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## Generic Attributed of IS Graduates An Australian Academic View

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### Abstract

*This paper reports on a follow-up study that validates a group of generic attributes of graduates of Australian undergraduate degree programs with majors in Information Systems (IS). A three round Delphi questionnaire was used. Major findings include the high ratings of generic interpersonal attributes involving teamwork, problem definition, analysis of various solution, oral and written communication, listening are rated as essential team participation and the commitment to further learning and intellectual development. Oral and written communications are significantly rated as more important than a comprehensive knowledge of IS. There has been a shift in the top ranking attributes with information retrieval and defining problems in a systematic way being ranked above the previous studies top ranking attributes of teamwork and the commitment to further learning and intellectual development. This study has a very strong overall correlation with previous Australian and Queensland studies.*

### Keywords

IS Education and Research (I), IS Curriculum (IA01), IS Research (IB01), IS Skill Requirements (EH0208), IS Professional Societies (IC)

### Introduction

This paper reports on a follow-up study by (Snoke & Underwood 1998a, 1999, 2006b, 2006a) that validates a group of generic attributes of graduates of Australian tertiary Information Systems (IS) programs of study. The 1998 Snoke and Underwood study identified a group of 29 attributes of graduates that were ranked by both industry and academics as important to graduates in their first year of employment after completing a degree in Information Systems. The major findings of the 1998 study included the essential ranking of the attributes *Participate in continued learning and intellectual development, Work as part of a team, Retrieve and use relevant information, Oral communications skills, and Define problems in a systematic way*. Anecdotal data and a study by Turner (Turner & Lowry 1999) suggest that tertiary curricula do not meet the needs of industry. Educators and trainers of future IS professionals must be able to identify and validate the generic attributes desired by employers of IS graduates. The study is significant in that it is a unique study in Australia to empirically validate the attributes of the graduates from the courses taught with an IS major.

The sample population included 528 academics from Australian universities. The study rates a previously identified set of attributes (Snoke & Underwood 1998b) and then ranks them according to their mean rating.

The paper proceeds as follows. First the aims of the study are explained and the definition of key terms given. The research method is then described along with the results of the study. Conclusions are drawn and recommendations made from the study.

### Aim of the Study

This Australian study identifies and examines the generic attributes required of entry-level employees from IS programs of study. This is a follow-up study to identify any changes that have occurred in the last 10 years since the first study was conducted. This project will help provide a focus for IS curriculum development in the next decade.

The results of the study will be used to develop a technique for developing a more responsive tertiary curriculum that meets the needs of the Information Systems industry. Institutions will be able to map their IS curriculum offerings against those of the Australian Computer Society (ACS) Core Body of Knowledge (Underwood 1996) to identify strengths and weaknesses in their curricula. They will be able to offer a curriculum that is more responsive to the local employment market that their institution serves. This is

particularly important for regional institutions as they serve a much smaller employment area.

## Definitions

This paper uses the term *generic attributes* to describe a core set of abilities and characteristics of an individual (Sandberg 1994, 1997). It has many meanings, interpretations and synonyms such as generic skills, basic skills, qualities, knowledge and understanding and competencies (Bradley 1997; Crebert 1995; Doyle 1996; Moss & Liang 1990; Stasz et al. 1993).

The literature often refers to the concept of generic attributes as generic skills or competencies. Competencies may be defined as consisting of skills, attributes or abilities and understanding or knowledge. Understanding or knowledge is defined as the content or core body knowledge of a subject discipline that a person has acquired. Skills are the routine implementation of the acquired knowledge or attributes. Attributes or abilities are the personal qualities that are applied by an individual to a specific task under a situation. Figure one gives one interpretation of the relationship between some of the terms used to describe generic attributes.

