

## **AN AUSTRALIAN IT INDUSTRY VIEW OF GENERIC ATTRIBUTES FOR IS GRADUATES**

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### **ABSTRACT**

*This paper describes the industry view of the final phase of a study that validates a group of generic attributes of graduates of Australian undergraduate degree programs with majors in Information Systems (IS). The study sponsored by the Australian Computer Society (ACS) used a three round Delphi questionnaire and involved 53 ACS members. The results of this study are compared with a previous study of generic attributes conducted by the authors in Queensland, Australia. Differences between academics and industry are identified. Major findings include the high ranking of the individual competencies of being willing to participate in continued learning and self-motivation being rated in the top three. Oral and written communications are significantly rated as more important than a comprehensive knowledge of IS. The interpersonal attributes of working as part of a team, interpersonal skills were not ranked highly This study has a very strong overall correlation with the previous Queensland study.*

### **1. INTRODUCTION**

This paper reports on the industry views of the final phase of a study (Snok and Underwood, 1998a; Snok and Underwood, 1998b; Snok and Underwood, 1999) that validates a group of generic attributes of graduates of Australian tertiary Information Systems (IS) programs of study. Anecdotal evidence from industry interviews and a study by Turner and Lowry (Turner and Lowry, 1999) suggests that tertiary curriculum does not meet the needs of industry. Educators and trainers of future IS professionals should be able to identify and validate the competencies of graduates, both required and desired by employers. The study is significant in that it samples a wide cross section of the Information Systems industry in Australia and empirically validates the attributes of the graduates from the courses taught with an IS major. The sample population represented the national IS industry which employs the graduates of IS courses. The population sampled consisted of 95 industry representatives, 48 of which participated.

A three round Delphi study was used in which respondents were asked to rate rather than rank questionnaire items. The study used, as its initial question set, a previously identified set of attributes (Snok and Underwood, 1998b). Respondents were asked to rate them according to their importance in the workplace.

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 from the results of the study and recommendations made for the conduct of further research.

## 2. AIM OF THE STUDY

This study identifies and examines the views of the Australian IS industry in relation to the required generic attributes of entry-level employees from IS programs of study. This study will provide a guide for IS curriculum development in the next millennium.

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 curriculum. 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 typically serve a much smaller employment area often with specifically needed application expertise.

## 3. DEFINITIONS

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

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 or capabilities. Attributes or abilities are the personal qualities that are applied by an individual to a specific task under a given situation.

To the authors' knowledge this study is unique, however there have been numerous studies conducted in other countries that identify the skill shortage of the IS profession. There exists much discussion 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 on a specific date. The possession of a set of competencies does not necessarily imply that a person is competent at any task. Therefore a 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 equates generic competencies to generic attributes that a graduate possesses upon completion of their degree.

## 4. RESEARCH METHOD

The Delphi technique for gaining consensus amongst a diverse group of individuals was used. Previous researchers (Ball and Harris, 1982; Dickson et al., 1984; Hartog and Herbert, 1986; Brancheau and Wetherbe, 1987; Watson, 1989; Niederman et al., 1991; Watson and Brancheau, 1991; Pervan, 1993; Morgado et al., 1994; Brancheau et al., 1996; Pervan, 1996; Snoke, 1996) 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 et al., 1986). The Delphi technique has been modified in recent years with the addition of focus groups, interviews and the use of different rating methods as a means of validating the results obtained in the study (Morgado et al., 1994).

A traditional Delphi study commences with an open-ended statement and asks participants to respond to the statement. The information is collated and a variety of statistics calculated. A second questionnaire is then sent out which includes revised statement(s) based on information obtained from the first round questionnaire asking respondents to revise their opinions about this revised statement. This often takes the form of asking respondents to rank the revised statements in priority order. The process is repeated until the

respondents have reached consensus or the facilitators identify that they have acquired sufficient data for their purpose (Brancheau et al., 1996). In practice, however, the researcher may decide to end the process after two or three rounds, by which time firm trends will have generally emerged.

