

## INTERPERSONAL SKILL REQUIREMENTS FOR FRESH COMPUTER PROGRAMMERS: EXPECTATION OF BRUNEI-BASED ORGANISATIONS

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### ABSTRACT

*Computing is a rapidly changing technology. To compete successfully in this highly dynamic area, programmers tend to place more emphasis on technical know-how, and may ignore the importance of developing interpersonal skills. This study involves a survey of nearly 40 Brunei-based organisations and reports the immense requirements of interpersonal skills expected from fresh programmers. This useful finding is discussed in detail, and some suggestions are offered to both academics and practitioners.*

**Keywords:** *Interpersonal skill, programmers, discriminant analysis*

### 1.0 INTRODUCTION

Over the past decades, a dramatic change has taken place in computer technology. The mammoth multimillion mainframe computers which processed data for large organisations have been threatened by the arrival of powerful microcomputers. Those mainframe computers were solely the domain of highly specialised technical gurus who remained behind locked glass rooms. Thus, it is not surprising that in the past, a computer programmer is reflected as a picture of a person who used to work alone - often beyond the normal office hours. The interactions of those programmers were confined with the machine, and hardly anybody outside the information technology (IT) department could understand the working mechanism of a programmer. As such, programmers were regarded as system-oriented 'machine-people' [1]. To overcome this problem, often a computer professor serves as an intermediary between the users and the programmers while designing a business computer system [2].

This scenario, however, no longer persists in the computing world today. Today, computers became more accessible, smaller, and yet powerful. These computers outstrip the power and memory of room-sized mainframe

computers that were the norm thirty years ago [3]. Furthermore, with the rapid decline in the cost of computers, organisations regardless of types and sizes have begun to automate their business tasks. However, unlike the past when computers were used to automate manual tasks, today's computers are changing the way an organisation operates in the marketplace [4-5]. Business organisations now use IT to create opportunities. As such, the success or failure of an organisation often depends on the effective use of IT.

The change in technologies and their application in business setting have created new expectations from programmers. Today's computer programmers are required not only to keep abreast with new technological advancements, but they must apply cost effective ways to use computer technology to solve business problems [6]. This implies that it is no longer adequate for programmers to be competent only in technology, they must also have an in-depth understanding of the business functions and needs. Programmers are thus required to work hand-in-hand with functional peers and end-users. As such, programmers must develop effective interpersonal skills.

Business executives and academics alike have expressed concerns regarding the knowledge and skills required by programmers in order to work effectively within organisations [7-8]. Most of the existing studies are US-based, the findings of which may not be applicable to other parts of the world. Moreover, the skill requirements of programmers in the Asian countries are least reported. Against this backdrop, a study was undertaken to determine the need for interpersonal skills of fresh computer programmers in Brunei Darussalam.

The remainder of this paper has been arranged in the following sequence. First, previous studies on interpersonal skills of programmers are reviewed. Second, research questions are formulated. Third, a set of hypothesis is postulated. Fourth, the research approach is described. Fifth, the findings of the study are presented and discussed. Finally, some suggestions are offered and conclusions are drawn.

## **2.0 LITERATURE REVIEW**

Past researches related to skill requirements of IT professionals span a period of over twenty-five years. Much of what appeared in the computer literature, however, examined the skill and knowledge requirements of IT personnel in general, and studies focusing particularly on interpersonal skills of programmers are few. In the late 70s, Jensen and Tonies [9] in a book on 'Software Engineering' proposed an effectiveness formula for programmers. They advocated that the effectiveness of programmers depends on their skills in the areas of management concepts, communication and technical know-how.

Empirical studies conducted in the 70s however, solely indicated the need for technical skills for programmers [10-11]. Only Roark [12] expressed a need to improve communication skills for programmers. None of these studies identified knowledge of management concepts as a requisite ability for programmers. This scenario however, changed during the 80s when interpersonal skills were rated more important for the programmers [13], and the lack of business skills was found to inhibit the career paths of programmers [14]. In the 90s, the importance of technical skill is still acknowledged, but increased communication skill [15-16], and knowledge on the business were seen as contributing factors in the career advancement of programmers. In short, existing literature shows a strong continuing emphasis on technical skills for programmers, with business and interpersonal skills appearing to increase in importance over time. Thus, the views of Jensen and Tonies [9] received recognition only in recent years.

