AN ANALYSIS OF SKILL REQUIREMENTS
IN DATA PROCESSING ENVIRONMENTS

by

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to the required standard

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ABSTRACT

The purpose of this study was to examine the skills deemed to be useful to data processing managers and to systems analysts in data processing environments of varying levels of maturity.

The subjects of the study were 35 data processing managers and 50 systems analysts from a sample of 35 companies of varying size and of varying experience with electronic data processing (EDP). The research method used to gather the data was the mail questionnaire. Two questionnaires were developed: one to measure an EDP organization's relative maturity in terms of data processing, and one to measure EDP practitioners' perceived usefulness of 99 data processing skills in terms of their own job position.

The results obtained indicate that data processing managers and systems analysts of both more and less mature organizations perceived generalist skills as being more useful than specialist skills. In particular, people, organization and society skills were perceived to be the most useful to data processing managers, whereas people, organizations and system skills were perceived to be the most useful to systems analysts. Model and computer skills were perceived to be the least useful to both groups of practitioners. Data processing managers of more mature organizations perceived people and society skills to be more useful than did their counterparts.
in less mature organizations. Finally, generalist skills were perceived to be more useful to data processing managers than to systems analysts, whereas specialist skills were perceived to be more useful to systems analysts than to data processing managers.

The implication of this study on university curricula in information systems is that universities should prepare their information systems graduates to solve people and organization problems rather than technical problems. However, it was pointed out in this study that a good technical background is necessary to function effectively as an EDP practitioner in the data processing community.
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CHAPTER I

INTRODUCTION

Objective Of The Study

The objective of this study is to examine the skills deemed to be useful to data processing managers and systems analysts in data processing environments of different levels of maturity.

Review Of Related Studies

In 1972 the Association for Computing Machinery (ACM) Curriculum Committee on Computer Education for Management presented its report of curriculum recommendations for graduate professional programs in information systems. The report outlined the need for professional programs in information systems and determined the knowledge and abilities required by information system specialists to work effectively in their field.

These abilities were grouped into six skill categories: people, models, systems, computers, organizations and society. Based on these skill requirements the committee developed a 13

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course academic program outlining course contents, relationships between courses, course prerequisites, course reference materials, etc. In their report, the committee stressed that information systems will be successful only if a balance is struck between the emphasis placed on organizational and technical factors. They recognized two distinct systems development activities: information analysis and systems design. Information analysis was defined as being concerned with the determination of information needs and the patterns of information flow which satisfy these needs, whereas systems design related to the translation of specified information requirements into a detailed implementation plan which could be realized with hardware and software. The committee's curriculum tried to give the student a good knowledge of both the systems analysis area (ie. organizational systems) and the systems design area (ie. computer systems). The curriculum recommendations were based on the belief that expertise in only one of the two areas was inadequate and that an understanding of both types of systems (organizational and computer) was needed to become a competent electronic data processing (EDP) practitioner.

A study undertaken by the University of Minnesota's Management Information Systems Research Center (MISRC) sought to empirically test ACM's recommendations by surveying EDP practitioners to determine what skills they possessed, what skills were thought to be useful, and how employees, supervisors and users varied in their perceptions of the
skills that were possessed and deemed to be useful. The researchers clustered 97 skills into the six skill categories mentioned in the ACM report. They argued that three of these skill categories (organizations, people, society), contained many skills which were more closely related to the information analysis activity and three others (systems, computers, models), were more closely related to the systems design activity. Therefore, they regrouped the skills into two major clusters which correspond to these two basic activities, calling them generalist and specialist skills. The study introduced a new skill category called 'performance' which didn't overlap with the generalist or specialist skills.

Nine hundred and eighty-one subjects from fourteen firms were categorized as employees, supervisors, or users within one of twelve data processing positions ranging from MIS director to junior programmer. The firms surveyed had hardware expenditures averaging slightly over $75,000 per month. The Information Systems director reported through the vice-president of Administration or Management Services. One could infer that these were large and mature data processing environments:

By evolutionary level of system federation activity; by total budgeting activity; by reporting structures; by the currency of typical hardware and software systems; but principally through interaction with organizational

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personnel and enhanced roles of users and analysts and/or programmer/analysts the organizations surveyed tend toward what persons would generally label "MIS environments".\(^3\)

Each participating data processing employee rated the skills he/she possessed on a four point scale. Each participant supervisor and user rated the skills actually possessed and skills deemed useful to the EDP employees. Table I gives the rank ordering of skills given by employees, supervisors and users.

The study concluded that the ACM course recommendations appear to be too technically oriented and that based on their survey there was a more pronounced need for performance, people and organizational skills. The researchers speculated that specialist skills would continue to be in demand in small to medium size data processing organizations. However, they did not have enough empirical results to support this claim since they had only surveyed larger organizations. In its report, the ACM also stated that there was a need for both systems analysis (generalist) and systems design (specialist) skills for smaller organizations:

For some organizational situations the foregoing model of the development process may seem too elaborate. A simpler version is one where an information center is run as a service by a group of highly capable technicians with "applications programmers" developing programs for this center which manipulate organizational information as required by the other departments. More and more it appears that this simpler model is inadequate even for smaller organizations because of the demands of the

\(^3\) ibid, page 9.
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constantly changing organizational environment, by virtue of natural evolution of practices, and of the constantly changing information processing environment, by virtue of the dynamics of computer technology. Organizations and computer complexes are both systems undergoing constant transition, and information processing functions must be developed along similarly systematic lines to cope with the situation.
The present study is an attempt to determine what skills are required by organizations of various sizes and levels of maturity. Can the Minnesota study conclusions be applied to smaller data processing organizations? Are the needs for human skills different in data processing organizations of varying levels of maturity?

These are valid questions to be asked in a Canadian context, where there are fewer large EDP organizations. In addition, there is an ever increasing proliferation of small systems implemented in smaller and smaller organizations. The implications of such questions as aids in developing graduate curricula in Information and Computer Systems are important. Universities may be training graduates in Information Systems which do not possess the skills required to function effectively in the area of data processing. This study will try to analyze the impact of the maturity levels of EDP organizations on the skill requirements of two data processing positions: the data processing manager and the systems analyst.

* op cit, page 368.
Stage Model Of EDP Growth

The stage hypothesis was originally stated by Nolan in 1973.\(^5\) It was based on the results of a research project at the Harvard Business School which showed that the pattern of EDP expenditures based on the budgets of three companies, when plotted over time, was "S" shaped. This hypothesis was later questioned by Lucas.\(^6\) Nolan believed that the "S" shape reflects how the organization learns to assimilate EDP technology. Based on this curve, Nolan distinguishes 4 stages of growth: Stage 1-initiation, slow steady growth; Stage 2-contagion, high exponential growth; Stage 3-control, absolute declining growth; and Stage 4-integration, managed steady growth. At each stage the characteristics of the tasks for managing the EDP organization were different. These tasks were defined as controlling, organizing and planning the EDP effort.


\(^6\) Lucas empirically tested the "S" shaped curve hypothesis. He found that data on EDP budgets for 29 California counties failed to support both the Nolan "S" curve hypothesis and the use of budgets as a basis for a stage model.

The stage hypothesis was restated by Nolan and Gibson after conducting a more intensive study of the "growth processes" at work at each stage. They defined three growth processes: 1) building an applications portfolio, 2) building an EDP organization, and 3) building an EDP planning and control system. The third growth process included the planning and control tasks of the first stage hypothesis statement. The second growth process corresponded to the organizing task and the first was a new growth process which did not correspond to any previous descriptive task(s).

Later in 1975, based on consulting work with ten large companies, Nolan introduced a fourth growth process called "user awareness". This process represented the extent to which users develop an understanding and awareness of the opportunities and limitations of computer technology.

Following is a brief description of the growth processes and their characteristics in the four stages.

(1) Initiation. The computer is introduced into the organization and manual systems are slowly converted to the automated media. The applications at this stage are functional and are justified by their cost savings. The

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electronic data processing (EDP) organization is technologically specialized to increase hardware efficiency. Management control is lax and costs are not scrutinized closely. The user does not participate in the EDP effort and has a "hands off" attitude towards the computer.

(2) Contagion. The excess of computing capacity acquired when the company first initiated an EDP facility, combined with the lure of broader and more advanced applications, trigger a period of rapid expansion. The type of applications proliferate in an uncoordinated manner in all areas of the organization. The EDP organization quickly builds a staff of user oriented programmers to develop a variety of applications. EDP management controls are relatively non-existent. Economic justification of projects and effective implementation standards are ignored. The user is eager to participate; however he overestimates potential benefits of applications.

(3) Consolidation. Rapid and uncontrolled EDP development gives rise to inevitable system problems as well as concern by upper management for the rapidly rising costs of the EDP activity. EDP management becomes control oriented and puts heavy emphasis on the efficiency of system operations. Existing applications are
consolidated and there is very little new system
development. Formalized control mechanisms are
introduced and the user is held accountable for
application development and operational costs.

(4) Integration. In this stage the EDP organization has
reached maturity. The emphasis is on integrating the
applications with the needs of the organization. On-line
and data base systems are introduced. The EDP organiza­
tion has become specialized in various areas such as on­
line time sharing systems, data base technology and
teleprocessing. Formal planning and control structures
exist at this stage. The user is capable of leading in
system design and is effectively held accountable and
responsible for his applications.