A modified form of the Delphi technique as suggested by (Watson, 1989) was used. Watson (Watson, 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. This was done so that the respondents could focus their attention on the absolute importance of the questions rather than the comparative importance of the questions. Miller (Miller, 1956) suggests that when the number of items to be ranked is large (greater than 10) humans have difficulty in processing the information. Watson (Watson, 1989; Watson and Brancheau, 1991; Morgado et al., 1994) 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 with significantly higher participation rates. Participants, in this study, were asked to rate, using a Likert scale from one to seven, each of the generic competencies as distinct from ranking them. This allowed them to concentrate on each individual attribute and to identify their importance to the entry-level employee. 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 in future rounds of the study.

The questionnaires were sent using 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 working days. This is a significant reduction in the time for a survey as compared with traditional paper-based mail surveys that take a minimum of several weeks per round (Delbecq et al., 1986). The total length for the completion of the survey was eight weeks.

The original list of competencies was developed from a list prepared by a working party at QUT (Crebert, 1995) and from a previous study of generic attributes of IS graduates in Queensland (Snoko and Underwood, 1998a, Snoko and Underwood, 1998b).

## **5. PARTICIPANTS**

The Australian Computer Society (ACS) sponsored this study in 1998 and participants who are Information Technology (IT) professionals selected from the ACS membership list as well as selected national industry representatives. The list of participants from the ACS (approximately 1000) was restricted to those who had email addresses and did not have an "edu" extension in their email address in order to exclude academics from this phase of the study. Access to the ACS list was through the ACS secretariat that forwarded an invitation to participate in the study to its members. This invitation to participate was issued only once. The lack of direct access to the list prevented the sending of reminder notices for successive rounds of the study. The invitation to participate was addressed to ACS members generally rather than to individual members. This was done to maintain the confidentiality of the ACS membership mailing list. A facet of the research methodology involving non-ACS members was that the questionnaires were individually addressed. This was done in an effort to increase the participation rate.

### **5.1 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 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 one. As can be seen from the table there was a slight decrease in the number of participants per round. This is in contrast to the previous generic attribute (Snoke and Underwood, 1998a; Snoke and Underwood, 1998b) studies, which saw a slight increase in the participation rate per round. The final round participation rate of 51% is at the top end of the accepted range for participation in survey studies (Wallace, 1988).

|                | Number | Percent |
|----------------|--------|---------|
| <b>Round 1</b> | 51     | 54      |
| <b>Round 2</b> | 47     | 49      |
| <b>Round 3</b> | 48     | 51      |

**Table 1:** Respondent rates per round

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

### 5.2 Round Two

Respondents to the first round were sent a second round questionnaire that contained the mean response for each of the competency statements from the first round as well as the respondents' individual responses to the first round questionnaire. Non-respondents to the first round, for whom email addresses were available, were sent a second round questionnaire with only the mean response for each of the competency statements included as additional information. Again the mean, median, mode and standard deviation were calculated for each of the competencies received from second round participants.

### 5.3 Round Three

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. Round three questionnaires were sent to respondents of either round one or round two. Respondents to round two or round one received questionnaires that contained the mean from round two and their individual rating to each of the competencies. A small decrease in the response rate of 2% gave an overall response rate of 51%. A significant number of respondents (31%) did not change their opinion between round two and round three.

Reminder notices were only sent to 5 percent of the participants in round three asking them to complete the questionnaire. This was done to increase the participation rate and to improve the validity of the results. If a modified Delphi technique had not been used the final round response rate would have been at best 46%. This is still a very good participation rate.

