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Information Technology Training in Organisations: A Replication

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Abstract

This paper replicates a study conducted in the USA to test the perceived need for IT training in organisations by non-IS employees, and the need for more general business knowledge by IS employees. The hypothesis tested was that these needs differed for the two categories of employees. This paper contrasts the results of the local survey with that conducted by R R Nelson. The findings have relevance for fuller utilisation of Information Technology in organisations.
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Computing Review Categories: *K.3.m, K.6.1, K.6.m*

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1 Introduction

Employee development is often the first to suffer budgetary cuts in recessionary times such as experienced in South Africa at present. Related to the training dilemma, it has also been stated that the computer-related knowledge or skill of general personnel is suspect, as is Information Systems (IS) personnel's knowledge of the business of the organisation. This is cause for concern regarding the adequate use of Information Technology (IT) in companies.

It is essential for employees to have sufficient skill in and understanding of the use of IT combined with knowledge of the goals of the organisation in order to use IT to the best advantage of the organisation. Owing to the fast-changing technological environment, it is difficult for both non-IS personnel and IS personnel to be able to assess and exploit new technological opportunities.

End-user computing i.e. the use of computers by non-IS personnel is a phenomenon which is widely found in organisations. The reasons for this proliferation are many, but one of the main goals is to reduce problems experienced with traditional IS i.a. the dreaded "application backlog". The success of end-user computing is strongly related to the users' IT knowledge. Cheney *et al* [3] state that the availability of end-user training is positively related to the success of the end-user computing function. The amount spent on training by companies is not large. Nelson and Cheney found in a study [7] that of the companies surveyed, the end-user training budget was less than 2% of the MIS budget.

Historically, IS personnel have been technically orientated, with less business and interpersonal skills than the typical employee profile. This has resulted perhaps in a lack of communication between the IS department and the other employees. On the other hand, it is accepted wisdom that the lack of user involvement in system design is linked closely to lack of success in system implementation. Users should be able to communicate effectively with IS personnel and thus play a constructive role in the design process.

The conclusion from the above is that it is necessary to bridge the communication gap between IS and non-IS employees.

How serious is the lack of IT knowledge? A survey conducted by Nelson [6] measured the perceived lack of knowledge/skills in organisations in the States in the two types of personnel (IS and non-IS). The hypothesis was that there was a difference in the deficiency levels between the two groups firstly in their general organisational knowledge/skills and secondly in their computer-related knowledge/skills.

Nelson's survey measured the gap between what personnel think they need to know to do their jobs properly and how good they judge their knowledge/skill to be. He called this the deficiency rate. The survey covered IT knowledge/skill, and also general organisational knowledge and skills.

It was thought instructive to replicate his research in South Africa, both to examine these differences, and also to examine whether there is an appreciable difference between the States and South Africa in terms of these abilities. Not only was it assumed that the results would be of interest to Human Resource and IS managers, but it was also thought that the differences and similarities between SA and the USA would be of interest.

2 End-users and IS Training – An Overview

Definition of end-users

We will adapt Rockart and Flannery's taxonomy [8] of end-users for the purpose of this research i.e. their grouping of users of computers into 6 categories:

1. Non-programming end-user i.e. users of output
2. Command level end-user i.e. users of models, simple data entry and use of packages
3. End-user programmer i.e. programming, model building, query construction

4. Functional support personnel
5. End-user support personnel
6. Data processing personnel such as programmers, analysts etc.

In terms of the Nelson study, the first three categories could be viewed as a set of non-IS employees, and the next three as a set of IS employees.

Problems with end-user computing

There are various assumptions to do with what is loosely called end-user and IS interaction and training in the literature:

1. That IS workers are technicians who do not understand the business they are in and traditionally have greater loyalty to their profession than to their organisation.

   Nelson & Cheney [7] state that "facilitation of organisational learning" was the third most important issue for IT managers. A Delphi study conducted by Couger [5] gave as the highest ranking human resource issue for IT executives the need for "acquiring a stronger business orientation".
2. That IS workers are not good at people skills such as communication.
3. That end-users lack skill in, or knowledge of, IT.
4. That end-user training is generally not effective and end-user computing is not as prevalent as assumed.

