1963) a contingency table was produced so that the student could see how well students with marks similar to his had succeeded in the past.

After selecting a high school pattern for the following year the student was provided with a section in which he selected course options. This portion of the interview was programmed to give the student information about any course that he wanted. Matriculation students were advised to choose French or Latin as one of their options. This was in line with the model counselor's behavior.

A review of the students' options was output. Under the following conditions, the student would have been given another chance to choose course options: 1) he changed his mind, or accidentally typed the wrong

TABLE 1

Item			Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
1	I received enough information during the interview to help me plan my high school program.	Comp	0	1	5	8	1
		Conns	0	2	6	5	2
2	The interview was boring.		13	2	0	0	0
			11	4	0	0	0
3	There were times I disagreed with some of the courses selected for my program.		2	7	2	4	0
			4	1	4	6	0
4	I would have liked the computer (counselor) to tell me that the choices I made were the correct ones.		0	0	0	7	8
			3	2	5	2	3
5	Some of the topics discussed in the interview were confidential.		3	9	2	1	0
			5	6	1	3	0
6	I could have made the same program without the help of the computer (counselor).		1	9	3	2	1
			8	3	2	2	0
7	It felt like the interview would never end.		13	1	1	0	0
			10	4	1	0	0
8	I am happy with my program.		0	1	7	4	3
			1	0	4	4	6
9	I had a lot of say in the courses selected for my program.		1	2	4	7	1
			0	2	1	10	2
10	I think my program will have to be changed.		7	6	6	1	1
			5	4	3	3	0
11	The instructions given by the computer (counselor) were easy to follow.		0	0	0	3	12
			0	0	1	10	4
12	There were times when I felt like stopping the interview.		12	3	0	0	0
			9	6	0	0	0
13	It was easy to talk to the computer (counselor).		1	0	0	6	8
			0	0	1	3	11
14	I felt like the computer (counselor) was rushing me through the interview.		4	6	3	2	0
			6	6	2	1	0
15	I would rather be interviewed by a human counselor (by a machine than a human counselor).		6	6	2	0	1
			10	2	2	0	1

option code number; 2) a male student had chosen fabric and dress as one of his options; and 3) both French and Latin were chosen as options.

Evaluation of the Interview

A total of 30 grade nine students were divided at random into two groups. One group used the computer as an aid in planning tenth grade programs, the other group of students planned their programs during individual interviews with the high school counselor. The evaluation data were of two kinds. An attitude questionnaire consisted of the 15 items as shown in Table 1. The items for the two groups differed in that the word counselor was substituted for computer in five of the questions. The words in parentheses in Table 1 indicate the changes that were made for the counselor group.

In the second stage of the evaluation, the completed high school programs were rated in terms of their degree of acceptability by three judges—the model counselor, the counselor for the students' junior high school and the supervisor of pupil personnel in the school district. The thirty programs were typed on standard forms which showed the proposed program and the student's Easter report card grades. The names of the students were not shown. The forms were randomly ordered and presented independently to each of the three judges, about two weeks after the interviews. The judges were asked to rate the forms on a five point scale, "A few courses need to be changed." "Some choices are unrealistic." "A suitable pattern." "More care could have been exercised in a few choices." "A well thought out program." "No changes necessary."

Results of the Evaluation

The results of the evaluation questionnaire are tabulated in Table 2. The pattern of responses for the two groups is similar except for item 4 and to a lesser extent items 6, 8, 9, and 15. In the present study, the students who participated in the computerized interview wanted some explicit feedback regarding the selections that they had made. The responses to item 6 indicate that the counselor's role was a more active one than the computer's in guiding the selection of courses.

It is interesting to note that while the counselor's group were solidly in disagreement with the idea of being interviewed by a machine (item 15), the computer group disagreed with the idea of preferring to be interviewed by a counselor. This suggests that the students in the computer group may have held some initial feelings against the computerized interview, but that less than 10 minutes of exposure to it tended to reverse the feelings. Item 8 suggests however, that some of the wariness persisted after the exposure, as more people were undecided about whether or not they were happy with their programs in the computer group than in the counselor group.

In short, the attitude questionnaire results indicated that the computer students seemed to enjoy the experience (perhaps for the novelty alone), but confidence in their selections was not quite as complete as the students in the counselor group.