It was assumed that as an organization moves from stage I
to stage IV, it becomes more mature. Stated otherwise, orga­
nizations displaying characteristics of stage IV are
considered to be more mature than organizations displaying
characteristics of stage I. Therefore, the characteristics
describing each stage can be used as a means of measuring an
EDP organization's maturity.
Organizational Maturity

The characteristics of Nolan's stage model and the maturity assumptions stated in the previous section were used to develop eleven EDP maturity criteria. These criteria were then used to develop the EDP maturity questionnaire which is included in Appendix A and will be discussed in Chapter II. Following is a description of the eleven criteria:

(1) Monthly Expenditures on Hardware.
Organizations which have large expenditures on hardware tend to be more mature than organizations which have smaller expenditures.

(2) EDP History.
More mature organizations tend to have more experience with computers and computer technology.

(3) Position in Organizational Structure.
EDP departments in more mature organizations are placed at a higher level in the organization, whereas less mature EDP departments tend to be located under a functional authority.

(4) User Awareness.
More mature organizations have users which are more interested and capable of participating actively in the systems development effort.

(5) Role of Senior Management.
Senior management plays a greater role in the overall
planning and control of the more mature EDP organizations.

(6) Objective setting.

More mature EDP organizations have more formal EDP objectives which are tied to overall organizational objectives.

(7) EDP Department Performance Evaluation.

The evaluation of more mature EDP departments is based less on clerical cost savings and more on overall contribution to the organizational goals as stated in the overall organizational plan.

(8) Budgeting Process.

More mature EDP departments have a formal budgeting process integrated with the overall organizational priorities.

(9) EDP Planning.

More mature EDP departments have a formal EDP plan integrated with the overall organizational plan.

(10) EDP Control Mechanisms.

More mature organizations use a charge-out system, enforce formal documentation standards and require periodic project reports.

(11) Portfolio mix.

More mature EDP organizations have a portfolio which would include more tactical and strategic level information systems than less mature organizations.
Some of the above criteria may be better indicators of maturity than others. Nevertheless, for each criterion there will be some exceptions where an organization would normally be considered as "mature" but would not satisfy that particular criterion. Therefore, a combination of the criteria would not be as sensitive to different particular characteristics of particular organizations and would give a better reading of an organization's maturity than any single criterion.

Skill Requirements Of Data Processing Managers

Hypothesis I. Managers of more mature EDP organizations will perceive a greater usefulness for generalist skills than for specialist skills.

Hypothesis II. Managers of less mature EDP organizations will perceive a greater usefulness for specialist skills than for generalist skills.

Hypothesis III. Managers of more mature EDP organizations will perceive a greater usefulness for generalist skills than will managers of less mature EDP organizations.

Hypothesis IV. Managers of less mature EDP organizations will perceive a greater usefulness for specialist skills than will managers of more mature organizations.

Nolan states that the larger the EDP organization, the more managerial (generalist) skills and the less technical (specialist) skills the data processing manager will require.  

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He argues that less mature EDP organizations will require managers to perform many of the technical functions of systems analysts and programmers, whereas more mature organizations will require managers to perform more managerial and administrative functions.

The above four hypotheses are described in Figure I. It is hypothesized that the EDP manager's mix of skills perceived to be useful will contain more generalist and less specialist skills for more mature EDP organizations, and more specialist and less generalist skills for less mature EDP organizations.

**FIGURE I**

**PICTORIAL DESCRIPTION OF THE FIRST FOUR HYPOTHESES**

**EDP MANAGER'S SKILL MIX**

![Diagram showing the skill mix of EDP managers across organizational maturity]

**Skill Requirements Of Systems Analysts**

**Hypothesis V.** Systems Analysts in more mature EDP organizations will perceive a greater usefulness for generalist skills than will Systems Analysts in less mature EDP organizations.
One of the main characteristics of maturing organizations is the increased penetration of computerized information systems throughout the organization. Consequently, systems analysts in more mature organizations will need to effectively interact with various people in all functional areas. They will need a better understanding of the organization's structure, functions, and information needs. It is hypothesized that the analysts of more mature organizations will require more generalist skills than analysts in less mature organizations since most applications in the latter organizations would be serving one functional area. One of the characteristics of Nolan's stage hypothesis is that organizations in stage I (less mature) use the computer in one functional area (usually accounting). Therefore, analysts in such organizations will require less generalist skills than analysts in more mature organizations.

Hypothesis VI. Systems Analysts in less mature EDP organizations will perceive a greater usefulness for specialist skills than will Systems Analysts in more mature organizations.

Analysts in less mature firms will often be "programmer/analysts" and will require more systems development/design skills which are highly specialized. In less mature organizations there will be less division of labor and analysts will need to perform many of the technical tasks which would be performed by programmers in more mature organizations. Consequently, analysts will require more specialist skills than their counterparts in more mature organizations.
Hypothesis VII. Systems Analysts from both more and less mature EDP organizations (combined) will perceive a greater usefulness for generalist skills than for specialist skills.

Systems analysts design systems to satisfy organizational needs and therefore must be competent with social systems (related to generalist skills) as well as with technical systems (related to specialist skills). In the University of Minnesota's MISRC study, it was stated that "specialist skills would be elevated, for example, over generalist skills for both senior and junior programmers. At all other positions generalist skills were deemed more useful."\(^{10}\) It is therefore hypothesized here, in accordance with the results of the Minnesota study, that systems analysts will have a greater need for generalist skills than for specialist skills.

Hypothesis VIII. Systems Analysts in less mature organizations will obtain a lower variance of scores rating the perceived usefulness of skills than analysts in more mature organizations.

One of the characteristics mentioned in the stage analysis is the increasing specialization of EDP personnel as the organization matures. In stage I there is less division of labor; the personnel perform a wider variety of tasks than in stage IV. Applying this to systems analysts, this would mean that analysts in less mature organizations would perceive the need for a wide range of skills, whereas analysts in more mature organizations would perceive the need for greater

\(^{10}\) MISRC-WP-74-01, p. 15.
expertise in a fewer number of skills. The variance of scores rating the perceived usefulness of all skills (both generalist and specialist) will be used as an indicator of the degree of skill specialization perceived to be useful by the respondent. A low variance would indicate a low degree of specialization and a high variance would indicate a high degree of specialization.

**Skill Requirements Of Managers Versus Analysts**

Hypothesis IX. EDP Managers will perceive a greater usefulness for generalist skills than will Systems Analysts.

Hypothesis X. Systems Analysts will perceive a greater usefulness for specialist skills than will EDP Managers.

Hypothesis XI. People, Organization and Society skills will each be perceived as being more useful to EDP Managers than to Systems Analysts.

Hypothesis XII. Systems, Computer and Model skills will each be perceived as being more useful to Systems Analysts than to EDP Managers.

The University of Minnesota's MISRC study did not compare skill requirements across job positions. Because of inherent differences between the tasks performed by EDP managers and systems analysts, it is expected that there will be a significant difference in the usefulness attributed to the various skills. In particular, managers are expected to perceive a greater usefulness for generalist skills than systems analysts, and analysts are expected to perceive a greater usefulness for specialist skills than EDP managers.
In order to make a finer distinction between skills, Hypothesis XI and XII were formulated using the six skill categories. It is hypothesized that people, organization and society skills will each be more useful to managers than to analysts and that systems, computers and model skills will each be more useful to systems analysts than to managers.
CHAPTER II

METHOD

Mail Questionnaire Survey

The Methodology

The purpose of this study is to gather data on the skills deemed to be useful by data processing managers and systems analysts in a representative sample of data processing organizations. The mail questionnaire was selected as the best method of accomplishing this goal. There are advantages and disadvantages to using mail questionnaires. The key to succeeding with this technique is to invest time and resources in the careful planning of the data gathering process.

This method is a cost-effective way of gathering self-reported data. The questionnaire may be sent to a large number of people at minimal cost. The respondent does not feel pressured to answer as with an interview, and it may result in a feeling of privacy and anonymity which could increase the validity of responses.

Some of the disadvantages of the method are that respondents may misinterpret questions and will tend to distort answers in their, or the researcher's, favor. The implications of these disadvantages are that questions must be
very carefully worded and the researcher must be aware of potential biases. However, low response rate is the main disadvantage most often attributed to mail questionnaires. Charach states that a low response rate is primarily due to poor questionnaire design.\footnote{Charach L., \textit{An Exploratory Investigation Toward The Development Of A Research Design For A Study Of Youth Work Transition}, unpublished master's thesis, University of British Columbia, 1977.} He describes a methodology which, he claims, will obtain a high response rate even with questionnaires exceeding fifteen pages in length. This claim was put to the test in this study. After having unsuccessfully distributed 60 questionnaire packages at a meeting of data processing managers, analysts, and other members of the data processing community,\footnote{None of the 60 questionnaires distributed by a member of the executive of a local data processing association was returned.} it was decided to follow the methodology developed by Charach.

Questionnaires were mailed to respondents in a package containing a covering letter, one five page questionnaire, three fourteen page questionnaires and a return envelope. The package was personally addressed to an executive in the data processing department of the organization surveyed. This executive (which we termed, data processing manager) was requested to fill out the five page organizational profile questionnaire and one fourteen page EDP skill questionnaire.\footnote{None of the 60 questionnaires distributed by a member of the executive of a local data processing association was returned.} The executive was then asked to give the two remaining EDP
skill questionnaires to two of his systems analysts for completion. We will now describe the covering letter and both questionnaires in greater detail.

The Covering Letter

Each package was accompanied by a hand signed, personalized covering letter, printed with carbon ribbon on a typewriter-terminal by computer on University of British Columbia, Faculty of Commerce and Business Administration letterhead. The letter was purposefully not right justified, in order to conceal the fact that it was computer produced. The letter was signed by Dr. A.S. Dexter who is a member of the author's thesis committee. It was felt that a member of the Commerce Faculty would add more importance to the questionnaire and would give a better justification to the respondent for spending time answering it, than a graduate student would. Vocino looked at the difference in response rates when sending a covering letter signed by a well known person in the discipline as compared to sending a covering letter on university stationary signed by a less well known individual. He stated that: "The difference was far less than expected and suggests that endorsements from "big-name" personages might result in only marginal benefits".15

13 see appendices A and B respectively.