## 6. RESULTS

The data was analysed using the Statistical Package for the Social Sciences (SPSS). The participation distribution by size and type is shown in table two. There is little general agreement on what constitutes a particular size of a business. Most definitions are local or industry specific definitions depending on the type of industry. The definition used in this paper for the size of the business entity is from the Australian Bureau of Statistics (ABS) (Australian Bureau of Statistics, 1993), which defines a small business as one that employs less than 20 people. The ABS also defines a medium size business as one that employs less than 50 and a large business as one that employs more than 50.

|                | Small | Medium | Large |
|----------------|-------|--------|-------|
| Government     | 1     | 0      | 14    |
| Non-Government | 7     | 3      | 26    |
| Totals         | 8     | 3      | 40    |

**Table 2:** Participation by Size and Type

The participation by ACS industry groupings (Australian Computer Society, 1998) is shown in table three. It should be noted that most industry classifications are represented. Five respondents identified with more than one classification and are therefore counted twice. This may give a slight bias when comparing results across classification groups. As may be expected the largest number of participants was from the Information Technology Service classification.

| Classification                  | Number | Percentage |
|---------------------------------|--------|------------|
| Accounting                      | 5      | 9%         |
| Agriculture                     | 1      | 2%         |
| Communications                  | 3      | 5%         |
| Construction                    | 0      | 0%         |
| Education                       | 6      | 11%        |
| Financial Banking & Investment  | 4      | 7%         |
| Health                          | 0      | 0%         |
| Information Technology Hardware | 4      | 7%         |
| Information Technology Software | 5      | 9%         |
| Information Technology Services | 10     | 18%        |
| Insurance                       | 1      | 2%         |
| Legal                           | 5      | 9%         |
| Manufacturing                   | 2      | 4%         |
| Public Administration           | 2      | 4%         |
| Recreation                      | 0      | 0%         |
| Resources                       | 1      | 2%         |
| Retail Trade                    | 0      | 0%         |
| Wholesale Trade                 | 0      | 0%         |
| Transportation                  | 4      | 7%         |
| Utilities                       | 0      | 0%         |
| Others (Consultants)            | 3      | 5%         |
|                                 | 112    |            |

**Table 3:** Participation by ACS Industry Classification

The competencies are listed in overall rank order in table four, using the mean of the third round to rank them. The ranking from a similar study of industry representatives in Queensland (Snoke and Underwood, 1998b) is included for comparison purposes. The Queensland study was conducted in 1998 and sought the opinions of 50 academics and 50 industry representatives on the importance of the same list of generic competencies.

| Rank | Attribute/ Competency   | Mean | Standard Deviation | Qld Industry Ranking |
|------|---|------|--------------------|----------------------|
| 1    | Self motivation   | 6.22 | 0.8239             | 4                    |
| 2    | Retrieve, evaluate and use relevant information   | 6.00 | 1.1929             | 1                    |
| 3    | Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking. | 5.99 | 0.9732             | 3                    |
| 4    | Confidence about their ability to learn independently   | 5.88 | 0.8955             | 7                    |
| 5    | Analyse, synthesise and evaluate the various solutions  | 5.88 | 0.9281             | 16                   |
| 6    | Consider the quality of the solution and its timeliness   | 5.85 | 1.1327             | 11                   |
| 7    | Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology                 | 5.84 | 0.91867            | 5                    |
| 8    | Work as part of a team in a productive and cooperative manner   | 5.83 | 1.3161             | 2                    |
| 9    | With respect to the IS discipline be technologically competent (the person is able to use the current technology competently)     | 5.78 | 1.0814             | 12                   |
| 10   | Value the ethics of the Information Technology profession   | 5.77 | 1.2846             | 17                   |
| 11   | Oral communication skills   | 5.75 | 0.9931             | 5                    |
| 12   | Define problems in a systematic way   | 5.75 | 0.9436             | 8                    |
| 13   | Interpersonal skills  | 5.71 | 1.0219             | 9                    |
| 14   | Work independently  | 5.63 | 1.0701             | 15                   |
| 15   | Written communication skills  | 5.53 | 1.4645             | 13                   |
| 16   | With respect to the IS discipline possess coherent, extensive, theoretical and practical knowledge                                | 5.48 | 1.1530             | 18                   |
| 17   | Ability to reflect on own strengths and weaknesses  | 5.48 | 0.9328             | 20                   |
| 18   | Participate in on-going professional development  | 5.47 | 1.1005             | 13                   |
| 19   | Possess a sense of basic curiosity about technology   | 5.43 | 0.8401             | 19                   |
| 20   | Time management skills  | 5.40 | 1.1822             | 9                    |
| 21   | Sensitivity to differences in gender, culture and customs   | 5.29 | 1.1920             | 22                   |
| 22   | Research skills   | 5.23 | 0.9880             | 25                   |
| 23   | Demonstrate practical knowledge and understanding in at least one computer language   | 5.22 | 1.5336             | 24                   |