The second stage of the evaluation consisted of independent ratings, by three judges, of the programs selected by the students. These ratings were analyzed by a two-way analysis of variance (two treatments by three judges),

TABLE 2
Average Rating of the Appropriateness of Student Program

	Judge			
Counseling Method	High School Counselor	Supervisor of Pupil Personnel	Junior High Counselor	Method Mean
Computer	3.87	3.33	3.83	3.67
Counselor	4.53	3.43	3.90	3.95
Counselor Mean	4.20	3.38	3.87	

where the judge factor is a repeated measure. The cell means are shown in Table 2, and the summary analysis of variance table is shown in Table 3.

As can be seen from Table 3, no significant difference was found between the two modes of counseling. A significant difference between judges was noted. A Newman-Keuls *a posteriori* test on judge means was performed and both the high school counselor (who conducted the interivews) and the junior high school counselor were significantly lower in their judgments than the supervisor of pupil personnel. Table 2 indicates that the largest differences between ratings of programs of the computer group and the counselor group occurred with the high school counselor. This is not surprising since it was this judge who interviewed the students in the counselor group. Discussion with the judges following the completion of the ratings indicated that the supervisor of pupil personnel and the junior high school counselor had more stringent criteria for acceptable high school programs in the matriculation pattern than did the high school counselor.

One reason for the lack of significance between counseling modes may have been caused by the difficulty encountered by the judges in their task. The programs were judged solely on the basis of Easter report card marks. The judges suggested that more biographical data would be needed in order to increase the validity of their ratings.

A third piece of evaluation evidence consisted of a tabulation of the times required to complete the interview. The average time required by the computer group was about 12 minutes. This includes the time required to learn to use the terminals. The average counseling interview took about 10 minutes.

Despite the shortcomings of the evaluation there seems little evidence to suggest that one mode of planning interview was substantially superior to

TABLE 3
Analysis of Variance of Ratings of Student Programs

Source of Variation	*d.f.*	*MS*	*F*
Between Subjects	*29*		
A (Mode of Counseling)	1	1.736	1.085
Subjects within mode	28	1.601	
Within Subjects	*60*		
B (Judges)	2	5.058	6.851*
A x B	2	.853	1.155
B x Subjects within mode	56	.738	

*$P<.001$

the other. Nevertheless, several suggestions can be made for future development in this area. It would be a simple matter to write into computer programs, statements which would reassure the student that the program that he had selected was reasonable in the light of his background, or to refer the student to a counselor if there seemed to be some problem. These options would be based on counselors' experiences.

The results of the study indicate that the routine information, dissemination, and correct filling out of high school program forms is an activity that need not occupy the time of a highly trained counselor. Thus freed from essentially clerical chores, the counselor should be free to devote more time to students who need more intensive vocational and academic counseling.

Preparation of the present program required about 25 hours. This time included both designing the program and entering it into the system. Its use with more than 250 students would result in a saving of professional time.

Although the combination of APL and typewriter terminals provided an adequate medium for the computerized interview, the slow pace of the typewriter may become monotonous. Recent developments in computer assisted instruction have provided cathode ray tube, which allow for instantaneous presentation of paragraphs of information. The use of a system of this type would considerably decrease the amount of time required for an interview.

In actual application, one might foresee school boards renting a medium sized time sharing system which would be centrally located with terminals in schools throughout the district. Such a system could be devoted to administrative functions, such as payroll, attendance records, and inventory during the evenings. During the day, in addition to their use in the guidance area, the terminals could be applied in such diverse courses as mathematics, typing, and foreign language instruction. Although some would claim that the costs of such a system are prohibitive to school boards, the fact that many boards now rent such systems for administrative use only would seem to indicate that the finances are available but foresight and creativity are lacking.

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ILLUSTRATION 1

Sample Interview

Now that you know how to operate the terminal, we are ready to carry on with the interview.
Please type your code number.

* * * *

6

Are you Carl Smith?
Type Y of N.

* * * *

Y

According to my records, these were your Easter report card marks.

Subject	*Mark*
Literature	60
Language	50
Social Studies	50
Math	55
Science	60
Art	85
Music	A

After you finish high school do you plan to continue your formal education?

* * * *

Y

From the following list, select the one type of school that you plan to attend.

1. NAIT or SAIT.
2. Nursing School.
3. University.
4. I have not decided yet.
5. None of the choices apply to me.

Type the number of your choice.

* * * *

1

Would you like some information about NAIT or SAIT?

* * * *

Y

Most of the technology programs at NAIT require at least two years to complete. For the majority of technologies, the entrance requirement is a high school diploma with at least a B standing in grade twelve mathematics. One of the exceptions to the above requirement is the medical science program (lab technician, record librarian, or X-ray technician). The entrance requirement to this program is a total of five grade twelve matriculation subjects with an overall average of at least 60 percent and no subject less than 50 percent.