14 see Appendix C.
Therefore, based on these results, it was decided not to solicit the full endorsement of the president of the association which cooperated with us by forwarding the names and addresses of its members.

One of the major uses of the covering letter is to transmit to the respondent the value of his responses. This means that the researcher must overcome the respondent's feeling that he is one of many "numbers". For this reason, the covering letter was hand signed and personalized. Each letter had the name and address of the respondent typed (by computer) with the same typeface as the body of the letter. Matteson compared response rates between respondents receiving a form letter and respondents receiving a personalized letter.\textsuperscript{16} He found that the return rate for the personalized letter was 31.9\% as opposed to 22.0\% for the form letter.

The letter's first paragraph gave an introduction to the letter and varied depending on the source of the respondent's name and address. Some letters referred to the association from which some of the names and addresses originated, others referred to a source person, and others to a previous meeting or phone call between the researcher and the respondent.

\textsuperscript{15} Vocino T., \textit{Three Variables In Stimulating Responses To Mailed Questionnaires}, Journal of Marketing, October 1977, p.76.

Since the letter was stored on computer, it was relatively simple to make the required modifications.

The second paragraph introduced the purpose of the study. It was felt that many of these respondents would be aware of the problems of recruiting university graduates who do not possess the necessary data processing skills. The paragraph mentioned that the university was aware of the problem and that an effort was being made to solve it. The purpose of the paragraph was to relate the study to an issue which might have been of interest to the respondent and to stress the importance of the study. The letter tried to cater to the respondent's unselfishness rather than emphasizing potential benefits to him. In a study by Dillman, it was found that a covering letter which conveyed an image of social utility, was more effective than an egoistical letter. This is especially true for respondents of middle and higher socio-economic status, as was found by Champion and Sear.

The next paragraph described the package contents and the purpose of the two questionnaire types and specified who was to complete what questionnaires. Since the researcher was not available to answer queries, it was important that the survey

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be as self-explanatory as possible. For this reason, instructions relating to which individual was to complete which questionnaires were included in both the covering letter and in the instruction sheet attached to each questionnaire.

The fifth paragraph assured the respondent that no more than twenty-five minutes were needed to complete the survey. This is particularly important with thicker questionnaire packages. For example, even though the skill questionnaire was voluminous, it was composed of many short questions which took no more than a few seconds each to answer, resulting in a short overall questionnaire completion time. The paragraph also pointed out that the respondent would not incur any out-of-pocket costs, since the return envelope was pre-stamped. Pre-stamping has two effects: the first, is that the respondent does not need to incur extra costs for postage; second, it enhances the impression that the study is worthwhile. It is partially for this reason that first class postage was used, both for sending packages and for the return envelopes. The other advantage of first class postage is that the post-office will make some effort to forward the packages or return them if a respondent is not locatable.

The next paragraph of the letter was very important. It assured the respondent of the confidentiality of his responses. This was to induce better responses and minimize self-report bias. The paragraph also offered the research results to the respondent. This repaid the respondent for his time, and increased his involvement in the project by
providing him with feedback.

The Follow-up Process

One of the advantages of having the names and addresses of potential respondents (besides being able to send personalized covering letters), is that the researcher may persist in his efforts to obtain responses. As stated in Charach, the follow-up process is the key to obtaining high response rates using mail questionnaires.¹⁹

In this study, a post-card was sent to the respondents five days after the questionnaire was mailed.²⁰ One side of the card consisted of the researcher's name and address, the respondent's computer printed address-label and a stamp. The reverse side, identified the university, the faculty and the study. The first paragraph expressed the wish that the respondent had actually received the package and thanked those who had already responded. The latter was included to give the respondent the impression that a number of managers had returned the completed questionnaire and that he had not. In reality, only two of the 61 packages sent had been returned when the post-cards were mailed out.

The second paragraph gave the respondent the opportunity of phoning the researcher in the eventuality that he had not

¹⁹ ibid, page 73.

²⁰ see Appendix D.
received, had lost the questionnaire package, or to clarify some technicalities related to the questionnaire. This was also to assure him that the researcher was available for consultation and was serious in his endeavour.

The next step in the follow-up was sending a second postcard (the same one as above), one week after the first, to those organizations who had not yet responded. The effects of this last reminder were minimal. Since a satisfactory sample size had been achieved, no other follow-up methods were used.

The Maturity Questionnaire

In the survey documentation, the maturity questionnaire was called the "Organization Profile Questionnaire". The respondent was told that the questionnaire was designed to allow the researcher to get a better picture (or "profile") of the organizations surveyed. It was felt that calling it a "maturity" questionnaire would create unnecessary self-report bias.

Both the maturity and EDP skill questionnaires had an attached instruction sheet. On this sheet the respondent identified the name of his firm and his job position or title. The name of the firm was needed to identify which organizations had responded and the job title of the respondent was to make sure that he was indeed a "data processing manager". The

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21 see Appendix A.
name of the respondent was not necessary and was not requested. However, if the respondent wished a copy of the research results, he was asked to attach his business card to the questionnaire. This obviously hindered anonymity, but it was believed that the assurance of confidentiality in the covering letter was sufficient to alleviate any fears of response disclosure and that anonymity was not a crucial issue.

Most questions required that the respondent select an answer alternative among many, whereas a few other questions required that he enter percentages or weights. A paragraph warning that the latter questions were more difficult to answer was included in the instruction sheet. As a result all respondents answered these questions even though they were relatively more arduous than the multiple choice questions.

The organization profile questions were developed from the eleven maturity criteria discussed in Chapter I. Each question tried to measure the organization against the criteria by requesting the manager to select an alternative which best described the situation in his organization. In most questions the alternatives were ranked in ascending order of maturity based on the criteria stipulated in Chapter I. For example, the question related to "objective setting" had as first alternative, "objectives are set informally by the EDP manager", the second, "objectives are set formally by the EDP manager", which would be considered more mature, to the last alternative, "objectives are derived from overall
business objectives in cooperation with top management". This was done to allow the respondent to position himself on the maturity "continuum" for each criterion.

At the end of the questionnaire, the respondent was given the opportunity to comment on the relevance of the questions with respect to the situation in his organization. This helped the researcher determine if there were any weak points in the questionnaire which could be corrected by using proper question weighting factors and to demonstrate to the respondent that the questionnaires were carefully analyzed.

The EDP Skill Questionnaire

The instruction page of the EDP skill questionnaire described the questionnaire purpose and gave an example of each of its two types of skills: those beginning with "Ability to ..." and those beginning with "Knowledge of ...". These two categories did not represent different skill types but were simply different formulations. The respondent was required to circle a number from one to five, indicating his perceived usefulness of the skill from "of no use" represented by "1" to "of absolute necessity" represented by "5". An example of the first formulation would be:

22 see appendix B.
Ability to present in writing a detailed description of part of a project.

of no use 1 2 3 4 5 of absolute necessity and of the second:

Knowledge of fundamentals of probability theory.

of no use 1 2 3 4 5 of absolute necessity

The instruction sheet clearly indicated that the researcher was interested in the perceived usefulness of the skill for the job position held by the respondent and not in his possessed skill level. In the University of Minnesota's Management Information Systems Research Center (MISRC) study discussed in Chapter I, it was found that "skills were generally consistent within positions as to mean rank ordering of skills possessed versus skills useful". This researcher believed that this was true because respondents would not likely rank the usefulness of a skill for their job, significantly differently from the skill level possessed if they were asked to rank both at the same time. Therefore, it was felt that asking a respondent to rank the usefulness of a skill in relation to his own work rather than ranking his own skill level, would reduce self-report bias and would increase response objectivity.

The questionnaire consisted of 99 questions which were divided into two groups. Part I of the questionnaire grouped

23 MISRC-WP-74, p.15.
62 skills beginning with "Ability to..." and Part II grouped 37 skills starting with "Knowledge of...". In order to facilitate the respondent's task it was decided not to intermix the skills which had the two different formulations.

Of the 99 different skills, 46 were generalist skills and 53 were specialist skills. These skills could also be classified further using the six categories (people, organizations, society, systems, computers, and models) developed in the ACM Curriculum Committee report discussed in Chapter I. Table II illustrates the distribution of the skills within the various categories.

**TABLE II**

**DISTRIBUTION OF SKILLS**
**BY CATEGORY**

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>GENERALIST</th>
<th>SPECIALIST</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>People</td>
<td>9</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Organizations</td>
<td>17</td>
<td>0</td>
<td>17</td>
</tr>
<tr>
<td>Society</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Systems</td>
<td>15</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Computers</td>
<td>1</td>
<td>34</td>
<td>35</td>
</tr>
<tr>
<td>Models</td>
<td>1</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>46</strong></td>
<td><strong>53</strong></td>
<td><strong>99</strong></td>
</tr>
</tbody>
</table>

The great majority of skills were a subset of the 111 skills developed for the University of Minnesota's MISRC study. Fourteen of the study's 111 skills belonged to a category called 'performance'. These skills, which could not
be classified as specialist or generalist, were consistently ranked higher than the others. After closer analysis it was observed that these performance skills were so essential that the respondent had to give them a high usefulness score. Example of these were: "Ability to perform tasks accurately", "Ability to work independently with limited supervision", and "Ability to plan and organize work assignments". Since these skills failed to discriminate between respondents and were consistently ranked above the other skills, they were not included in this study's skill set.