| Rank | Attribute/ Competency  | Mean | Standard Deviation | Qld Industry Ranking |
|------|--|------|--------------------|----------------------|
| 24   | With respect to the IS discipline possess theoretical and practical knowledge in at least one reference discipline which include behavioural science, computer science, decision theory, information theory, organizational theory, management theory. | 5.15 | 1.0812             | 21                   |
| 25   | Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment  | 5.10 | 1.2206             | 26                   |
| 26   | Knowledge of how a business operates, is structured or is orientated   | 4.98 | 1.4762             | 27                   |
| 27   | Understand the profit motive of business   | 4.88 | 1.1773             | 28                   |
| 28   | With respect to the IS discipline possess the theoretical and practical knowledge of related disciplines. For example, business, law, education, data communications, computer science or leisure recreation   | 4.69 | 1.0485             | 28                   |
| 29   | Project Management Skills  | 4.58 | 1.2158             | 23                   |

**Table 4:** IS generic competencies

From the mean values listed in table four it can be seen that the top 25 competencies are rated as being at least very important (mean rating of 5.00 or greater) with only the first two being rated as being of major importance with a mean rating of 6.00 or greater. The important result is that the knowledge and skills in IS are rated sixteenth below many of the more general attributes such as oral communications skills (ranked 11th) and written communications skills (ranked 15th). These results are consistent with the results obtained in the previous Queensland studies (Snoke and Underwood, 1998a; Snoke and Underwood, 1998b) and the Turner (Turner and Lowry, 1999) study which identified acquiring new skills, working as part of a team and accepting direction as being important.

Eight attributes (5, 6, 19, 8, 11, 18, 20, 29) had a difference of ranking between the national study and the Queensland study of 5 or more. The attributes which showed a significant drop in ranking between the national study and the Queensland study were oral communications –6, working as part of a team in a cooperative manner –6, professional development –5, time management skills –11, and project management skills –6. Three attributes showed an improvement in their ranking. These included the attributes of *analyse, synthesize and evaluate various solutions, consider the quality of a solution and its timeliness, and value the ethics of the information technology profession*. This may suggest that on a national level quality principles have greater emphasis while the increase in the ethics attribute reflects an increased awareness by the IT industry world-wide for an emphasis on ethical behaviour. Another factor may be the differences in the sample population. The Queensland study industry sample population consisted of 25 representatives of large multi-national corporations with a head office in Brisbane and 25 from the ACS consultant list with telephone area codes from Queensland.

The three lowest ranking attributes of *research skills, project management and understanding the profit motive of business* are the attributes that are often considered to be the characteristics that distinguish between IS graduates and graduates from other Information Technology (IT) disciplines such as computer science. Knowledge of business and how it operates including understanding the profit motive in business is rated very low. A recent study by (ACNielsen Research Services, 2000) and anecdotal evidence suggests that the most important competency that is desired in an employee is an understanding of the profit motive of business and how the business operates.

The results of the national study are generally supported by the Queensland study. Of the top five attributes in the national study only the attribute of *analyse, synthesize and evaluate the various solutions* showed marked differences as compared with the Queensland study.