## **3.0 RESEARCH QUESTIONS**

The cardinal aim of this study is to identify the types of interpersonal skills that managers of Brunei-based organisations are willing to find among fresh computer programmers. Another related objective is to examine the impact of organisation size and type on the interpersonal skill requirements of fresh programmers. Previous studies did not investigate skills based on size and types of organisations. More specifically, this study seeks to find answers for the following three research questions:

- [a] What interpersonal skills are required from computer programmers?
- [b] Do the requirements for interpersonal skills vary depending on size of organisations?
- [c] Do the requirements for interpersonal skills vary depending on type of organisations?

## **4.0 RESEARCH VARIABLES AND DEVELOPMENT OF HYPOTHESIS**

In this study, the dependent variable is the interpersonal skill requirement of programmers. The term 'skill' is generally defined as a specific psychomotor process which is necessary to meet the current requirement of a specific task [17]. A skill is generally manifested through a behaviour such as writing a well structured program using Pascal. 'Interpersonal skill' is one prominent category of skill that refers to a person's ability to convey information, thoughts, feelings and attitude [18]. It is both oral and written. It is essential that a programmer can communicate effectively both orally and in written form. In this study, seven different types of interpersonal skills are considered: working effectively as a member of a team, listening to others, managing own roles and responsibilities, working alone to accomplish some goals, communicating in writing, training others and giving effective oral presentation. Probably one of the important interpersonal skill is listening. It involves the accurate receipt and interpretation of communication [19]. It is generally understood that a rushed, never-listening programmer will seldom get an objective view of the requirements of users. Furthermore, users want to be heard, want to be taken seriously, and want to be understood. Thus, a programmer should listen carefully to users. A great deal of information is also communicated orally. As such, programmers should have oral skill which could be applied in a face-to-face meeting of two people or in a presentation to a large audience. It can be formal or informal [20].

Interpersonal skills in general are capable being learnt, being developed by practice and being applied in a given situation to achieve a desired result. In this study, a five point interval scale is used to measure the interpersonal skills. This scale varies from 0 to 4, where 0 indicates 'of no use', and 4 indicates 'absolutely necessary'. Interval scale was chosen because it is easy to construct and the respondents readily understand how to use [19].

This study has identified size and type of organisation as the independent variables. No specific definition of organisational size was adopted in this study. It is due to the existence of confusion surrounding organisational size, which has reached such a point that the logic underlying its definition has been described as a theoretical waste [21]. Furthermore, previous studies have also failed to offer a consensus definition of organisational size [22]. Organisational size further suffers from measurement problems. One reason for this is that size is a multidimensional rather than a global concept [23]. In fact, the literature on organisation theory has suggested several indicators of size including market share, number of product lines, asset, number of branches, and number of employees among others. The number of full-time employees in an organisation was however

considered as the relevant measure of organisation size. This measure is chosen because it is a convenient common denominator [24], and is a less subjective measure than market share, product lines, and other methods of measuring size [21]. Moreover, the number of employees, is the measure that is most commonly cited in the literature [25]. Using the number of employees as a measure, Grover and Segars [20] as well as Pervan and Chua [26] have identified three categories of organisational sizes: small, medium and large. This study has adopted their classification, which suggests that an organisation is small when it employs fewer than 250 people, while a large organisation is one that has over 1000 employees. A medium organisation is the one that employs between 250 to 1000 people.

Programmers in large and medium organisations need to possess excellent interpersonal skills in the areas of writing documents, oral presentation, listening and training end-users. This is quite obvious because large organisations are characterised by the presence of a formal environment, and have a greater end-user population. The formal environment implies that programmers are not only required to communicate their ideas in writing, but are often asked to make formal presentations. Programmers also need to participate in group discussion, and need to listen carefully to various groups of end-users who often suggest conflicting requirements. Furthermore, the presence of large end-user population demands that programmers should possess adequate skills to train these end-users.

