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## USING COMPUTERS IN GUIDANCE: AN EXPERIMENT IN A SECONDARY SCHOOL\*

It is a commonplace, today, to have it pointed out that electronic computers have the capacity to store more information more accurately, and to retrieve this information more quickly and more effectively, than can the human mind. It is equally common to hear discussed the help that this storage and retrieval capacity can provide in education and in management. That it takes time and effort to write the programs for storing needed data and for retrieving them in appropriate ways is sometimes mentioned as an afterthought, and the time, let it be said, is always underestimated. Program writing consists, in effect, of identifying every relevant process, putting every detail of each process into words, and converting those words into locations on a card, tape, or disk.

In education and vocational guidance there are, as has been frequently pointed out during the past half-century, three basic processes: 1) supplying the individual with information concerning educational and occupational opportunities and requirements, 2) helping him to know and to understand his own abilities and interests, and 3) helping him to see the implications of these situational and personal data for his career. Inherent in these guidance and counseling processes there is, clearly, an information storage and retrieval process. It is a process which deals with educational, occupational, and personal data, the first two steps in vocational guidance. The capacity of retrieval methods to relate a given type of data to other types of data means, furthermore, that computers can help not only with the first two guidance processes, educational and vocational information and individual analysis, but also with the third, counseling.

It was only natural, therefore, that psychologists and counselors should begin work with the computerization of guidance processes. It was to be expected that they would adapt computer hardware and software to the storage and retrieval of educational, occupational, and personal data in ways which might be helpful to students and to counselors. The first such effort was that of John Cogswell and associates at the Systems Development Corporation in Santa Monica, California (Loughary, *et al.*, 1966), in which an attempt was made to simulate, with the computer, what the school counselor actually does in working with students. A half-dozen other projects have, during the last five years, undertaken somewhat similar work. Generally much more limited in scope (Bohn & Super, 1969), some projects have sought fully to tap the computer's potential. The two most ambitious efforts are probably those of Professor David Tiedeman (1968) recently completed with Federal support at Harvard, known as the *Information System for Voca-*

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*tional Decisions*, of Miss Jo Ann Harris at Villa Park, Ill., with state funds, and of Dr. Frank Minor, Professor Roger Myers, and myself, with IBM support, known as the *Educational and Career Exploration System* (1969).

It is my purpose, today, to describe this last system, to tell about its use in one high school, and to report some of the results of an evaluation study now being completed by colleagues at Teachers College, Columbia University.

#### THE SYSTEM

Let me begin by describing the hardware, the equipment, used in the *Educational and Career Exploration System* (ECES).

There are three major pieces of equipment: a typewriter keyboard and the computer which controls and is controlled by the two student-used elements, the keyboard and typewriter, and there is a screen of a *film-image projector* connected to the computer and used to show filmstrips. Each frame in the filmstrip consists of a few sentences of educational or occupational information, often illustrated by a picture in color and often accompanied by a multiple-choice question to which the student responds by touching a key on the keyboard. When the student is ready for the next frame of information or questions he presses a "ready" key and the computer responds by directing the projector to present the next appropriate frame. The *typewriter* is used for the student to sign in, releasing information concerning him for his use. It begins his orientation to the use of the system if he is new to it. It enables him to begin where he left off if he has used it before. The typewriter is then used by the computer to type out personal messages to the student, as these are needed, and to supply him with copies of material which he may wish to keep for later use. Among these, for example, are lists of appropriate colleges, job descriptions, and summaries of his dialogue with the computer.

The *computer* itself does not need to be near the terminal, and in this case was actually 100 miles away from the high school in which the experiment was conducted. Many terminals can use the computer, an IBM 360, at the same time.

So much for the hardware. Now to describe the data-base, the material in the computer and how it is used. School counselors or clerks working under their supervision enter data concerning the students into the computer. They use the typewriter for this, and a simple computer language called Coursewriter, developed for teacher use. The data consist of school grades, aptitude test scores, and interest inventory results. The student may consult the counselor concerning where to begin his use of the system, and he may start with vocational orientation, educational orientation, or a search for a college or a technical school. He may decide this question alone. The monitor or clerk shows him how to sign on. The computer then teaches the student how to use the terminals and the system.