The data suggests there are significant differences between the public sector and the private sector views of the importance of generic attributes. Some of the significant findings are listed in Table Five. The full results will be published in a future paper.

| Overall Rank | Attributes  | Public Sector |      |                    | Private Sector |      |                    |
|--------------|---|---------------|------|--------------------|----------------|------|--------------------|
|              |   | Rank          | Mean | Standard Deviation | Rank           | Mean | Standard Deviation |
| 16           | Consider the quality of the solution and its timeliness   | 20            | 5.13 | 1.5976             | 4              | 6.05 | 0.7693             |
| 19           | Written communications skills   | 26            | 4.60 | 2.1974             | 14             | 5.72 | 0.9057             |
| 7            | Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology | 2             | 6.00 | 0.8452             | 13             | 5.78 | 0.9494             |
| 14           | Work independently  | 4             | 5.67 | 0.8165             | 15             | 5.68 | 1.1649             |

**Table 5:** Public Sector versus Private Sector Rankings

The large disparity between the public sector ranking of the *attributes work independently* and *embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology* may be a reflection of the difference in the mission of the enterprises and the work environments.

This same difference in work environments may also explain the significantly higher rating of *written communication skills* and *consider the quality of the solution and its timeliness* by the private sector that rely on the timely delivery of product for business income. It should also be noted that the large standard deviation for the public sector ranking of written communication skills points to the large disagreement on the importance of it. Care should be taken in drawing conclusion from this data due to the relatively small public sector sample.

## 7. OVERALL CONCLUSIONS FROM THE STUDY

The research findings reflect some intuitively surprising results which will need further investigation. The study showed that the more generic personal attributes are consistently more highly rated than the technical knowledge competencies (9,16,24). The ranking of oral communications above written communications skills suggests that more oral presentation should form part of the IS curriculum as this is a required skill in industry. This suggests that industry require an employee to be able to work from the first day on the job and to be able to productively interact with other employees.

Another possible explanation of the differences 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.



In today's society it is surprising to see that written and oral communications skills are not rated more highly. The interpersonal attributes of working as part of a team, interpersonal skills were not ranked highly. Individual competencies of being willing to participate in continued learning and self-motivation are rated in the top three. This may indicate that employers value the employee's individual abilities more than their group abilities. This result is consistent with the results of a Sydney study by Turner (Turner and Lowry, 1999).

Overall the results of the study suggests that all of the competencies are required of graduates but that industry simply views some as more important and essential than others.

## **8. FURTHER RESEARCH**

A further focus group study will be conducted to examine the underlying competencies and the reasons for the relative importance of each. This study will then be further extended to investigate the amount of treatment that each attribute receives in undergraduate IS curricula. An expanded study involving students, academics and employers will be undertaken to identify any trends that may emerge over time. This further study will be followed by an international comparative study of the importance of the identified competencies.

## **REFERENCES**

- ACNielsen Research Services (2000). *Employer Satisfaction with Graduate Skills: Research Report*. Canberra, Department of Education, Training and Youth Affairs: 71.
- Australian Bureau of Statistics (1993). *Business Operations and Industry Performance Australia*. Belconnen.
- Australian Computer Society (1998). *Industry Classifications*.
- Ball, L. and R. Harris (1982). "SMIS Members: A Membership Analysis." *MIS Quarterly* 6(1): 19-38.
- Bradley, D. (1997). *The qualities of a University of South Australia graduate Information for External Members of University Committees*, Denise Bradley. 1998.
- Brancheau, J. and J. C. Wetherbe (1987). "Key Issues in Information Systems - 1986." *MIS Quarterly* 11(1): 23-46.
- Brancheau, J. C., B. D. Janz and J. C. Wetherbe (1996). *Key Issues in Information Systems Management: A Shift Toward Technology Infrastructure*. <http://www.colorado.edu/infs/jcb/key/us94wp.html>.
- Crebert, G. (1995). *Implementing Generic Attributes*. Brisbane.
- Delbecq, A. L., Andrew H Van de Ven and David H Gustafson (1986). *Group Techniques for Program Planning: a guide to nominal group and delphi processes*. Middleton, Wisconsin, Green Briar Press.
- Dickson, G. W., R. L. Leitheiser, J. C. Wetherbe and M. Nechis (1984). "Key Information Systems Issues for the 1980's." *MIS Quarterly* 8(3): 135-159.
- Doyle, K. (1996). *Framework for the Development of National Competencies for the IT Industry*.
- Hartog, C. and M. Herbert (1986). "1985 Opinion Survey of MIS Managers: Key Issues." *MIS Quarterly* 10(4): 351-362.
- Herzberg, F. (1968). "One More Time: How Do You Motivate Employees?" *Harvard Business Review*(January - February): 53-62.
- Miller, G. A. (1956). "The Magical Number Seven, Plus or Minus Two: Some Limits on our Capacity for Processing Information." *The Psychological Review* 63(2): 81-97.