In contrast, small organisations are characterised by less formal environment [24, 18]. The members in small organisations come into close contact with each other daily. It is not unusual for the employer and the employees to eat and work together. Because people know each other personally, there appears to be little need for written rules and the like. When communication is necessary, the members talk face-to-face, there is little place for rules/procedures. As such, there is less emphasis on formal mode of presentation. Programmers are still required to exchange their ideas/proposals orally, but in an informal manner. Training skill is also less needed, because programmers can train end-users in a more cosy environment, and the number of end-users is also less. Thus, although interpersonal skills are needed, but they are required to a lesser extent as opposed to those of large and medium organisations. Thus, the following set of hypothesis is postulated:

H1<sub>a</sub>: *There does not exist any difference in the requirement of interpersonal skills among small, medium and large organisations.*

H1<sub>b</sub>: *There exists a difference in the requirement of interpersonal skills among small, medium and large organisations.*

Like organisation size, it is also difficult to find a widely accepted definition of organisation type. Existing literature however indicates that organisations can be grouped into different types based on a variety of criteria such as means of obtaining compliance [28], business activity [18], social needs orientation [28], primary beneficiary [29, 28], technology [29], and ownership [30]. In this study, organisation type refers to nature of ownership of an organisation. Two types of organisations are identified: public or private. The private sector refers to business organisations that are owned by individuals, not the government, while public sector includes those organisations that are owned and controlled by the government [30]. The private sector competes with one another for resources to provide goods and services for their customers [18]. It is also true for the public sector organisations. In order to facilitate organisations' competition for resources, organisations, regardless of their nature, often develop high quality IT systems. A good and dependable IT system could only be developed if the developers, particularly the programmers, are equipped with adequate interpersonal skills. The lack of interpersonal skills may put an organisation at a disadvantage because of their failure to produce quality IT system. This implies that the demand for interpersonal skills should not differ between the public and private sector organisations. Thus, the following set of hypothesis is postulated:

H2<sub>a</sub>: *There does not exist any difference in interpersonal skills among the public and private organisations.*

H2<sub>b</sub>: *There exists a difference in interpersonal skills among the public and private organisations.*

## 5.0 RESEARCH APPROACH

A survey research method was adopted to address the research questions and to examine the hypotheses as introduced earlier. A questionnaire consisting of two parts was prepared. Part A captured background information about the participating organisations, while Part B collected information about the skill requirements. The questionnaire was basically structured in nature, and all the questions employed a five-point interval scale. The questionnaire was reviewed by several academics. Later, the suitability of the questionnaire was examined through a pilot test among selected organisations. Based on their suggestions, several alterations were incorporated.

The revised questionnaires were distributed to 100 organisations which were selected randomly from two published sources: Directory of Malay Chamber of Commerce and Directory of Chinese Chamber of Commerce. The selected organisations were telephoned prior to mailing the questionnaire in order to identify the

appropriate individual to whom the questionnaire should be sent, and to gain a commitment to return the questionnaire, and therefore ensuring a high response rate. The final questionnaires, with cover letters assuring the respondent's confidentiality, were sent to the chief executives of IT departments of the selected organisations. Follow-up telephone calls and personal visits were made to further boost response rates.

The reliability of the questionnaire was tested using Cronbach's Alpha [27]. The alpha coefficient of the overall interpersonal skill variables was 0.7398. This alpha coefficient was found to be higher than 0.6, indicating that the questionnaire could be considered adequate for exploratory studies [27].

## 6.0 RESULTS

Results obtained from the survey are presented in three sub-sections. Section 6.1 reports organisational demographics, section 6.2 presents the expectations of participating organisations about the requirements for interpersonal skills from fresh programmers, while section 6.3 presents the results of discriminant analysis to test the research hypotheses. SPSS 6.1.3 for Windows, a well-known statistical software package was used to perform statistical analysis.