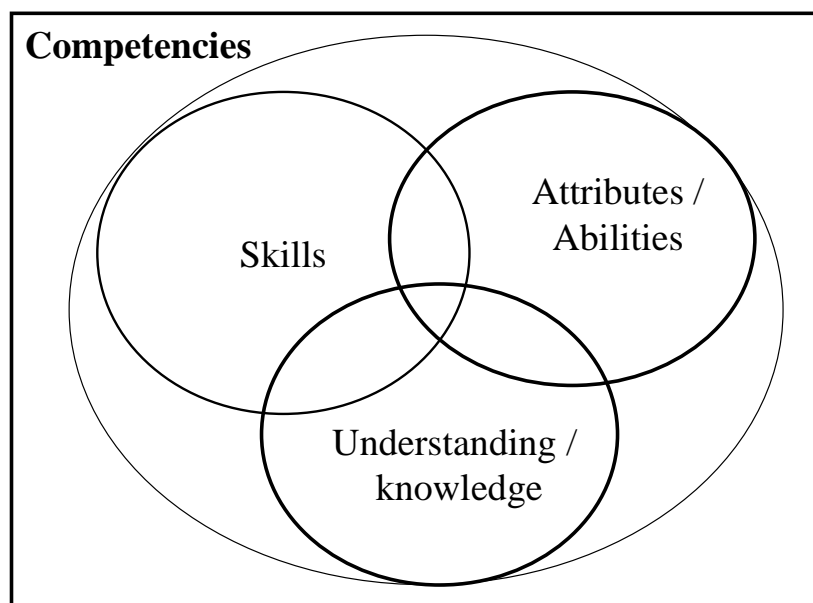


Figure 1: Components of Competencies

There exists much debate as to the meaning of the terms competency, competent and competencies. A person by definition is defined to possess competencies if they are competent at a specified task under a given set of conditions. The possession of a set of competencies does not necessarily imply that a person is competent at any task. Therefore the task of educators is to identify a minimalist set of qualities or competencies that will enable a graduate of an IS course to obtain employment. This paper treats generic attributes as competencies that a graduate possesses upon completion of a tertiary degree.

## Research Method

The Delphi technique for gaining consensus amongst a diverse group of individuals was used and asked respondents to rate rather than rank questionnaire items. Previous researchers (Ball & Harris 1982; Brancheau, J. & Wetherbe 1987; Brancheau, J.C., Janz & Wetherbe 1996; Dickson et al. 1984; Hartog & Herbert 1986; Morgado, Reinhard & Watson 1994; Niederman, Brancheau & Wetherbe 1991; Pervan 1993, 1996; Snoke 1996; Snoke & Underwood 1998a, 1998b; Watson, R. 1989; Watson, R.T. & Brancheau 1991) investigating the key issues in IS have used the Delphi technique to rank and rate the relative importance of the issues. The Delphi method was retained for its value in surfacing new issues and moving study participants toward consensus (Delbecq, Gustafson & Andrew H Van de Ven 1986).

A traditional Delphi study starts with an open-ended statement and asks participants to respond to the statement. The information is collated and statistics calculated. A second questionnaire is sent out which includes the revised statements and information obtained from the first round questionnaire asking respondents to revise their opinions about the original statement. The process is repeated until the respondents have reached consensus or

the facilitator identifies that they have acquired sufficient data for their purpose (Brancheau, J.C., Janz & Wetherbe 1996). In practice, however, the researcher frequently decides to end the process after two or three rounds, by which time firm trends have generally emerged.

A modified form of the Delphi technique as suggested by (Watson, R. 1989) was used. Watson (Watson, R. 1989) in his study of the key issues in information management modified the Delphi technique by having the respondents rate rather than rank the issues. Miller (Miller 1956) suggests that when the number of items to be ranked is large (greater than 10) that humans have difficulty in processing the information. Watson (Morgado, Reinhard & Watson 1994; Watson, R. 1989; Watson, R.T. & Brancheau 1991) also sent round two questionnaires to the non-respondents from round one of his studies. This has become the standard method of using the Delphi technique in all subsequent key issue studies and has been found to produce reliable results in the previous generic attribute surveys (Snoke & Underwood 1998a, 1998b, 1999) that formed part of this study. Participants, in this study, were asked to rate each of the generic competencies as distinct from ranking them. Space was provided at the end of the questionnaire for respondents to make any comments they desired or to add additional competencies that they thought should be included. 56 comments were received from participants and these will be reported in future publications.

The questionnaires were sent via email asking respondents to use the reply function on their email package to complete the questionnaire. This allowed for a short turn around time, as each round was completed within 10 days. This is a significant reduction in the time for a survey as compared with traditional paper based mail surveys that take weeks per round.

The list of competencies was taken from the previous study (Snoke and Underwood, 1998a). This list was expanded from the results of a pilot study and literature.

## Participants

Academic participants were selected from Australian universities. This was done by searching the universities' homepages. The search was conducted to include academics who taught IS but may be positioned within other organizational units with the institution. Some pages listed IS personnel who had since retired or left the particular institution. Most faculty homepages also identified the position of the individuals listed. An underlying feature of the adopted research methodology was the ability to use individually addressed questionnaires. Other surveys have reported a significantly lower response rate, in the order of only 5-10 percent, to non-personalised email.