- Morgado, E. M., N. Reinhard and R. T. Watson (1994). Extending the analysis of key issues in information technology management: 1-19.
- Moss, J., Jr. and T. Liang (1990).: Leadership, Leadership Development, and the National Center for Research in Vocational Education. Berkeley, National Center for Research in Vocational Education.
- Niederman, F., J. C. Brancheau and J. C. Wetherbe (1991). "Information Systems Management Issues for the 1990's." MIS Quarterly 15(4): 475-502.
- Pervan, G. (1996). Results from a Study of Key Issues in Australasian IS Management - 1996. 7th Australasian Conference on Information Systems, - 1996, Hobart, Tasmania, Department of Computer Science, University of Tasmania.
- Pervan, G. P. (1993). Results From A Study of Key Issues in Australian IS Management. 4th Australian Conference on Information Systems, Brisbane, Queensland Australia, Department of Commerce, The University of Queensland.
- Sandberg, J. (1994). Human Competence at Work. Goteborg, BAS.
- Sandberg, J. (1997). Competence, Lecture, QUT, 19 June, 1997.
- Snoke, R. (1996). A Technique for Mapping Tertiary Information Systems Education and Training onto Current and Predicted Industry Needs. Hobart, University of Tasmania.
- Snoke, R. and A. Underwood (1998a). Generic Attributes of IS Graduates - An Australian Study. European Conference on Information Systems, AIX, France.
- Snoke, R. and A. Underwood (1998b). Generic Attributes of IS Graduates - A Queensland Study. Australasian Conference on Information Systems, University of New South Wales, Sydney, New South Wales.
- Snoke, R. and A. Underwood (1999). Generic Attributes of IS Graduates - an Australian IS Academic Study. 10th Australasian Conference on Information Systems, Victoria University of Wellington.
- Stasz, C., D. McArthur, K. Ramsay and M. Lewis (1993). Teaching and Learning Generic Skills for the Workplace. Berkeley, National Center for Research in Vocational Education.
- Turner, R. and G. Lowry (1999). Educating Information Systems Professionals: Towards a Rapprochement Between New Graduates and Employers. 10th Australasian Conference on Information Systems, Victoria University of Wellington, School of Communications and Information Management, Victoria University of Wellington.
- Underwood, A. (1996). The ACS Core Body of Knowledge for Information Technology Professionals. Australian Information Systems Curriculum Working Conference, Melbourne, Department of Information Systems, Monash University.
- Wallace, R. S. O. M., C.J. (1988). "Nonresponse bias in mail accounting surveys: A pedagogical note." The British Accounting Review 20(2): 131-139.
- Watson, R. (1989). "Key Issues in Information Systems Management: An Australian Perspective 1988." Australian Computer Journal 21(3): 118-129.
- Watson, R. T. and J. C. Brancheau (1991). "Key issues in information systems management: An international perspective." Information & Management 20(3): 213-223.