The type of school you will be able to attend after high school will be greatly determined by the marks you will receive in high school.

Let us assume that your grade nine departmental marks will be the same as your present Easter report marks.

If so, then here is a look at how students with marks like yours did in high school.

90 percent completed grade 10 (30 credits or more)
63 percent completed grade 11 (65 credits or more)
30 percent completed 100 credits or more
26 percent received a high school diploma
3 percent obtained matriculation

Now let us discuss a tentative grade 10 course plan. Here is a list of the three high school programs offered at St. Francis Xavier.

1. Business (diploma)
2. General (diploma)
3. Matriculation

Please select the program you would like to take next year.

* * * *

2

Your choice is the general (diploma) pattern?
(Y or N)

* * * *

Y

The following are required courses (each course has a value of 5 credits).

English 10
Social Studies 10
Physical Education 10

You are required to take a math course. Here is a list of the grade 10 math courses offered at St. Francis.

1. Math 10
2. Math 11
3. Math 12

Would you like some information about the math courses?

* * * *

Y

Math 10—The prerequisite for this course is at least B (50 percent or more in grade 9 math). This math is usually taken by students wishing to go to university or technical school.
Math 11—Designed for students entering business or consumer occupations.
Math 12—Is a first math course in the vocational pattern.

Type the code of the math option of your choice.

* * * *

3

You have chosen math 12?

* * * *

Y

You are required to take a science course. Here is a list of the grade 10 science courses offered at St. Francis.

1. Science 10
2. Science 11

Would you like some information about the science courses?

* * * *

N

Type the code of the science option of your choice.

* * * *

1

You have chosen Science 10?

* * * *

Y

Total credits = 25

It is generally recommended that Grade 10 students carry a course load of at least 35 credits, but no more than 40 credits.

Here is a list of the options you may choose from. Remember that each course is assigned five credits.

1. Art 10
2. Bookkeeping
3. Drama 10
4. Fab and Dress
5. French 10
6. Latin 10
7. Typewriting 10

Before you actually choose your options, would you like any information about any of the options.

* * * *

Y

How many options would you like information about?

* * * *

2

Type the code number corresponding to your first choice.

* * * *

1

Second choice?

* * * *

7

1. Art 10: In this course one studies design, color and composition, outdoor sketching, still life and figure drawing.

7. Typewriting 10: An introductory course. This course is a prerequisite for typewriting 20 and 30.

It is recommended that students take only two options. A maximum of three options is permissible if you have a high grade nine average.

How many options would you like to take? (2 or 3)?

* * * *

2

Type the code number corresponding to your first choice.

* * * *

9

Your answer must contain one numeral from one to seven. Try again.

First choice?

* * * *

1

Second choice?

* * * *

7

Therefore your options are:

Art 10
Typewriting 10

Total credits = 35

Is this correct?

* * * *

Y

This is what your proposed program looks like:

English 10
Social Studies 10
Physical Education 10
Math 12
Science 10
Art 10
Typewriting 10

Total credits = 35

Carl, when this interview is complete, Mr. Romaniuk will give you a planning booklet to be used by students who will be attending St. Francis Xavier High School. Also you will be given the paper on which this interview is now being typed.

Please discuss the proposed program with your parents or guardians. After you have decided on your final program fill in the program form you will find in the booklet.

Hand the completed forms to Mr. Ostashewski by Monday.

I hope that this interview has been an aid in helping you plan your grade 10 program.

Thanks, Carl, it's been nice talking to you.

Time for:

1. Learning operation of terminal = 3.8 minutes.
2. Interview = 8.4 minutes.
3. Total session = 12.2 minutes.

This interview is now complete. Before you go, I would like you to answer a questionnaire concerning this interview. Please call Mr. Romaniuk and he will instruct me to give you the questionnaire.

LES ORDINATEURS AU SERVICE DE L'ORIENTATION

E. W. ROMANIUK, T. O. MAGUIRE

Cette étude a pour but a éxaminer en détail l'usage d'un ordinateur pour venir en aide aux élèves de la nevième dans la choix d'un programme pour leur dixième. Un programme d'ordinateur fut developpé pour simuler la conduite et les decisions d'un conseillor lors d'une entrevu. Le programme fut evalué en comparant les choix de cours pour la dixième année qu'avaient fait les élèves avec l'assistance de l'ordinateur aux choix de ceux que ne l'avaient pas employé. Des suggestions sur comment executer la technique et sur son developpement futur son donnés.