Certain skills were considered not to be very important or were of absolute necessity in any work environment, and were not included. An example of the former would be "Knowledge of professional data processing associations", and an example of the latter, "Ability to communicate with others verbally." Skills related to topics which have surfaced since the MISRC study was undertaken, such as "data bases" and "structured programming", were added to the set. The 99 skills were randomly intermixed within Part I and Part II. Consequently, the respondent could not adopt a pattern of response for a certain skill category and had to be more attentive in his evaluation of each skill.

---

24 see Table I, Chapter I.
Statistical Procedures

In order to derive a maturity score for an organization, the raw score of each maturity question was converted to a percentage of its maximum attainable score. This was done so that a question scored on a six point scale would not carry more weight than a question scored on a four point scale. The individually adjusted scores were added to form the organization's overall maturity score. Scores were sorted and the median was chosen as the dividing point between the scores of the mature and less mature organizations. A sensitivity test was performed on this ranking by varying the weights of the criteria. There were no significant changes observed in the ranking. The ranking was considered to be a good representation of the relative maturities of the organizations surveyed.

The skill data was entered into two computer files. One file contained manager data and the other systems analyst data. Both files consisted of the employee's company number and his 99 skill scores. These two files were combined to produce two new files. The first, contained the mean score of managers and analysts for generalist and specialist skills. The second, contained the mean scores of managers and analysts for each of the six skill categories. All hypotheses, except

25 Companies were sequentially assigned an individual number as their completed questionnaires were received.
Hypothesis VIII (which was related to score variance), were tested using t-tests. The tests were performed using SPSS.26

In order to test Hypothesis VIII, the variance across the 99 skills for each analyst was computed. The set of variances of analysts working for more mature EDP organizations was compared to the set of variances of analysts working for less mature organizations using the Mann-Whitney U test (non-parametric test). The t-test was not used to compare the variances because the assumption of independence of scores for each analyst could not be made. In addition, the t-test was limited to comparing differences in means. Therefore, some of the basic assumptions underlying the t-test were violated. The Mann-Whitney U test employs the actual ranks of the observations as a device for testing hypotheses about the identity of two population distributions. With regard to the Mann-Whitney U test, Winkler and Hays stated: "It is a good, relatively powerful alternative to the usual T test for equality of means".27 Its main advantage, which made it appealing for this study, was that it did not assume that the hypotheses were related to means of populations.


CHAPTER III

RESULTS

EDP Organization Sample

Thirty-five companies returned useable questionnaires.\(^{28}\) The overall sample on which the statistical tests were performed consisted of 35 data processing managers and 50 systems analysts. Tests were also performed on a subset of these 35 companies by eliminating three of the companies which had scored immediately above and three which had scored immediately below the median maturity score. There was no significant difference in the results; consequently, it was decided to use the whole sample rather than use a subset.

Following is a description of a typical more mature EDP organization which responded to the survey and returned a completed maturity questionnaire.

The organization has been using computers for over 15 years. Its monthly EDP hardware budget is in the $20,000 to $50,000 range. A sizeable portion of its users (40%) can actively participate in the systems design activity, but are highly dependent on the EDP staff. Very few are capable of planning and leading a systems design project. Senior

\(^{28}\) Sixty-one questionnaires were mailed out in the second distribution attempt. As was discussed in the previous chapter, the first attempt was not successful.
management is involved in the EDP effort through a steering committee. The EDP department is independent of any other functional department. EDP objectives are derived from overall business objectives in cooperation with top management. The department is evaluated based on its contribution to organizational goals as stated in the overall organizational plan. The EDP budget is viewed with other investments and is based on organizational priorities. The EDP department develops structured plans linked to overall organizational plans in cooperation with the planning committee or department. The department charges its users for its services, enforces documentation standards, and requires periodic progress reports from its project leaders and/or systems analysts. The organization's portfolio mix consists of approximately 80% operational support systems, 15% management control systems, and 5% planning systems.

We can see from the above that many of the characteristics belong to Nolan's stage IV, while others belong to the other three stages. This would indicate that this typical "more mature" organization approaches stage IV but could not be classified as a fully mature stage IV organization. This was to be expected, since there are very few, if any, EDP organizations, especially in Canada or more specifically in the Vancouver area, which could satisfy the criteria developed by Nolan describing a fully mature, stage IV organization. It is for this reason that this chapter will compare the results of "more" and "less" mature organizations.
rather than "mature" and "immature" organizations.

Even though the University of Minnesota's MISRC study did not give many details describing the organizations they surveyed, they mentioned that the average monthly hardware expenditures on EDP averaged slightly over $75,000, which is somewhat more than the $40,000 average obtained for the more mature organizations in this study. With respect to other non-budgetary characteristics, such as reporting structures, the organizations in both studies could be considered equivalent in terms of maturity.

A description of a typical less mature organization follows. The organization has been using computers for the past 6 or 7 years. Its monthly EDP hardware budget is between $2,000 and $5,000. Most of the organization's users are not capable or are not interested in participating in the systems design activity. Senior management is very little involved with EDP. The data processing department is under the accounting function in the organizational structure. EDP objectives are set by the data processing manager only. The evaluation of the EDP department is based mostly on cost savings (50%), user satisfaction (25%), and meeting budgets (25%). Budgets are determined by the EDP manager with approval by top management. There is no formal planning performed by the department, but the EDP manager may be developing informal plans. The organization does not charge out for its services, there are no enforced documentation standards, and analysts are not required to hand in periodic
project progress reports. The mix of application systems includes operational support systems (85%) and management control systems (15%).

The above organization could be classified as a stage I organization and is considered in this study to be a "less mature" organization.
Data Processing Managers

Testing Of The Hypotheses

The questionnaire results related to the first four hypotheses are summarized in Table III.

TABLE III

EDP MANAGERS - MEAN SCORES

GENERALIST/SPECIALIST SKILLS

BY

MORE/LESS MATURE EDP ORGANIZATIONS

<table>
<thead>
<tr>
<th>GENERALIST SKILLS</th>
<th>SPECIALIST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MORE MATURE</strong></td>
<td></td>
</tr>
<tr>
<td>n=17</td>
<td>n=17</td>
</tr>
<tr>
<td>4.145</td>
<td>2.606</td>
</tr>
<tr>
<td>3.375</td>
<td></td>
</tr>
<tr>
<td><strong>LESS MATURE</strong></td>
<td></td>
</tr>
<tr>
<td>n=18</td>
<td>n=18</td>
</tr>
<tr>
<td>3.907</td>
<td>2.472</td>
</tr>
<tr>
<td>3.189</td>
<td></td>
</tr>
<tr>
<td></td>
<td>n=35</td>
</tr>
<tr>
<td>4.022</td>
<td>2.537</td>
</tr>
<tr>
<td>N=70</td>
<td></td>
</tr>
</tbody>
</table>

Hypothesis I was strongly supported (p<.001). ²⁹ Managers

²⁹ When not specified, "p" is understood to be the level of significance of a one-tailed t-test.
of more mature organizations ranked the usefulness of gener-
alist skills on average 1.6 times higher than they ranked the
usefulness of specialist skills. This would indicate that
these managers were performing more managerial and
administrative than technical tasks. The same was true for
managers of less mature EDP organizations. These managers
assigned a larger usefulness score to generalist skills than
to specialist skills (p<.001). They also ranked the useful-
ness of generalist skills 1.6 times higher than specialist
skills. Therefore Hypothesis II was not supported.

We can observe from Table III, that managers of more
mature EDP organizations perceived generalist skills as being
more useful than did managers of less mature organizations
(p<.03), thereby supporting Hypothesis III. On the other
hand, Hypothesis IV was not supported. The perceived useful-
ness of specialist skills was not significantly different
between managers of mature and less mature organizations. To
summarize:

(1) Managers of both more and less mature EDP organizations
perceived generalist skills to be more useful than spe-
cialist skills.

(2) Managers of more mature EDP organizations perceived gen-
eralist skills to be more useful than did managers of
less mature organizations.

(3) There was no significant difference between the perceived
usefulness of specialist skills between managers of both
levels of maturity.

Additional Findings

Additional tests were made to compare the usefulness of each of the six skill categories, individually, between managers of more and less mature EDP organizations. These results are summarized in Table IV.

<table>
<thead>
<tr>
<th>TABLE IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDP MANAGERS - MEAN SCORES</td>
</tr>
<tr>
<td>SKILL CATEGORIES</td>
</tr>
<tr>
<td>BY</td>
</tr>
<tr>
<td>ORGANIZATIONAL MATURITY</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>MORE MATURE</th>
<th>LESS MATURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>n=17</td>
<td>n=18</td>
<td></td>
</tr>
<tr>
<td>People</td>
<td>4.679</td>
<td>4.401</td>
</tr>
<tr>
<td>Systems</td>
<td>3.578</td>
<td>3.393</td>
</tr>
<tr>
<td>Computers</td>
<td>2.541</td>
<td>2.431</td>
</tr>
<tr>
<td>Organizations</td>
<td>4.249</td>
<td>4.071</td>
</tr>
<tr>
<td>Models</td>
<td>2.358</td>
<td>2.088</td>
</tr>
<tr>
<td>Society</td>
<td>4.137</td>
<td>3.703</td>
</tr>
</tbody>
</table>

People and society skills were considered to be significantly more useful to managers of mature EDP organizations than to managers of less mature EDP organizations (respectively, $p<.02$, $p<.04$). It must be noted that model skills were assigned the lowest score of all skills. Therefore, even though they were perceived to be significantly
more useful to managers of more mature than to managers of less mature organizations from a statistical point of view, their usefulness was not of a practical significance. There was no significant difference between the perceived usefulness of computer and system skills between the managers of the two groups.