The computer takes two sets of data, the school's record of grades and test scores, and the student-supplied data on his perception of his abilities, interests, and goals, and relates these to each other. The comparison of the objective school data with the subjective self-estimates of the student is

made in a way designed to promote realism in the student without damaging his ego. When a discrepancy does exist the student is encouraged by the computer to discuss the data with his counselor.

The student decides to proceed with vocational exploration. He is given the opportunity to browse rapidly through a number of different occupations to get a birdseye view of the world of work or he may choose to examine occupations of special interest in some detail. If he chooses the former he may glance at as many as 1,500 occupations (of course, no one looks at that many). He is aided in his browsing by answering questions about liking to work with people, data, or things. His response to these and other questions lead the computer to suggest a list of occupations which meet his specifications. He then, like the student who chooses not to browse because he already knows what he wants to examine, enters the names of specific occupations for further study.

The computer reports to the student on the appropriateness of his selections, using the stored data on his measured and self-estimated abilities and interests. It may suggest other occupations which the student might want to explore. It may suggest that he discuss these choices and their wisdom with his counselor.

The student may select an occupation for further study, drawing on a data base of 375 occupations. In ECES this is done, not by giving him a long description of the occupation, similar to a page in the *Occupational Outlook Handbook*, but by presenting, on the screen, brief bits of relevant information. These consist of samples of work done in the occupation set up for the student to do himself, brief statements about educational requirements, working conditions, salaries, and the like. It often asks him questions about his reactions to these facts as they are presented. The student can ask for additional types of information. Or, satisfied for the time being to leave that occupation, he can choose another to examine. The computer continues to give him feedback as to the apparent appropriateness of his choices. The student may be referred to his counselor by the computer because of lack of agreement between his traits and occupational requirements.

When the student feels ready, whether after, before, or without occupational exploration, he can proceed to educational orientation. Here he may explore his curricula preferences, for the data base has descriptions of 300 fields of study in technical schools, junior colleges, and universities. It also contains descriptions of each of the courses in those areas. The computer asks him questions about his views, and suggests additional appropriate fields of study for the student. It takes into account both the curricula he has already examined and the occupations in which he has shown an interest.

The student enters his preferred field of study, together with other specifications for his further education, and the names of any institutions which he has in mind. The computer has information on 1,500 post-high-school institutions, including all of those to which students from his school have gone in recent years. The computer then types out, for the student, a list of schools or universities which meet his specifications. It adds supplementary information which may help in decision-making. The student can add specifications to obtain a shorter list, or simplify them in order to get a longer list of institutions. The printout is taken by the student to use

in discussion with his counselor and with his parents, leading to decisions as to whether and where to apply for further education or training. These decisions, although facilitated by the computer, are made independently by student, counselor, and parents. The computer helps, it does not direct.

#### THE FIELD TRIAL

The field trial of the system, developed between February, 1966, and February, 1969, had as its objective the trial in a high school of the ECES terminals, program, and materials or data base. These had previously been used only in an IBM laboratory with a small number of high school students who served as experimental subjects during the development and debugging processes. The criteria for the selection of the high school required that it be within a two-hour drive of the IBM laboratory and of Columbia University; that it be a comprehensive high school; that it have significant proportions of college and of non-college bound students, of blacks and whites, of boys and girls; that it include grades 9 through 12; and that it be the only public high school in its community, serving all socio-economic strata. The high school selected was that in Montclair, New Jersey, a New York suburb of about 45,000 population.