### 6.1 Organisational Demographics

Out of 100 organisations, 38 responses were received. Thus, the response rate was 38%, which is less than anticipated. However, such a response rate could still be viewed as satisfactory taking into consideration the exploratory nature of this study. Survey data indicate that small organisations dominated (39%) the sample. This is followed by medium (34%) and large (27%) organisations. With regards to type of organisations, the public sector dominated the sample (66%) and the remaining 34% constituted the private sector. One plausible explanation is that this study was undertaken

from a public academic institution, and as such more public sector organisations might have felt a moral obligation to respond. This argument is in line with the observations of Scott [31] and Brunner and Carroll [32] who reported a higher response rate when their studies were supported by government bodies, and public universities. Another reason for low response rate from the private sector could be attributed to their excessive work load at the time of survey, even though they initially agreed to participate.

Business profiles of the participating organisations vary widely. Administrative services from the public sector dominated the business profiles (37%). This is followed by organisations in the following categories: finance (22%), IT services (8%), education (8%), transportation (5%), petroleum (5%), telecommunication (2.5%), trading (2.5%), food processing (2.5%), management services (2.5%), and others (5%).

### 6.2 Interpersonal Skill Requirements

The mean rating and rank obtained by each IP skill was computed and is shown in Table 1. It can be observed that each interpersonal skill is rated as 'very necessary' as their mean scores are all over 3.0.

Most of the interpersonal skills attain a higher rating scale regardless of the size of organisations. Fig. 1 represents the responses to the question whose aim which was to determine the interpersonal skills needed by programmers based on size of the organisation. Large organisations tend to give more focus to listening while the smaller organisations concentrate more on the ability to train users.

Fig. 2 represents the responses to the question which was aimed to determine the interpersonal skills needed by programmers based on type of the organisation. Most of private organisation mean ratings are considerably higher than the public organisations

Table 1: Rank and means of interpersonal skill

| Skills                                 | Mean Rating*<br>(N= 38) | Rank |
|--|-------------------------|------|
| Work effectively as a member of a team | 3.68                    | 1    |
| Listens to others                      | 3.32                    | 2    |
| Manage own roles and responsibilities  | 3.24                    | 3    |
| Work alone to accomplish some goals    | 3.18                    | 4    |
| Communicate in writing                 | 3.11                    | 5    |
| Train others                           | 3.08                    | 6    |
| Give effective oral presentation       | 3.03                    | 7    |

\*Note: Skill was measured on a scale of 0 to 4, where 4 means absolutely necessary and 0 means of no use