Systems Analysts

Testing Of The Hypotheses

The survey results related to Hypotheses V, VI and VII are summarized in Table V.

The results suggest that there was no significant difference in the perceived usefulness of generalist skills between analysts of more and less mature organizations. Consequently, Hypothesis V was rejected. It was also found that there was no significant difference between the specialist skill requirements of analysts in more and less mature EDP organizations. Therefore, these results fail to support Hypothesis VI. In addition, analysts in both more and less mature EDP organizations ranked generalist skills as being significantly more useful (p<.001) than specialist skills, thereby supporting Hypothesis VII.

The results of the Mann-Whitney U test performed to test Hypothesis VIII are included in Table VI. These results show
## TABLE V

**SYSTEMS ANALYSTS - MEAN SCORES**

**GENERALIST/SPECIALIST SKILLS**

**BY**

MORE/LESS MATURE EDP ORGANIZATIONS

<table>
<thead>
<tr>
<th>Generalist Skills</th>
<th>Specialist</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>More Mature</strong></td>
<td></td>
</tr>
<tr>
<td>n=28</td>
<td>n=28</td>
</tr>
<tr>
<td>3.822</td>
<td>3.085</td>
</tr>
<tr>
<td><strong>Less Mature</strong></td>
<td></td>
</tr>
<tr>
<td>n=22</td>
<td>n=22</td>
</tr>
<tr>
<td>3.927</td>
<td>3.072</td>
</tr>
</tbody>
</table>

**n=50**  **n=50**  **N=100**

That the median variance across the 99 skill ratings (computed for each individual respondent) for analysts of less mature EDP organizations was significantly larger than the median variance for analysts in more mature organizations (p<.02). This fails to support Hypothesis VIII. Further analysis revealed that the high variance of the analysts of less mature EDP organizations was due to scoring the perceived usefulness of a certain subset of skills significantly lower than the analysts' overall mean scores. This subset was composed of 16 skills which were all specialist skills.
TABLE VI
SYSTEMS ANALYSTS
RANKING OF VARIANCE SCORES
BY ORGANIZATIONAL MATURITY

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>MEAN</th>
<th>SAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MORE MATURE</td>
<td>21.36</td>
<td>n=28</td>
</tr>
<tr>
<td>LESS MATURE</td>
<td>30.77</td>
<td>n=22</td>
</tr>
</tbody>
</table>

belonging to the computer skill category and 8 belonging to the model skill category. Examples of these skills are: "Ability to program in simulation type languages (GPSS, SIMULA, SIMSCRIPT)", "Ability to use interactive debugging facilities (available on time-sharing systems)", "Knowledge of micro-programming", "Knowledge of matrix algebra", and "Knowledge of set theory".

Analysts in more mature organizations tended to give these skills a score which was closer to their overall mean, whereas analysts of less mature organizations assigned a significantly lower score to these highly specialized skills. Since the mean scores of analysts of more and less mature organizations were approximately equal (see Table V), a significant difference in variances resulted. The same test for variances was performed for managers and there were no
significant differences found. Therefore to summarize:

1. There was no significant difference in the perceived usefulness of both generalist and specialist skills between systems analysts of more and less mature EDP organizations.

2. Systems analysts in both mature and less mature EDP organizations perceived a greater usefulness for generalist skills than they did for specialist skills.

3. Systems analysts in less mature organizations had a higher score variance in terms of perceived usefulness of skills than analysts of more mature organizations.

Additional Findings

Tests were performed to compare the usefulness of each of the six skill categories, individually, between analysts of more and less mature organizations. These results are summarized in Table VII.

There were no significant differences for any of the skill categories between analysts of more and less mature EDP organizations.
TABLE VII
SYSTEMS ANALYSTS - MEAN SCORES
SKILL CATEGORIES
BY
ORGANIZATIONAL MATURITY

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>MORE MATURE</th>
<th>LESS MATURE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=28</td>
<td>n=22</td>
</tr>
<tr>
<td>People</td>
<td>4.150</td>
<td>4.161</td>
</tr>
<tr>
<td>Systems</td>
<td>3.801</td>
<td>3.916</td>
</tr>
<tr>
<td>Computers</td>
<td>3.080</td>
<td>3.084</td>
</tr>
<tr>
<td>Organizations</td>
<td>3.848</td>
<td>3.973</td>
</tr>
<tr>
<td>Models</td>
<td>2.382</td>
<td>2.181</td>
</tr>
<tr>
<td>Society</td>
<td>3.297</td>
<td>3.379</td>
</tr>
</tbody>
</table>

EDP Managers And Systems Analysts

The survey results related to Hypotheses IX and X are summarized in Table VIII.

Generalist skills were perceived as being significantly more useful to EDP managers than to systems analysts (p<.06), thereby supporting Hypothesis IX. Systems analysts perceived a significantly greater usefulness for specialist skills than did EDP managers (p<.001), thereby supporting Hypothesis X. Table VIII shows that generalist skills were perceived as being significantly more useful than specialist skills for both EDP managers and systems analysts (p<.001).

The survey results related to Hypothesis XI and XII are summarized in Table IX.
**TABLE VIII**

EDP MANAGERS AND SYSTEMS ANALYSTS - MEAN SCORES

MANAGERS/ANALYSTS
BY
GENERALIST/SPECIALIST SKILLS

<table>
<thead>
<tr>
<th>EDP MANAGERS</th>
<th>SYSTEMS ANALYSTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERALIST</strong></td>
<td></td>
</tr>
<tr>
<td>n=35</td>
<td>n=50</td>
</tr>
<tr>
<td>4.022</td>
<td>3.868</td>
</tr>
<tr>
<td><strong>SPECIALIST</strong></td>
<td></td>
</tr>
<tr>
<td>n=35</td>
<td>n=50</td>
</tr>
<tr>
<td>2.537</td>
<td>3.080</td>
</tr>
</tbody>
</table>

3.279 3.474

n=70 n=100 N=170

People, organization and society skills were perceived to be significantly more useful to EDP managers than they were to systems analysts (respectively, p<.001, p<.01, p<.001), thereby supporting Hypothesis XI. Systems and computer skills were perceived to be significantly more useful to systems analysts than to EDP managers (p<.001 in both cases). There was no significant difference in the perceived usefulness of model skills between managers and analysts. To summarize:

(1) Generalist skills were perceived as being significantly more useful to EDP managers than to systems analysts.
(2) Systems analysts perceived a greater usefulness for specialist skills than did EDP managers.

(3) People, organization and society skills were perceived to be more useful to EDP managers than they were to systems analysts.

(4) Computer and systems skills were perceived to be more useful to systems analysts than to EDP managers.

(5) There was no significant difference in the perceived usefulness of model skills.
Ranking Of The Skill Categories

Table X shows the ranking and mean scores of the 6 skill categories (people, systems, computers, organizations and models) for EDP managers and systems analysts. These ranks were significantly different at the 0.05 level (2-tailed test). Managers of more and less mature organizations did not assign different ranks to the six skill categories than above. The same was true for systems analysts. A comparison of the above ranks with those of the University of Minnesota's MISRC study will be made in the next chapter.

<table>
<thead>
<tr>
<th>RANK</th>
<th>EDP MANAGERS</th>
<th>SYSTEMS ANALYSTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>People [4.536]</td>
<td>People [4.155]</td>
</tr>
</tbody>
</table>
CHAPTER IV

DISCUSSION

Data Processing Managers

The tests performed on the hypotheses were divided into three groups: those concerned solely with the data processing managers, those concerned solely with the systems analysts, and those comparing the skill requirements of managers and analysts.

The tests on the first group indicated that generalist skills were significantly more useful to data processing managers than were specialist skills. This held true for managers of both more and less mature organizations, supporting the results obtained by the University of Minnesota's MISRC study which looked only at larger (more mature) organizations. However, the findings failed to support Nolan's hypothesis that the skill mix of managers of smaller organizations would contain more technical skills, and that the skill mix of managers of larger organizations would contain more managerial skills.\(^\text{30}\) The results of the present study indicated that regardless of the organizational maturity level, generalist skills were perceived as being more important to data

processing managers than specialist skills.

The discrepancy between Nolan's hypothesis and these findings could be explained by the fact that in less mature organizations, managers would have little use for the highly specialized skills (e.g., model skills) included in this study. Consequently, the "technical" skills of Nolan's hypothesis would not correspond to the "specialist" skills of both the University of Minnesota's MISRC study and the present study. One can only try to explain this discrepancy, since Nolan did not describe in any detail what was meant by the word "technical".

The results also indicated that generalist skills were perceived to be more useful to managers of more mature organizations than they were to managers of less mature organizations. This reflected the additional administrative and managerial tasks assumed by managers of more mature organizations. The perceived usefulness of specialist skills remained low and was not significantly different between managers; regardless of organizational maturity. This would indicate that a basic knowledge of the more specialized aspects of data processing is necessary for managers but that the requirements for these skills do not vary across organizations of varying levels of maturity. In addition, some of the specialist skills were very specialized and were of little use to managers of both more and less mature organizations (e.g., most of the model skills and many of the computer skills). Consequently, these skills did not differentiate between both
groups of managers and therefore contributed to this lack of
difference in perceived usefulness for specialist skills.

Tests were made to compare the usefulness of each of the
six skill categories (people, systems, computers, organiza-
tions, models, and society), between managers of more and less
mature organizations.

People and society skills were perceived to be signif-
icantly more useful to managers of more mature EDP organiza-
tions than to managers of less mature organizations. This is
to be expected since a manager of a more mature organization
must have a good understanding and an ability to work with the
people under him, as well as with his peers and superiors.
These skills are even more important in an organization where
there are many subordinates and where there is a need to
coordinate the uses of data processing resources between the
many integrated functional areas of the organization.