The design of the experiment called for about 200 students, a stratified random sample of the school, to use the terminals once each week for one school period of 40 minutes, plus whatever additional time the student wanted to schedule during times when his and the terminals' schedules permitted (a few free hours were left, plus one hour after school each day). Students would use the terminals for as many consecutive weeks as they desired during the three months of the Spring term, the objective being to ascertain what kinds of students use the system, what parts they use, and with what effect on their educational and vocational planning and decision-making. The availability of only five terminals with the needed performance capacities, one of which had to remain in the laboratory, set the limit at four students per school period, and a total weekly capacity of about 200 users. An additional group of 200 similar students was selected by project staff to serve as a control group, no students or counselors knowing in which group they would be until after basic personal data had been collected.

In the planing of the field trial, school authorities were consulted from the beginning of the agreement to cooperate. The high school counselors reviewed the proposed procedures with the project staff, agreed on the feasibility of the design, and made certain decisions such as that not to receive printout on students nor to intervene in student use during the experiment. They agreed on the type of records they, the *counselors*, would keep on student contracts during the experiment, so that its effects on their work might be analyzed. They were to assist as needed in the collection of pre- and postexperimental data.

The data to be collected from *students* consisted of ability and interest measures needed in the computer system, data on their educational and vocational aspirations and plans which would be used in assessing their vocational maturity and decision-making skills, and self-concept measures. These were to be collected by means of questionnaires administered both before and after the experimental period, to both experimental and control students. In addition, the students using the system were to complete a

questionnaire concerning its perceived value to them at the end of the term. Student reactions to the system were also recorded after each session, the counselor-monitor kept a log of observations, and the audit trail or computer's record of work done was planned to permit study of how each student used the system.

Finally, parents and teachers were to complete questionnaires covering the value of the system as they saw it through students. In due course, longer term follow-up data are to be collected on the educational and vocational histories of the two groups of students.

#### RESULTS

The computer-assisted guidance system was available from early March until the end of May, 1969. It was used by 156 boys and girls in grades 9 through 12; they were compared with 158 control subjects or similar non-users.

*The Counselors.* Although the counselors were involved in the making of the major operating decisions from the time of the decision to conduct the field trial in Montclair, the fact that the experiment was an evaluation by an outside group (professors at a nearby university) of a guidance aid developed by an outside group (IBM and university faculty members) led them to remain somewhat aloof. In addition, their understanding of the desire to find out about student use led them to avoid promoting the system with students or inquiring more than casually about it. The fact that the first month of the three-month field trial was the time during which student schedules for the Fall term needed to be prepared also kept down counselor-student discussion of experiences at the computer terminals.

Nevertheless, in a conference between counselors and the investigators at the end of the school term, the counselors' evaluations were generally favorable. Three counselors reported little or no effect of the use of the system on their advisees, but as the discussion proceeded two of them cited two or more cases in which the use of the system was helpful in producing more realistic self-evaluations and educational and vocational plans. The other two counselors reported in some detail the beneficial effects on about half of their advisee-users of the computer-system. They also noted cases in which it did not have the effect of motivating students to study, of increasing the realism of their objectives, or of in some way helping them.

The counselors reported an increase in the use of the occupational information library after the availability of the computer-system, both on the part of experimental and of other students. Evidently, the utility and availability of occupational information became clearer to many students.

The counselors all stated that they would like to have such a system available regularly in the school, with its use required of all 9th and 10th grade students (14 and 15 year-olds), and available on demand or referral for 11th and 12th grade students. They viewed it as a useful supplement to the educational and occupational opportunities libraries and to their own efforts in counseling.

*The Teachers.* Many classroom teachers (half of those answering the questionnaire) did not, during the three-month trial, learn anything about their students' use of the system. It should be noted that they had had an orientation to the system as it went into use, but did not know they would

be asked anything later. Even some teachers known to have excellent rapport with students and returning questionnaires had had no feedback. Many other teachers, however, half of those responding, did hear students talk about their experiences at the terminals, and these reported hearing favorable evaluations. The student-users were believed to like to use the computer terminals and to have found the content and method of the system helpful: the average rating was 4 on a 5-point scale, i.e., "good." Home-room teachers discussed ECES with more students than did other teachers, but discussed related issues in less depth than did subject matter teachers.