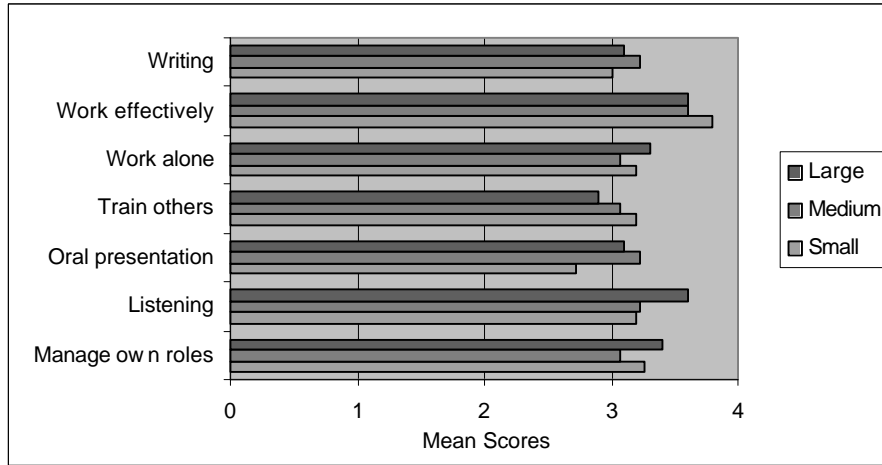


Fig. 1: Interpersonal skills base on size of organisations

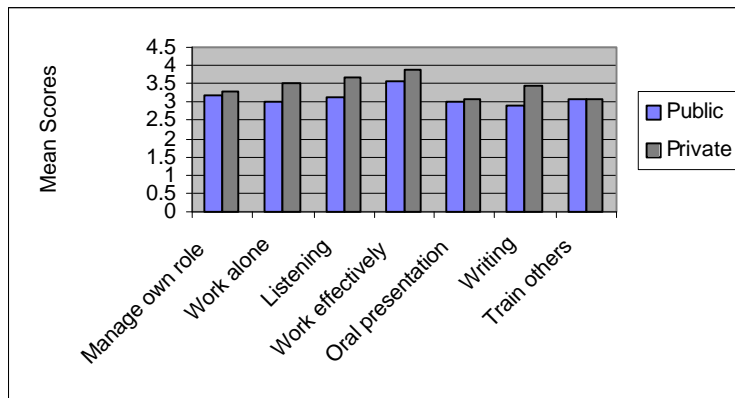


Fig. 2: Interpersonal skills base on type of organisation

### 6.3 Hypotheses Testing

In order to test the hypotheses, a very common common technique known as multivariate discriminant analysis [33] was used with the help of SPSS. This technique allows one to study the differences between two or more groups of objects with respect to several variables. The dependent variables (organisation size and organisation type) as used in this study are categorical, whereas the interpersonal skills variables are on an interval scale in nature. An examination of the difference across groups is the basic function to be used [34]. To assess the impact of organisation size on the requirement of interpersonal skill, two functions multiple discriminant analysis was used. It is because the dependent variable (organisation size) was divided into three broad categories (small, medium, and large). The results of the discriminant analysis are shown in Table 2. There are several ways to interpret the results as shown in Table 2. The close analysis of the  $r^2$  obtained from canonical correlation of both the function are 0.53 and 0.21 respectively. This

shows that a weak relationship exists among the independent variables. The Eigen value is close to 0. This shows a superior function. Similarly, the Wilk's Lamda is close to 1 which shows that the group means do not seem to be different. Lastly, the p-values (which are greater than 0.5) further support that there exists no difference in the requirement of interpersonal skills among small, medium and large organisations. It is also evident that the independent variables, IP1 to IP7 (shown in the lower part of Table 2), show no significant p-value. Thus, the null hypothesis ( $H1_a$ ) was found to be true.

With regard to the organisation type, two groups discriminant analysis with one function was used. The result is given in Table 3. The degree of significance  $p < 0.204$ , Wilk's Lamda (0.74) the value is close to 1 and correlation  $r^2 = 0.25$ , indicate a weak relationship. All these lead to the conclusion that the means of all independent variables between the public and private organisations are the same. This further indicates that the null hypothesis ( $H2_a$ ) is true.

**7.0 DISCUSSION**

This study has been successful in highlighting the importance of interpersonal skills expected from fresh computer programmers. This study has also yielded several interesting findings that warrant further elaboration. Firstly, the ability of a programmer to work successfully in a team or group received highest rating. This is not surprising because traditionally, programmers are less enthusiastic to be part of end-users activities. This often leads to communication gap among peers, end-users and other developers. In order to overcome these problems, organisations want programmers to work effectively as a member of a team. When they work in groups they should possess the ability to listen to their team members arguments and suggestions. This listening

ability is not only concentrating in a team but it is also applicable individually.

Secondly, although programmers do develop application program in a team, they should be able to manage their own roles and responsibilities. A programmer needs to work alone to accomplish some goals. A programmer should be able to complete his/her part of the program, and later on link his/her parts with those of others. Thirdly, programmers should be able to communicate with their peers, subordinates and bosses in writing. They should be able to address any shortcomings or problems effectively. Expressing these opinions and suggestions in writing must be acquired either through training or experiences.