Because more mature organizations are often larger, their
use of computers may affect more people (e.g. credit card
companies). The managers of such EDP organizations must be
aware of the societal implications of using their computers.
The recent introduction of privacy legislation is a case at
point. Such legislation would be of importance to those organ-
ization which maintain large data banks on individuals.
These organizations will often be, based on our criteria, more
mature organizations.

Organization and model skills were also perceived as
being more useful to managers of more mature EDP organiza-
tions, though this finding was only significant at the 0.10 level. Both managers of more and less mature organizations require a good understanding of their organizations. However, more mature organizations are often larger, more complex and far more integrated. In smaller, less mature organizations, applications are independent, each application having its own data files. There are no interactions between the systems themselves or between their files. In more mature organizations, applications become highly integrated, often with a common database. Therefore, a better understanding of the various functions within the organization is needed to satisfy various and often conflicting information needs. In addition, more mature organizations are evaluated based on their overall contribution to organizational goals. Consequently, managers must have a good understanding of these goals, of the means of attaining them, and of the role of their department in this attainment. Similarly, EDP planning must be done in accordance with the overall organizational plan (as specified in the criteria of a more mature organization in chapter I). This requires a better understanding of the overall organization than if the EDP department did not develop any plans, or did so without considering other departments. More mature organizations will also use more sophisticated systems involving advanced mathematical modelling techniques (e.g. Operations Research, Management Science). The managers of these organizations will require a better knowledge of modelling skills than their counterparts in less mature organizations.
However, model skills were the least important of all skills. Therefore one must not attach too great an importance to these modelling skills; they are not necessarily of practical significance.

Systems and computer skills were perceived to be equally useful by managers of both more and less mature organizations. As was discussed above, this would indicate that EDP managers require a basic set of technology-related skills which are not dependent on the maturity of their organization. This set of skills allows them to interact with members of the data processing community (e.g. vendors) and with their own more technologically-oriented subordinates.

**Systems Analysts**

As was the case for data processing managers, generalist skills were perceived to be more useful to systems analysts than specialist skills, for analysts of both more and less mature organizations. This finding is also in agreement with the University of Minnesota's MISRC study. The results would indicate that the position of systems analyst is oriented towards solving organizational problems rather than technical problems. The perception of usefulness of generalist and specialist skills by systems analysts was not dependent on the maturity of their EDP organizations. The same was true about their perceptions of the usefulness of the six skill categories. However, there were significant differences in the
variances of scores rating the perceived usefulness of the 99 skills. Systems analysts in less mature organizations had a higher score variance when ranking the usefulness of the EDP skills than their counterparts in more mature organizations. The reason being that systems analysts in less mature organizations ranked a subset of highly specialized skills significantly lower than their overall mean. It is to be expected that certain highly specialized skills, such as the knowledge of simulation languages, would not be as useful to analysts in less mature organizations. With the exception of these few skills, the set of skills required by analysts did not differ in relation to organizational maturity.

**EDP Managers And Systems Analysts**

As hypothesized, generalist skills were perceived to be more useful to data processing managers than to systems analysts and specialist skills were perceived to be more useful to analysts than to managers. To further refine the comparison between managers and analysts; people, organization, and society skills were perceived to be significantly more useful to managers while systems and computer skills were more useful to analysts than to managers. This is to be expected because of the differences in the tasks performed by practitioners in both EDP positions.

Model skills were perceived to be the least useful by both analysts and managers. There was no significant
difference in the assigned usefulness scores for model skills by managers and analysts.

EDP managers and systems analysts have little disagreement as to which skills are the most useful. People and organization skills are respectively ranked first and second (in descending order of usefulness). There is a slight variation in the rank assigned to systems and society skills between managers and analysts. Managers ranked society skills as being more useful than systems skills, and analysts ranked system skills higher than society skills. The main difference between the ranks found in this study and those found in the University of Minnesota's MISRC study was that society skills were considered to be more useful for both data processing managers and analysts than they were in the MISRC study. This difference may be due to the small number (3) of these skills and to their better "quality" in this study. Systems skills which were ranked between people and organizational skills in the MISRC study, were considered to be as useful as organizational skills to systems analysts (3.90 for organization skills and 3.85 for systems skills), but were considered to be less useful than organizational skills to data processing managers (4.15 for organization skills and 3.48 for systems skills). Therefore, systems skills were considered to be slightly less useful in this study.

There were no differences between the ranks of managers of more and less mature organizations. The same was true for analysts. Consequently, even though the organizations of the
MISBC were, on the average, larger (which could be considered as a surrogate for maturity) than those of this study, this cannot explain the discrepancy in the ranks. However, the MISBC study was undertaken 5 years ago. In those five years, systems evolved as organizations were careful not to make the expensive mistakes of the 1960's. The role of the user was enhanced and the behavioural aspects of information systems became more important in both academic and business circles. This could explain why systems skills were ranked lower in this study than in the MISBC study, and society skills were ranked higher. Unfortunately, the average scores obtained on these skill categories in the MISBC study were not published and thus a comparison across skills was not possible.

The similarities between the two studies are that people skills were considered to be the most useful skills whereas computer and model skills were considered to be the least useful.
Implications For University Curricula

The study has shown that generalist skills, or more specifically those related to people and organizations, were deemed to be the most useful to data processing managers and systems analysts, whereas specialist skills such as computer and model skills were considered to be the least useful. There were no major differences between the skill requirements of EDP practitioners in more and less mature organizations.

One can infer from these results that universities should prepare those students interested in data processing and information systems to solve people and organization-related problems rather than technical problems. Technology remains important but only as one of many tools the EDP practitioner must have with him. Technology is a means to an end, not an end in itself.

In the report of the ACM described in chapter I, it was mentioned that information systems would be successful only if a balance was struck between the emphasis placed on organizational and technical factors, and that systems in the past had failed because organizational factors had been too often ignored. Based on this premise, a thirteen-course graduate curriculum was developed. Of the 13 courses, 6 courses were related to generalist skills and 7 courses were related to specialist skills. The report also described possible positions in information systems which could be filled by individuals possessing the skills outlined in the ACM
The present study looked at two of these positions: EDP manager and systems analyst. The results obtained seem to indicate that the ACM curriculum recommendations placed too much emphasis on the technical aspects of information systems. Based on this study, it would seem that more emphasis should be placed on acquiring people, organizational, and society skills rather than specialist skills. For example, model skills, which were assigned a very low score in both the MISRC study and in this study, have a full course dedicated to them in the ACM curriculum. This course could be combined with other courses or become a prerequisite to an MIS graduate program. Graduate programs in information systems, such as the one offered at U.B.C., which place a heavy emphasis on the managerial and administrative aspects of MIS, seem to be well suited to satisfy the present skill requirements of data processing managers and systems analysts.

Benbasat and Dexter looked at the information systems courses offered in Canadian business schools, and found that the courses appeared to be managerial and non-technical in nature.\(^{31}\) This is encouraging. However, a closer study of the courses revealed that very few schools offered courses concerned with the legal and societal aspects of information

\(^{31}\) Benbasat, I., Dexter, A.S., A Proposed Program For Management Information Systems Education In Schools Of Business, University of British Columbia, Faculty of Commerce and Business Administration working paper #471, April 1978.
systems. The present study indicated that society-related skills were considered to be very useful to EDP practitioners, especially to those of more mature organizations. In addition, very few schools offered courses which were specifically related to people skills. For example, there did not seem to be any courses offered in Canadian business schools, which combined the knowledge of both the MIS and Organizational Behaviour fields of study, or the MIS field and the Organizational Development field, which concerns itself specifically with the introduction of change and modification of organizations. The results of this study would indicate that research into the development of courses of this nature seems necessary. Both the MISRC study and this study found that people-related skills were highly useful, more useful than any purely MIS related skills. This should be taken into consideration by the developers of MIS curricula.

As computers penetrate deeper and deeper into all functional areas of the organization, the need for skills and knowledge in information systems will increase. The problems which will be encountered will not be technical problems, but people and organizational problems. Therefore, it is safe to expect an even greater emphasis on the need for generalist skills from EDP practitioners in the future.
REFERENCES


APPENDIX A

MATUREITY QUESTIONNAIRE
EDP SKILL SURVEY

ORGANIZATION PROFILE QUESTIONNAIRE

(to be completed by the data processing manager only)

Name of firm: ________________________________

Please indicate your job position/title:______________________

This questionnaire will allow us to get a better picture of your EDP organization. Some questions require that you select among possible answer alternatives. In these cases please circle the number of the choice alternative you select.

Other questions require that you enter percentages or weights. We realize that these questions are more difficult to answer, but we would appreciate if you could determine these percentages or weights as accurately as possible.

Please give an answer for each question.

If you wish to receive a copy of the research results please attach your business card to this page.

Thank you for participating.
ORGANIZATIONAL PROFILE QUESTIONNAIRE

1) Monthly expenditures on hardware (includes maintenance)

Please indicate the mean monthly rental cost of computing hardware in your organization for the past 12 months (use rental equivalent if leased or purchased).

1. $1 to $1,999
2. $2,000 to $4,999
3. $5,000 to $9,999
4. $10,000 to $19,999
5. $20,000 to $49,999
6. $50,000 and over.

2) EDP history

Please indicate the number of years your organization has been using computers.

1. less than 3 years
2. 3 to 6 years
3. 7 to 10 years
4. 11 to 15 years
5. over 15 years.