A number of teachers volunteered anecdotal material. One such was the case of a bright but alienated white student who reacted negatively to a teacher's inquiry after the orientation film and talk. However, he later showed rare enthusiasm for a school experience when showing his first computer printout, complete with name and some personal data, to the teacher who had not, that time, asked him anything about it.

Summarizing the teacher data quantitatively, the mean rating of teacher-perceived student attitudes toward the computer system was 4, meaning "good."

*The Parents.* An open house was held for parents at the end of the term, to enable them to see the system at work and to discuss the project with the staff. It attracted about 20 percent of the total parent group. The response in this obviously unrepresentative sample of parents of users was uniformly favorable, ranging from merely accepting to very positive. This applied both to what they saw and to what they believed the system had done for their children. For example, two pairs of parents described how, in using the system, their 9th grade sons had come to see that education did have something relevant to offer them.

The Parent Questionnaire provides more objective and more representative data, for respondents have been compared to non-respondents by systematic follow-up, and carefully formulated questions have been thoughtfully answered. Data may best be summarized by reporting the distribution of responses to several questions showing parental evaluation of the system, as follows:

The parents answering the questionnaire (fifty percent of those to whom it was mailed), included roughly proportionate samples of parents of college-bound and non-college-bound youth. All had discussed the child's use of the computer-assisted guidance system with their son or daughter. More than half had engaged in considerable discussion of it and its implications, and this was only slightly more true of the college-going than of others.

Almost all parents believed that the use of the computer system was helpful, and again college and non-college families differed little in this respect. Parents of both categories of students were about equally divided in believing that they had, or had not, become more involved in educational and vocational planning with their child as a result of the use of the system. It may, of course, be difficult for some parents to state that they were not already as fully involved as they might have been, making the impact of any such experience appear less than it really was.

Responding to questions about the specific ways in which the use of the computer system helped the child, most parents stressed the effect on

seeing the relevance of high school to later careers, making decisions for the post-high school years, decision-making ability, learning about educational and occupational opportunities, seeing connections between abilities, interests, and occupations, and opening up educational and occupational possibilities which had not been considered before. Again, college and non-college differences were not great.

These parents, as well as the counselors, would like to have a system similar to ECES available to their children. Nearly one-third would like to see its use begin in the 7th or 8th grade, when children are about 12 years old, although more than half suggest 9th or 10th grade as the beginning year. Most attach considerable importance to making such systems available. They want more guidance, and believe that the computer can help provide it in important ways, even in a school such as Montclair High School with a ratio of one counselor to 300 students and with a guidance program which is, in the eyes of most of the questionnaire respondents who are familiar with it, up to their expectations.

*The Students.* Data on student use came from four sources: 1) the record of which students used the system and of the frequency of their use; 2) evaluation sheets filled out by students after each session; 3) observations of students just before, during, and immediately after sessions at the terminals, made by a professional project staff member; and 4) the pre- and postexperimental inventories and questionnaires already briefly described.

*Who used the System?* Two-thirds of the students selected for inclusion in the experimental group of users were white, one-third black. Two-thirds were college-going, one-third non-college going, but these ethnic and educational groups were not identical, for the stratified random sample included adequate numbers of college-bound blacks and of non-college-bound whites.

Whites and blacks in the stratified random sample of experimental users made about equal use of the system, the former averaging 7.0 sessions, and the latter 6.3, of a possible normal total of 12 in the three-month period. The ethnic difference is not statistically significant.

The college and non-college groups split the same way, with the former averaging 6.8 and the latter 6.4 sessions, no difference. The boys averaged 7.2 sessions, the girls 6.13, and this difference is significant at the .05 level of probability. When race, sex, and educational goals are viewed together, it is the non-college-bound black females who make least use of the computer-assisted guidance system, all other categories, regardless of sex, race, or goals making about equal use of the system.