Table 2: Interpersonal skills in small, medium and large organisations

| Group Centroids | Means |        |       | Wilk's Lambda | Chi Sq. | Df | P-value | Canonical correlation | Eigen value |
|-----------------|-------|--------|-------|---------------|---------|----|---------|-----------------------|-------------|
|                 | Small | Medium | Large |               |         |    |         |                       |             |
| Function 1      | -0.74 | 0.39   | 0.60  | 0.68          | 12.24   | 14 | 0.58    | 0.53                  | 0.39        |
| Function 2      | 0.036 | -0.26  | 0.28  | 0.95          | 1.56    | 6  | 0.95    | 0.21                  | 0.05        |

| Independent Variables | Group Means |        |       | F    | P    |
|-----------------------|-------------|--------|-------|------|------|
|                       | Small       | Medium | Large |      |      |
| IP1                   | 3.26        | 3.07   | 3.40  | 0.48 | 0.62 |
| IP2                   | 3.20        | 3.07   | 3.30  | 0.16 | 0.85 |
| IP3                   | 3.20        | 3.23   | 3.60  | 0.62 | 0.54 |
| IP4                   | 3.80        | 3.61   | 3.60  | 0.42 | 0.65 |
| IP5                   | 2.73        | 3.23   | 3.20  | 1.79 | 0.18 |
| IP6                   | 3.00        | 3.23   | 3.10  | 0.27 | 0.75 |
| IP7                   | 3.20        | 3.08   | 2.90  | 0.29 | 0.74 |

**Note :**

IP1 : Manage own roles and responsibilities  
 IP3 : Listen to other  
 IP5 : Give effective oral presentation  
 IP7 : Train others

IP2 : Work alone to accomplish some goals  
 IP4 : Work effectively as a member of a team  
 IP6 : Communicate in writing

Table 3: Interpersonal skills in public and private organisations

| Group Centroids | Means  |         | Wilk's Lambda | Chi Sq. | Df | P-value | Canonical correlation | Eigen value |
|-----------------|--------|---------|---------------|---------|----|---------|-----------------------|-------------|
|                 | Public | Private |               |         |    |         |                       |             |
|                 | 0.414  | 0.797   | 0.741         | 9.73    | 7  | 0.204   | 0.508                 | 0.349       |

| Independent Variables | Group Means |         | F     | P     |
|-----------------------|-------------|---------|-------|-------|
|                       | Public      | Private |       |       |
| IP1                   | 3.20        | 3.31    | 0.156 | 0.694 |
| IP2                   | 3.00        | 3.51    | 3.05  | 0.089 |
| IP3                   | 3.12        | 3.69    | 3.43  | 0.072 |
| IP4                   | 3.56        | 3.92    | 3.10  | 0.086 |
| IP5                   | 3.00        | 3.08    | 0.079 | 0.779 |
| IP6                   | 2.92        | 3.46    | 4.285 | 0.450 |
| IP7                   | 3.08        | 3.08    | 0.001 | 0.993 |

Fourthly, the majority of organisations rated 'training others' and 'giving effective oral presentation' as the least needed skills. This finding is not unexpected because training is often conducted by the system analysts and they require effective oral communication. They need to communicate with end users and programmers. Programmers on the other hand often communicate among themselves and peers.

Finally, based on statistical analysis, it seems obvious that the interpersonal skills which are required by the programmers to develop successful IT applications do not vary much based on size and type of organisations. Even though programmers may have adequate technical knowledge, but the lack of interpersonal skills may hamper the progress of the software development project by alienating end-users from the project. End-users may feel that they have been isolated from this involvement.

## 8.0 CONCLUSION

This study departs from much of the previous research in a way that organisational impact on the requirements of programmers' interpersonal skill (which was never considered before) was investigated. The major findings as discussed earlier carry implications to the academics who should improve their course contents based on the results of the study. In this context, it is strongly suggested that educational institutions in Brunei Darussalam introduce and encourage team-based project work or discussion, based on related case studies so that students can develop the temperament to respond to group work environment. Working in a group requires students to develop patience, and to be able to adjust themselves with other individuals. These aspects cannot be learnt in an individual project.

Thus, academics are urged to generate awareness among computing students that in addition to technical knowledge, students would require adequate interpersonal skills to work effectively in their work places. The success of students would not merely depend on their technical skills alone, they would also require adequate interpersonal skills. Students should also be made aware that such interpersonal skills would be equally needed regardless of the type and size of their future work places.