3) User awareness (management users)

Please indicate the percentage of users in your organization who are:

1. ___% Not interested or capable of participating in the systems design activity.
2. ___% Capable of participating in the design activity but are highly dependent on the EDP staff.
3. ___% Capable of actively participating in the design activity.
4. ___% Capable of planning and leading a systems design project.

100% TOTAL

4) Role of senior management

Which of the following best describes the role of senior management relative to the EDP department in your organization.

1. There is very little involvement of senior management.
2. Senior management is supportive and encourages growth.
3. Senior management is involved through a steering committee or other similar body.
4. Senior management has overall control of the EDP activity.
5) Position in organizational structure

Please indicate the organizational location of your computer activity (department).

1. location 1. In Accounting department.
2. location 2. In Operating department such as Marketing, Manufacturing, etc.
3. location 3. Reporting to top management.
4. location 4. Independent department.

Please also enclose a photo copy of an organizational chart depicting the location of the DP/IS function in your organization.

6) Objective setting

Which of the following best describes the means of determining the EDP objectives in your organization.

1. Objectives are set informally by the EDP manager.
2. Objectives are set formally by the EDP manager.
3. EDP objectives are set by top management.
4. Objectives are derived from overall business objectives in cooperation with top management.
7) EDP department performance evaluation

Please indicate the weights attached (by your superiors) to the following EDP department evaluation criteria. Weights are decimal numbers between 0 and 1.0 (eg. 0.35) which must add up to 1.0.

1. ___ Costs savings due to clerical staff reduction or increased efficiency of operation support systems.
2. ___ User satisfaction.
3. ___ Meeting budgets.
4. ___ Contribution to organizational goals as stated in overall organizational plan.
   ___ 1.0 TOTAL

8) Budgeting Process

Which of the following best describes the EDP budgeting process in your organization.

1. There is no formal budgeting performed in the EDP organization.
2. Budgets are determined by the EDP manager.
3. Budgets are set by senior management.
4. Budgets are viewed with other investments and are based on organizational priorities.

9) EDP Planning

Which of the following best describes the EDP planning process in your organization.

1. Little or no planning done in the EDP department.
2. Informal planning performed by EDP manager.
3. Formal plans are developed by the EDP manager.
4. Formal structured plans are developed and are linked to the overall organizational plans in cooperation with the planning committee or department.

10) EDP control mechanisms

Please circle answer:

a) Does your organization use a charge-out system? Yes No

b) Are there formal program documentation standards in your organization which are enforced? Yes No

c) During project implementation is the project leader or systems analysts required to hand in periodic progress reports? Yes No
11) Portfolio mix

Please indicate the approximate percentage of the EDP budget spent on the following three categories of systems (includes both development and maintenance):

1. ___% Operational Support Systems. Systems which perform the routine transaction level activity required in the daily operation of the organization and report on the operational status of the firm so that management is aware of day-to-day activities. (includes order entry systems, invoicing, payroll, etc.)

2. ___% Management Control Systems. Systems which provide control information required by managers of departments, profit centers, etc. to measure performance, track the efficiency and effectiveness of operations, decide on control actions, formulate new decision rules to be applied by operational personnel, allocate resources and provide for coordination between several departments. (includes manufacturing cost control systems, sales analysis systems, etc.)

3. ___% Planning Systems. Systems which provide information for strategic level management (top management). This information will permit these managers to carry out their planning activities, such as formulating and revising company objectives, determining long-term goals (over 3 years) and establishing company policies, (includes financial planning systems, corporate models, etc.)

___

100% TOTAL

12) If you felt uncomfortable answering any of the above questions, ie. the answer choices did not correspond to the situation in your organization, please comment below and on the back of this page.

Thank you.
APPENDIX B

SKILL QUESTIONNAIRE
EDP SKILL SURVEY

EDP SKILL QUESTIONNAIRE

(to be completed by both data processing managers and systems analysts)

Name of firm: ____________________________

Please check your position/title:

Data Processing Manager  ____

Systems Analyst  ____

if other, please indicate: ________________________
EDP SKILLS QUESTIONNAIRE

This questionnaire will help us determine the relative usefulness of various skills which are related to information processing. You will be asked to rank the usefulness of each skill described in this questionnaire on a 1 to 5 scale. For example:

Ability to write detailed program specifications.
of no use 1 2 3 4 5 of absolute necessity

If you felt that this skill was absolutely necessary to effectively perform the duties related to your job position, you would circle "5". On the other hand if you felt that this skill was irrelevant and would not in any way, contribute to the effective functioning of someone in your job position, then you would circle "1". If your feelings were not as categorical you would circle "2", "3" or "4" depending on their direction.

The questionnaire is divided into two parts. The first part contains skills which begin with "Ability to" (as in the example above). The second part contains skills which begin with "Knowledge of". An example of the latter would be:

Knowledge of microprogramming.
of no use 1 2 3 4 5 of absolute necessity

Both types of skill questions are answered in the same fashion. Therefore if the knowledge of a certain topic was perceived to be of absolute necessity you would circle "5", if it was of no use, you would circle "1".

We would like to emphasize that we are NOT asking whether YOU possess these skills, but we are asking you to rate the usefulness of the skill for the job position you hold (whether you possess the skill or not).

PLEASE GIVE AN ANSWER FOR EACH SKILL

Thank you for participating.
PART I (please circle answer)

1. Ability to identify in an on-going organizational situation the key issues and problems of a given functional area (production, finance, marketing, etc.).
   of no use 1 2 3 4 5 of absolute necessity

2. Ability to communicate and interact with non-computer oriented people.
   of no use 1 2 3 4 5 of absolute necessity

3. Ability to gather data and prepare long range information systems plans.
   of no use 1 2 3 4 5 of absolute necessity

4. Ability to analyze and determine costs and benefits of projects (information systems) to user.
   of no use 1 2 3 4 5 of absolute necessity

5. Ability to analyze and evaluate programming languages for selecting most appropriate language for a given problem.
   of no use 1 2 3 4 5 of absolute necessity

6. Ability to analyze and evaluate different software packages.
   of no use 1 2 3 4 5 of absolute necessity

7. Ability to analyze and evaluate different hardware configurations.
   of no use 1 2 3 4 5 of absolute necessity

8. Ability to consult the literature to select the most appropriate data base management system for a set of applications (or organization).
   of no use 1 2 3 4 5 of absolute necessity
9. Ability to develop the major alternatives in specifying an information processing system, including data files and communication structures.

of no use  1 2 3 4 5 of absolute necessity

10. Ability to use program testing aids (special debugging packages, traces, and snapshots).

of no use  1 2 3 4 5 of absolute necessity

11. Ability to make "rough-cut" feasibility evaluations of proposed new techniques or applications of current technology.

of no use  1 2 3 4 5 of absolute necessity

12. Ability to grasp the facts and feelings of what is spoken.

of no use  1 2 3 4 5 of absolute necessity

13. Ability to use direct and random file techniques.

of no use  1 2 3 4 5 of absolute necessity

14. Ability to prepare clear and useful documentation (programs and procedures within programs, systems etc.).

of no use  1 2 3 4 5 of absolute necessity

15. Ability to program in assembly type languages (BAL, COMPASS).

of no use  1 2 3 4 5 of absolute necessity

16. Ability to design logical data bases (determine data types, record types, relationships between data items etc.).

of no use  1 2 3 4 5 of absolute necessity

17. Ability to develop specifications for a major information system, addressing a given organizational need, and determine the breakdown into manual and computer-based parts.

of no use  1 2 3 4 5 of absolute necessity
18. Ability to describe and identify individual and group behaviour (e.g. describe and identify working relationships among people in an organizational environment).

   of no use  1  2  3  4  5  of absolute necessity

19. Ability to use sort and utility packages.

   of no use  1  2  3  4  5  of absolute necessity

20. Ability to evaluate the social consequences of a proposed system.

   of no use  1  2  3  4  5  of absolute necessity

21. Ability to prepare effective user documentation for either a portion of a system or an entire system.

   of no use  1  2  3  4  5  of absolute necessity

22. Ability to predict alternative future behaviour of individuals and groups (e.g. predict individuals' reactions to operating changes).

   of no use  1  2  3  4  5  of absolute necessity

23. Ability to program in file oriented languages (COBOL, RPG).

   of no use  1  2  3  4  5  of absolute necessity

24. Ability to effect change in work relationships.

   of no use  1  2  3  4  5  of absolute necessity

25. Ability to analyze programs outlined by the systems analysts for detailed design and construction.

   of no use  1  2  3  4  5  of absolute necessity

26. Ability to recognize the appropriate management science (operations research) model for situations commonly encountered.

   of no use  1  2  3  4  5  of absolute necessity
27. Ability to use sequential and index sequential file techniques.

    of no use  1  2  3  4  5  of absolute necessity

28. Ability to view, describe and define any situation as a system.

    of no use  1  2  3  4  5  of absolute necessity

29. Ability to develop positive and negative impacts of a specified information system on specified parts of the organization.

    of no use  1  2  3  4  5  of absolute necessity

30. Ability to write detailed program specifications.

    of no use  1  2  3  4  5  of absolute necessity

31. Ability to specify elements and relationships of information in various functional segments.

    of no use  1  2  3  4  5  of absolute necessity

32. Ability to manage a computer based systems project (team organization, cost and schedule control, etc.).

    of no use  1  2  3  4  5  of absolute necessity

33. Ability to analyze communication systems (estimate line and terminal requirements, volume and message length, queues, etc.).

    of no use  1  2  3  4  5  of absolute necessity

34. Ability to recognize and remove personality problems which interfere with job completion.

    of no use  1  2  3  4  5  of absolute necessity

35. Ability to formulate and solve simple management science type models (linear programming, dynamic programming, queuing, etc.).