## Round one

Each participant was sent a list of statements that were descriptions of the generic attributes or competencies of graduates from undergraduate degrees with a major in IS. They were asked to rate their importance in terms of the essential nature of the competency in the workplace for an entry-level graduate during their first year on the job. A seven point Likert type scale, in order of increasing importance, was used where 1 = extremely unimportant, 2 = unimportant, 3 = of little importance, 4 = neutral, 5 = very important, 6 = of major importance. 7 = extremely important (essential). Space was provided at the end of the survey instrument for additional attributes to be added or for other comments.).

The number of respondents per round is shown in Table 1.

Table 1: Respondent rates per round

	Total	
	Number	Percent
<b>Round 1</b>	122	23
<b>Round 2</b>	123	23
<b>Round 3</b>	123	23

The mean, median, mode and standard deviation for each attribute were calculated for each round of the study.

## Round two

Respondents to the first round were sent a second questionnaire that contained the mean response for each of the competencies as well as their individual responses to the first round questionnaire. Non respondents to the first round were sent a similar questionnaire with only the mean response for each of the competencies included as additional information. Again the mean, median, mode and standard deviation were calculated for each of the competencies. Competencies with a mean below four were to be excluded from round three of the study. There

were no competencies that were deleted from the third round. An interesting aspect of the participation of academics was the number of new participants in the second round of 35 which resulted in a participation rate of 23%.

### Round three

Round three questionnaires were sent to respondents of either round one or round two. Respondents to round two received questionnaires that contained the mean and their individual responses to each of the competencies. Non-respondents to round two or round one received questionnaires with the mean response of each competency in the previous round questionnaire. There were a significant number of respondents who did not change their opinion when given the additional information for the next round. This accounted for 50 percent of the responses to round three.

Reminder notices were sent to 12 percent of the participants in round three asking them to complete the questionnaire. If a modified Delphi technique had not been used the final round response rate would have been at best 12 percent.

### Results

The competencies are listed in overall rank order in Table 2 using the mean of the third round to rank them.

Table 2: IS generic competencies

Rank	Attribute	Mean	1998 Rank
1	Be able to retrieve, evaluate and use relevant information	6.46	3
2	Define problems in a systematic way	6.24	5
3	Analyze, synthesize and evaluate the various solutions	6.16	8
4	Work as part of a team in a productive and cooperative manner	6.15	1
5	Listening skills	6.13	NR
6	Written communication skills	6.09	6
7	Participate in continued learning and intellectual development and develop critical, reflective and creative thinking	6.08	2
8	Oral communication skills	6.06	4
9	Interpersonal skills	5.91	7
10	Consider the quality of the solution and its timeliness	5.91	11
11	Value the ethics of the Information Technology profession	5.91	13
12	Possess coherent, extensive, theoretical and practical knowledge of IS	5.88	10
13	Capacity to use new technologies with additional training	5.78	NR
14	Self motivation	5.77	9
15	Time management skills	5.76	17
16	Work independently	5.71	18
17	Be technologically competent (a person is able to use current technology competently)	5.69	12
18	Confidence about their ability to learn and work independently	5.67	15
19	Work with people of diverse ethnic and cultural backgrounds	5.63	NR
20	Adapt to unfamiliar situations and operate in a socially and culturally diverse environment	5.63	26
21	Embrace change and be engaged in incremental improvement to keep up with the rapid change in technology	5.59	14
22	Ability to reflect on own strengths and weaknesses	5.58	23

Rank	Attribute	Mean	1998 Rank
23	Possess theoretical and practical knowledge in at least one reference discipline which include behavioral science, computer science, decision theory, information theory, organizational theory, management theory, language theories, systems theory, social science, management science, Artificial Intelligence, economic theory, ergonomics, political science, psychology and accounting.	5.48	16
24	Maintain an awareness of information technology trends	5.48	NR
25	Knowledge of how a business operates or is structured or is orientated	5.45	22
26	Sensitivity to differences in gender, ethnicity, culture and customs	5.43	21
27	Participate in on-going professional development	5.42	19
28	Work with people at all corporate levels	5.39	NR
29	Skilled in Internet technologies	5.35	NR
30	Project Management Skills	5.33	27
31	Possess a sense of basic curiosity about technology	5.21	24
32	Possess the theoretical and practical knowledge of related disciplines. For example, business, law, education, data communications, computer science or leisure recreation	5.12	25
33	Research skills	5.07	28
34	Demonstrate practical skills and understanding in at least one computer language	5.04	20
35	Capacity to use new technologies without additional training	4.95	NR
36	Identify information systems that will provide competitive advantages	4.83	NR
37	Customer service orientation and skills	4.73	NR
38	Understand the profit motive of business	4.71	29