The results of this study are important to personnel managers of employing organisations as well. In order to ensure that employing organisations really recruit programmers with adequate interpersonal skills, they are advised to generate awareness of the immense significance of interpersonal skills among computing students. This can be achieved in close collaboration with educational institutions. For instance, educational institutions in Brunei Darussalam arrange annual 'Career

Dialogue', an event where prospective employing organisations introduce their organisations and brief students about the job opportunities in their organisations. During such briefings, personnel managers should emphasise their requirements for programmers interpersonal skills. This will motivate students to work hard to develop such interpersonal skills. In addition, prospective employing organisations are encouraged to highlight the requirement of interpersonal skills besides mentioning technical skills and qualifications in their job advertisements. This will further convince students on the need of interpersonal skills. In this connection, it is suggested that academics collect sample of job advertisements for programmers from prominent newspapers. These advertisements should be discussed with the students. Organisations should also provide academics the requirements for interpersonal skills in advance so as to tune the curriculum with the latest development. Organisations are encouraged to invite computing students to visit their working places. A short introduction regarding the interpersonal skills requirements for fresh computer programmers should be held. This will introduce the students at an early stage, on what they can expect later on.

This study has two limitations. Firstly, due to small sample size it may not possible to generalise the findings. As such, the results should be interpreted with caution. Future studies should therefore focus on larger sample size to support the results of this study. Secondly, this study obtained information from the employer's perspective, and did not examine the views of programmers. As such, further studies are recommended to investigate the views of both employers (IT managers/personnel managers) as well as individual employees (programmers) in order to determine whether those interpersonal skills as demanded by employers are really used by the employees (that is programmers).

This study did not investigate the impact of social and cultural factors on the interpersonal skills of fresh computer programmers. Future studies should include these two factors to highlight the cross-cultural comparisons.

## REFERENCES

- [1] C. Brooke, "Analyst and Programmer Stereotypes: a Self-Fulfilling Prophecy?", *Journal of Information Technology*, Vol. 10, 1995, pp. 15-25.
- [2] L. Long, and N. Long, *Introduction to Computers and Information Systems*, Prentice Hall (Englewood Cliffs, New Jersey), 1997.
- [3] D. S Hussain and K. M. Hussain, *Information Systems for Business*, Prentice Hall (UK), 1995.