    of no use  1  2  3  4  5  of absolute necessity
36. Ability to formulate and solve complex simulation models.
   of no use 1 2 3 4 5 of absolute necessity

37. Ability to gain the confidence and support of others in work relationships.
   of no use 1 2 3 4 5 of absolute necessity

38. Ability to perform economic analyses (cost/benefit studies) of proposed resource commitments for a project.
   of no use 1 2 3 4 5 of absolute necessity

39. Ability to create, maintain and interrogate files.
   of no use 1 2 3 4 5 of absolute necessity

40. Ability to calculate cost/performance tradeoffs in a system.
   of no use 1 2 3 4 5 of absolute necessity

41. Ability to prepare sample data for programs and test runs.
   of no use 1 2 3 4 5 of absolute necessity

42. Ability to gather information systematically within an organization, given specified information needs and/or specified information flows.
   of no use 1 2 3 4 5 of absolute necessity

43. Ability to program in scientific or algorithmic type languages (FORTRAN, PL/1)
   of no use 1 2 3 4 5 of absolute necessity

44. Ability to develop (design and implement) data bases using a generalized data base management system (IMS, TOTAL, ADABAS, IDS).
   of no use 1 2 3 4 5 of absolute necessity
45. Ability to program in simulation type languages (GPSS, SIMULA, SIMSCRIPT).

of no use 1 2 3 4 5 of absolute necessity

46. Ability to identify possible short term and long term effects of a specified action on organizational goals.

of no use 1 2 3 4 5 of absolute necessity

47. Ability to evaluate system performance and make adjustments to system after implementation.

of no use 1 2 3 4 5 of absolute necessity

48. Ability to convert existing programs from one system to another (language to language, computer to computer).

of no use 1 2 3 4 5 of absolute necessity

49. Ability to apply the "system viewpoint" in depth within the organizational structure.

of no use 1 2 3 4 5 of absolute necessity

50. Ability to interview others.

of no use 1 2 3 4 5 of absolute necessity

51. Ability to revise existing programs (including debugging and refinement).

of no use 1 2 3 4 5 of absolute necessity

52. Ability to use interactive debugging facilities (available on time-sharing systems).

of no use 1 2 3 4 5 of absolute necessity

53. Ability to develop structured (modular) programmes.

of no use 1 2 3 4 5 of absolute necessity
54. Ability to recognize, understand, and communicate the meaning a particular event has for you.

of no use 1 2 3 4 5 of absolute necessity

55. Ability to design and use decision tables.

of no use 1 2 3 4 5 of absolute necessity

56. Ability to design and use flowcharts (system and program).

of no use 1 2 3 4 5 of absolute necessity

57. Ability to design and use run and grid charts.

of no use 1 2 3 4 5 of absolute necessity

58. Ability to design and use I/O layouts.

of no use 1 2 3 4 5 of absolute necessity

59. Ability to specify, given information needs and sources, several alternative sets of information to meet needs.

of no use 1 2 3 4 5 of absolute necessity

60. Ability to design software and hardware configurations.

of no use 1 2 3 4 5 of absolute necessity

61. Ability to present in writing a summary of a project for management action (suitable to serve as a basis for decision).

of no use 1 2 3 4 5 of absolute necessity

62. Ability to present in writing a detailed description of part of a project.

of no use 1 2 3 4 5 of absolute necessity
The skills in this part of the questionnaire begin with "Knowledge of ...". Please rate these skills as you did for those of PART I.

PART II (please circle answer)

1. Knowledge of "outside" computer services (information concerning consultants, software houses, application packages etc.).
   of no use 1 2 3 4 5 of absolute necessity

2. Knowledge of inventory control models.
   of no use 1 2 3 4 5 of absolute necessity

   of no use 1 2 3 4 5 of absolute necessity

4. Knowledge of operating systems (scheduling algorithms, memory and facilities management, interrupt systems).
   of no use 1 2 3 4 5 of absolute necessity

5. Knowledge of searching techniques (sequential, binary, directory).
   of no use 1 2 3 4 5 of absolute necessity

6. Knowledge of the means to insure the security and integrity of programs and data during and after program implementation.
   of no use 1 2 3 4 5 of absolute necessity

7. Knowledge of the centralization/decentralization issue and its implications on the EDP function as well as on the whole organization.
   of no use 1 2 3 4 5 of absolute necessity

8. Knowledge of fundamentals of probability theory.
   of no use 1 2 3 4 5 of absolute necessity

of no use 1 2 3 4 5 of absolute necessity

10. Knowledge of existing communications facilities (line types, exchanges, utilities).

of no use 1 2 3 4 5 of absolute necessity

11. Knowledge of the privacy issue and its implications on data banks (both private and public).

of no use 1 2 3 4 5 of absolute necessity

12. Knowledge of sorting techniques (radix, merge, bubble, tree).

of no use 1 2 3 4 5 of absolute necessity

13. Knowledge of multilinked data structures (trees, multilists, inverted lists, hierarchies, networks etc.).

of no use 1 2 3 4 5 of absolute necessity

14. Knowledge of data gathering techniques (interviews, observation, sampling and others).

of no use 1 2 3 4 5 of absolute necessity

15. Knowledge of accounting practices and procedures.

of no use 1 2 3 4 5 of absolute necessity


of no use 1 2 3 4 5 of absolute necessity

17. Knowledge of queuing theory.

of no use 1 2 3 4 5 of absolute necessity

of no use 1 2 3 4 5 of absolute necessity

19. Knowledge of time-sharing operating systems (concepts and facilities).

of no use 1 2 3 4 5 of absolute necessity

20. Knowledge of the function of purposeful organizational structure and the major alternatives for that structure.

of no use 1 2 3 4 5 of absolute necessity

21. Knowledge of characteristics of auxiliary storage devices (storage capacity, etc.): tape, disk drum.

of no use 1 2 3 4 5 of absolute necessity

22. Knowledge of project planning and control tools.

of no use 1 2 3 4 5 of absolute necessity

23. Knowledge of job control languages (coding and techniques).

of no use 1 2 3 4 5 of absolute necessity

24. Knowledge of computer operations management (scheduling, data entry, system optimization, computer security, etc.).

of no use 1 2 3 4 5 of absolute necessity

25. Knowledge of sources for updating knowledge of technology.

of no use 1 2 3 4 5 of absolute necessity

26. Knowledge of computer personnel management (incentive systems, leadership styles, performance measurement, etc.).

of no use 1 2 3 4 5 of absolute necessity
27. Knowledge of input-output devices (types available, general market characteristics).

of no use 1 2 3 4 5 of absolute necessity


of no use 1 2 3 4 5 of absolute necessity

29. Knowledge of multiprogramming and multiprocessing.

of no use 1 2 3 4 5 of absolute necessity

30. Knowledge of "inner workings" of compilers, interpreters and other translators.

of no use 1 2 3 4 5 of absolute necessity

31. Knowledge of the impact of computers on industrial, clerical and managerial positions.

of no use 1 2 3 4 5 of absolute necessity

32. Knowledge of minicomputers.

of no use 1 2 3 4 5 of absolute necessity

33. Knowledge of communication access methods and their general features to support terminal/teleprocessing applications.

of no use 1 2 3 4 5 of absolute necessity

34. Knowledge of the structured programming concept and of its implications on systems development.

of no use 1 2 3 4 5 of absolute necessity

35. Knowledge of elementary statistics.

of no use 1 2 3 4 5 of absolute necessity
36. Knowledge of set theory.

of no use 1 2 3 4 5 of absolute necessity

37. Knowledge of general systems theory (open/closed systems, system boundaries, feedback concept).

of no use 1 2 3 4 5 of absolute necessity
APPENDIX C

COVERING LETTER
June 7th, 1978

Mr. S.Q. Alexander  
Data Processing Manager  
Canadian Buggy-Whip Company  
1900 Memory Lane,  
Victoria, B.C.  
N0T 1A1

Dear Mr. Alexander,

The executive of the Vancouver chapter of the XXXX has kindly cooperated with us in this study, undertaken by the Faculty of Commerce of UBC, and have forwarded your name in the hope that you may be of help to us.

Many data processing executives have mentioned to me that university graduates do not possess the skills which are required to function effectively in the data processing field. We at UBC are concerned about this and would like to take a few measures to solve this problem. The first step we propose is to survey a cross-section of the data processing industry to determine the skills perceived as important by data processing managers and systems analysts to be effective in their work.

This questionnaire package which is part of that survey, contains two types of questionnaires: the "Organization Profile" questionnaire and the "EDP Skills" questionnaire. The "Organization Profile" questionnaire is to be completed by the data processing managers and will be used to get a profile of the organizations surveyed. The "EDP Skills" questionnaire is to be completed by both data processing managers and systems analysts and will be used to determine the usefulness of skills related to data processing.

We would appreciate if you could fill out both the "Organization Profile" and the "EDP Skills" questionnaires and select two of your systems analysts to each fill out one of the remaining two "EDP Skills" questionnaires.
The questionnaires will not take more than 25 minutes of you and your systems' analysts time to fill out. Once completed, please mail the four questionnaires in the prepaid return envelope.

You may be assured that all information obtained will be used specifically for research purposes and under no circumstances will individual responses be disclosed. Completed questionnaires will be machine-processed centrally for use in this study only. However, we would be delighted to send you a summary of the research results. If you wish a copy please attach your business card to the returned questionnaires. We would be grateful if you could return the completed package to us as soon as possible.

We would like to take this opportunity to thank you in advance for taking part in this study and to emphasize that we do need your cooperation.

Sincerely yours,

Albert S. Dexter
Associate Professor
APPENDIX D

FOLLOW-UP CARD