From the mean values listed in Table 2 it can be seen that the top 34 attributes are rated as being at least very important (mean rating of 5.00 or greater) with the top eight being rated as being of major importance with a mean rating of 6.00 or greater. A significant finding is that knowledge and skills in IS are rated twelfth below many of the more general attributes such as oral communications skills (ranked 8<sup>th</sup>), written communications skills (ranked 6<sup>th</sup>) and listening skills (ranked 5<sup>th</sup>). These results are generally consistent with the results obtained in the previous Australian and Queensland studies (Snoke & Underwood 1998a, 1998b) and Turner's (Turner & Lowry 1999) study of third year students and employer groups in Victoria, Australia.

An interesting finding is the change in the order of the essential attributes compared to the 1998 study. The most important of these is the inclusion of the attribute *Analyze, synthesize and evaluate the various solutions*. This attribute has moved from a ranking of 8<sup>th</sup> in the 1998 study to 3<sup>rd</sup> in the current study. The attributes of *working as part of team and participation in continued learning and intellectual development* have dropped their rankings compared to the 1998 study. In today's society it is not surprising to see that listening, written and oral communications skills are rated highly. The information age skills of *retrieving and using information* and *defining problems in a systematic way* have increased their rankings from the 1998 study and are rated at number one (1998 ranking 3<sup>rd</sup>) and two (1998 ranking 5<sup>th</sup>) respectively. This is change from the previous studies which had the people skills more highly ranked than these information age skills.

The bottom ranking attributes of *capacity to use new technologies without additional training*, *identifying IS that will provide competitive advantage*, *customer service orientation* and *understanding the profit motive of business* is very surprising given anecdotal evidence that suggests that these specific attributes are most sought in IS graduates with industry sources constantly rating an understanding of the profit motive of business and being able to use new technologies as essential qualities of entry level employees.

A surprising result is the low ranking of Demonstrated practical skills and understanding in at least one computer language. The attribute had a ranking of 20 out of 29 in the 1998 study and is ranked 34<sup>th</sup> in the current study. One possible explanation for this may be a move within the Information Systems curriculum to more of an emphasis on the management of the system rather than practical programming skills.

A possible explanation of the difference in rankings between the *technical* and *human* attributes may be found in the controversial motivational theory of Herzberg (Herzberg 1968). Herzberg developed a theory of motivation related to work situations that proposed two groups of factors, which related to job satisfaction. One group comprising environmental factors (hygiene) do not, by themselves, motivate satisfaction, but their

absence will cause dissatisfaction. The other group are determinants of job satisfaction which are believed to result in improved performance and are termed "motivators". Thus, the technical skills/knowledge attributes will be expected to have been gained through the academic process, that is the "hygiene factors" in terms of Herzberg's motivation theory, while the more highly rated attributes represent "motivators" because they are determinants of job satisfaction which are assumed to lead to superior performance.

## Overall Conclusions from the Study

The study showed that the more generic interpersonal attributes involving teamwork, problem definition, analysis of various solution, oral and written communication, listening are rated as essential. It is important to note that eight of the attributes were rated as essential qualities for first year employees. An important finding is that while all of the attributes are considered to be important to first year employees some are simply considered to be more important.

There has been a shift in the top ranking attributes away from teamwork and continued intellectual development to information retrieval and defining problems in a systematic way. This may suggest that the information age usage attributes are more important than the teamwork attributes as identified in the previous study.

The high ranking of oral communications and team participation suggests that more group work and oral presentations should form part of the IS curriculum as this is a required skill in industry.

An interesting outcome has been the large drop in the ranking of demonstrated practical skills and understanding in at least one computer language.

## Further Research

Further analysis will be conducted to attempt to identify the relationship of the attribute rankings to the type of institution whether they be a regional or capital city institution. A state by state analysis will be conducted to identify any trends that may appear. Analysis will be conducted of the comments submitted by participants to provide a richer understanding of the issues relating to the development of these attributes in our students. This further study will be followed by an international comparative study of the importance of the identified competencies.

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