The high school grade in which the student finds himself appears not to be a determinant of use: 9th, 10th, and 11th graders made about equal use. Twelfth graders did use the system less in this experiment, but this is probably the result of the time of year at which the experiment had to begin (March) and of the greater delay in the delivery of the College Search material, both of which meant that the college-bound 12th graders were already committed and the non-college-bound seniors may have had similar feelings, although less concrete plans. The data from the other grade levels suggest that, if such a system were available all through the school year, and year after year, it would be used at all junior and senior high



school grade levels but for somewhat different purposes, perhaps there would be different degrees of commitment in exploration and decision-making at each grade level.

Some students used the system as little as once only, and stopped. Although they were scheduled again and reminded of appointments, they were then allowed to drop out if they had lost interest. Others used it two or three times, got what they wanted, and stopped, as does a person looking something up in an encyclopedia. Others explored more widely, as the average of 7 sessions when 12 could easily have been used and only two or three were really encouraged demonstrates. A few used many more sessions, stopping at the ECES room at the beginning of free periods to ascertain whether some other student had failed to keep an appointment and thus releasing a terminal for unscheduled use, and standing in line for opportunities during the hour after classes were over and terminals were available. One very unusual boy with a light class schedule and educational difficulties made serious and constructive use of the system during a total of 39 school periods!

*How useful did students consider the System?* Data on student evaluation of the computer-assisted guidance system come from expert observation at the terminals, student ratings after sessions, and a postexperimental questionnaire.

Direct observation shows that a number of students who were negative toward school and toward education developed more positive attitudes after they had worked with the computer a few times. Some such cases have already been reported, as seen by counselors, teachers, and parents. Staff members observed this in the terminal rooms, as students who had failed to keep first appointments came reluctantly after having been rescheduled one or more times, as hostile students became more friendly, and as students who had not related easily to people found the machine unthreatening and informative. The interactive capacity of the computer is important. The dialogue is as free of criticism and reproach as it is of praise. The machine supplies data on demand, asks relevant questions, points out appropriate facts, and occasionally gives out a useful list or a pertinent summary undistorted by selective remembering or personal bias. The student can ask questions about the unattainable without fearing ridicule, explore the unknown without loss of face through ignorance, examine discrepancies between his characteristics and those of people in an occupation without exposing himself. These are some of the conclusions drawn from anecdotal material collected by several observers.

Data from the post-session rating sheets are being analyzed in the microanalysis of the System, to aid in making improvements in the database and in the system for using it. The postexperimental evaluation questionnaire is being analyzed for more objective data on student reactions to the System. These are not yet ready for reporting.

*What effect did ECES have on students?* This question, too, is one which can be answered on the basis of data obtained from counselors, teachers, and parents, as well as from observation by experts at the terminals and from more objective measures taken at the pre- and posttesting sessions.

We have already seen that counselors, teachers, and parents reported



instances of improved motivation to use school courses, of broadening occupational horizons, of increase in awareness of the relationship between post-high school education and later career, and of increased realism in setting educational and vocational objectives. No such negative effects were reported. Lack of effect was of course reported in other instances: computers and computer systems are no panacea.

The objective data on changes in the vocational maturity, planning, and decision-making ability of the students who used the system, and of differences between experimental users and control non-users of the system, are now being processed. No definitive report can as yet be made, but it is possible and pertinent to indicate something of their nature.

A series of questions, both multiple-choice and completion, was included in the pre- and postexperimental questionnaires. These dealt with attitudes, information, and actions in educational and vocational planning. Classified *a priori* as vocational maturity, decision-making principles, and decision information items for the construction of scales, they were scored, and the scales were item-analyzed and empirically refined. The purified scales were then intercorrelated and factor analyzed. The results demonstrated that we did, indeed, succeed in constructing internally consistent, independent, and factorially satisfactory measures corresponding to our theoretical specifications. We can thus assess the effects of using this computer-assisted guidance system on the vocational maturity of our subjects, taking into account grade, sex, race, educational goals, and of course academic ability.