- [4] J. Child, "Information Technology, Organisation and the Response to Strategic Challenges", *California Management Review*, Vol. 30, No. 1, 1987, pp. 33-50.
- [5] M. Hammer, "Reengineering Work: Do Not Automate, Obliterate", *Harvard Business Review*, July-August, 1990, pp. 104-112.
- [6] S. Kay, "Firms Turn to Business Analysts", *Computerworld*, Vol. 23, No. 4, 1989, p. 6.
- [7] R. R. Nelson, "Educational Needs As Perceived By IS and End-User Personnel: A Survey of Knowledge and Skill Requirements", *MIS Quarterly*, Vol. 15, No. 4, 1991, pp. 502-525.
- [8] J. Yaffe, "MIS Education: A 20<sup>th</sup> Century Disaster", *Journal of Systems Management*, Vol. 40, No. 4, 1989, pp. 10-13.
- [9] R. W. Jensen and C. C. Tonies, *Software Engineering*, Prentice Hall (Englewood Cliffs, New Jersey, USA), 1979.
- [10] J. J. Anderson, "Developing An In-House Systems Training Program", *Data Management*, July, 1969, pp. 26-31.
- [11] T. C. White, "The 70s: People", *Datamation*, July 15, 1970, pp. 40-46.
- [12] M. L. Roark, "Information Systems Education: What Industry Thinks?", *Data Management*, June, 1976, pp. 24-28.
- [13] M. Albin and R. W. Otto, "The CIS Curriculum: What Employers Want From CIS and General Business Majors", *Journal of Computer Information Systems*, January, 1987, pp. 15-19.
- [14] P. H. Cheney and N. R. Lyons, "Information Systems Skill Requirements: A Survey", *MIS Quarterly*, March, 1980, pp. 35-43.
- [15] H. J. Watson, D. Young, S. Miranda, B. Robicahux, and R. Seerley, "Requisite Skills For New MIS Hires", *Data Base*, Spring, 1990, pp. 20-29.
- [16] A. T. Todd, J. D. Mckeen, and R. B. Gallupe, "The Evolution of IS Job Skills: A Content Analysis of IS Job Advertisements from 1970 to 1990", *MIS Quarterly*, March, 1995, pp. 1-27.
- [17] P. H. Cheney, D. P. Hale, and G. M. Kasper., "Knowledge, Skills and Abilities of Information Systems Professionals: Past, Present and Future", *Information & Management*, Vol. 19, 1990, pp. 237-247.
- [18] C. J. Eng, L. S. Chee, T. C. Huat and T. H. Phuong., *Management of Business*, 6<sup>th</sup> Edition, McGraw-Hill Book Co. (Singapore), 1994.
- [19] D. Law and N. Gorla, "Exploring Factors Underlying Effective Office Information Systems", *Information and Management*, Vol. 31, 1996, pp. 25-35.
- [20] T. Grover and A. H. Segars, "The Relationship Between Organizational Characteristics and Information System Structure: An International Survey", *International Journal of Information Management*, Vol. 16, No. 1, 1996, pp. 9-25.
- [21] J. R. Kimberly, "Organizational Size and the Structuralist Perspective: A Review, Critique and Proposal", *Administrative Science Quarterly*, Vol. 21, December, 1976, pp. 571-597.
- [22] J. H. Jackson, C. P. Morgan and J. G. P. Paolillo, *Organisation Theory: A Macro Perspective for Management*, 3<sup>rd</sup> Edition, Prentice-Hall (Englewood Cliffs, New Jersey, USA), 1986.
- [23] D. S. Mileti, D. F. Gillespie and D. S. Eitzen, "The Multidimensionality of Organisation Size", *Sociology and Social Research*, Vol. 65, 1981, pp. 400-414.
- [24] B. J. Hodge and W. P. Anthony, *Organisation Theory: A Strategic Approach*, 4<sup>th</sup> Edition, Prentice-Hall (Massachussetts, USA), 1991.
- [25] J. D. Ford and J. W. Slocum, "Size, Technology, Environment and Structure of Organisations", *Academy of Management Review*, Vol. 2, No. 4, October, 1977, pp. 561-575.
- [26] G. Pervan and Phua, "A Survey of the State of Executive Information Systems in Large Australian Organisations", *The Australian Computer Journal*, Vol. 29, No. 2, May, 1997, pp. 64-73.
- [27] J. C. Nunally, *Psychometric Theory*, McGraw-Hill Book Co. (New York), 1978.



- [28] E. F. Kast and J. E. Rosenzweig, *Organization and Management: A Systems and Contingency Approach*, 4<sup>th</sup> Edition, McGraw-Hill Book Company (New York), 1985.
- [29] R. Kreitner, *Management*, 3<sup>rd</sup> Edition, Houghton Mifflin Company (Boston, USA), 1986.
- [30] V. Gabriel, *Management*, 2<sup>nd</sup> Edition, Longman Singapore Publishers (Pte) Ltd (Singapore), 1989.
- [31] C. Scott, "Research on Mail Surveys", *Journal of the Royal Statistical Society*, Vol. 124, No. 2, 1961, pp. 143-191.
- [32] A. G. Brunner and S. J. Carroll, "The Effect of Prior Notification on the Refusal Rate in Fixed Address Surveys", *Journal of Advertising Research*, Vol. 9, March, 1969, pp. 42-44.
- [33] W. R. Klecka, *Discriminant Analysis*, Sage University Paper Series on Quantitative Applications in the Social Sciences, Series No. 07-019, 1980, p. 7.
- [34] P. E. Green, *Analyzing Multivariate Data*, Dryden (Hinsdale, IL, USA), 1978.

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