Whether or not a three-month trial of any new medium is sufficient trial is an open question. It is demanding a great deal of any procedure, system, or set of materials to expect that it produce important changes in students in such a short time. It means significantly changing in three months what the home, the church, the neighborhood, and the school have taken 14 or 18 years to do. But, once the data processing is completed, we will find out whether or not this type of intervention, in this period of time, can produce significant changes in any students. If it can, fine. If it cannot, longer term use will in due course provide the answers.

#### PROSPECTS FOR THE FUTURE

The prototype of a computer-assisted guidance system has been developed, improved through laboratory testing, and tried out in one high school. Its value in furthering the vocational development of students has been assessed in this preliminary three-month field trial. The results appear favorable. The system seems worthy of further work. What will happen next?

Several developments can now be foreseen.

1. The terminals must be improved to make them easier to maintain in efficient operation. This appears to be a real, but routine task, as the hitherto experimental IBM terminals used with the IBM 360 merely need improvement, to do more consistently what they now do fairly well.

2. The terminals must be mass produced, to make them available at reasonable cost to schools, universities, employment services, and counseling centers and to students and clients wishing to use them. This is a not im-

possible task, as prototypes have already been manufactured on a custom basis. But mass production does not just happen, it must be planned.

3. The data base, i.e., the educational and occupational information in the storage system, should be improved to cover more occupations, and more training opportunities, in somewhat more detail than is now done. This is a simple task, given the available printed models and the existing prototype. Improvement should also include the linguistic (readability) and graphic (interest-arousing and information-conveying) qualities of the presentation.

4. The system, improved or even merely adapted, should be tried out for a period of at least two years, and preferably five, in several high schools. Counselor involvement should be at least as great as that which now links counselors with educational and occupational information libraries and files. This would permit evaluation of the system under normal conditions. In such conditions a resource is available throughout a student's school experience, it is used cumulatively during his schooling, and the school staff have opportunity to develop skill in making use of the resource.

Will these developments indeed take place?

Whether or not they do depends upon a variety of factors. These include:

1. The awareness on the part of *research and development personnel*, of the promise of this medium and material and their consequent work in developing it;

2. The awareness on the part of *educators*, and especially of counselors, of the promise inherent in computer-assisted counseling, and their consequent demand for it;

3. The awareness on the part of the *producers* of the necessary hardware, software, and data bases of the interest in, and the effective demand for, such systems, and their consequent efforts to produce them.

That ECES, ISVD, and other such systems have been attempted, and that some are now in use, makes it clear that the first condition has been met.

That Montclair, Newton, Villa Park, Altoona, Palo Alto, and other school systems have cooperated in the development and trials of such systems shows that educators and counselors are ready and willing to try out and use these systems. That a number of other school systems are now eagerly seeking to use computer systems on a larger scale provides even more convincing evidence that not only educators, but the general consuming public, are interested.

There are indications that the manufactures of the necessary terminals, and the producers and eventual distributors of the essential software systems and data bases, are sensitive to the promise, to the interest, and to the support and the demand. We may realistically hope that they will respond by perfecting and mass-producing the needed systems.

If I read these signs correctly, the prospects of our soon being able to put to society's use this major educational resource are indeed good.

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## L'ÉLECTRONIQUE EN ORIENTATION: UNE EXPÉRIENCE DANS UNE ÉCOLE SECONDAIRE

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Dans un processus d'orientation et de counseling il est normal d'avoir recours à un dossier cumulatif. Ne serait-il pas possible de confier les notes et les détails de ce dossier à un ordinateur? Si la chose est possible en éducation et en information professionnelle, pourquoi ne pas recourir à l'électronique même en counseling?

Le présent article tente d'expliquer et d'évaluer l'emploi d'un système électronique en counseling.

Un ordinateur du type I.B.M. 360 a été mis à l'essai, soumis à des épreuves en laboratoire et utilisé dans une école secondaire. Cet essai de trois mois a donné des résultats favorables.