   Sein, Bostrom & Olfman [9] state the end-users require training in system development techniques, database modelling, security (e.g. backup and recovery, etc). They write that it is most crucial for end-users to learn to use end-user computing software tools.

   Benson [2] conducted a field study interviewing end-users in twenty locations. He found problems with end-user computing such as lack of documentation, security, time wastage, lack of coherent policies for end-user computing, and minimal support.
5. That most unsatisfactory systems are caused by a lack of communication between the two groups of employees.
6. Access to company data held on computers is an important priority for end-users and MIS managers.

   In SA IS managers ranked effective use of the data resource second in terms of IT issues facing them. [4]. Rockart and Flannery [8] stated that a major complaint of end-users was the inability either to locate where the data was stored in the corporation or to extract the data.

Educational needs

Rockart & Flannery [8] stated that there were various educational needs in relation to computers:

1. Education of IS personnel in the capabilities and uses of end-user computing.
2. In-depth training in end-user languages and capabilities for the more computer-literate end-users (categories 3 to 6 as described in the previous section).
3. Example-based (how-to) training for non-programming and command-level users. Education of line managers in the basics of end-user computing.
4. Education of top management in the formulation of end- user computing strategies.

Arnoudse & Ouellette [1] wrote that end users should be "taught more than specific product information: end-users need to learn such concepts as documentation, data security, and data integrity" as well as emerging technologies.

3 The Survey

Description of the survey

The survey as developed by Nelson [6], although it did not specifically address the assumptions set out in the earlier section "Problems with end-user computing" gave an important insight into these questions.

The present research was conducted by developing a questionnaire based on the one formulated by Nelson [6] in the USA to determine the education/training needs of employees in organisations in the context of Information Technology (IT) and Information Systems (IS). Amendments were made to the questionnaire to allow for local circumstances.

It was assumed that employees needed a blend of knowledge/skills to use IT/IS fully. These skills were grouped into 6 categories of which the first three concern general organisational knowledge and the next three concern computer or IS/IT knowledge.

The categories are:

1. *Organisational overview* which comprises knowledge of the objectives etc. of the organisation;
2. *Organisational skills* such as interpersonal behaviour and group dynamics;
3. *Departmental overview* consisting of knowledge of the purposes of the department and the linkage with other departments;
4. *IS/IT overview* knowledge such as knowledge of the potential use of technology, basic hardware and software knowledge and knowledge of applications;
5. *IT technical skills* such as model building, programming etc;
6. *IS product knowledge* including knowledge of the purpose, design, documentation and maintenance of IS software.

The questions asked were formulated to reflect aspects of the above 6 categories. Employees were asked to evaluate

- how important (in their own judgement) they perceived these aspects were for them to do their work properly and
- how good (in their judgement) their knowledge was in these areas.

Self-reporting is not an objective measure, but is an acceptable measure of the employees' perceptions. A deficiency rating was calculated from the difference between these two measures i.e. the perceived importance and perceived proficiency on a particular item. The greater the deficiency rating the greater the urgency for training or intervention on an item.

It was assumed that different levels of employees would see the need for knowledge differently in the six categories

described above. The completed questionnaires were thus summarised for the different levels of employees namely clerical, technical, supervisory management, middle management, and executive management. As per Nelson's study, a distinction was made between IS employees (reporting to the MIS manager/director/CIO) and non-IS employees, to test the hypothesis that there was a difference in the deficiency levels between the two groups.

The questionnaire was administered in 5 organisations in the Border area, of which 2 were public organisations and the other were manufacturing companies. The total number of questionnaires completed were 139 of which 30 were by IS personnel. This contrasts with Nelson's study of 8 organisations and 275 respondents, of which 150 were IS personnel. The industry and function breakdown of the participants in the study are shown in tables 1 and 2

What skills are important for employees

Table 3 and 4 give the perceived importance of knowledge/skill in the 6 categories per level of employee. The scale is from 1 to 5 where 5 indicates the maximum importance for the employees to have knowledge/skill in that category to do their work properly.

What is clearly shown in these tables is that departmental knowledge is rated by all the levels of employees as the most important knowledge, even by executive management. What is also interesting is that this holds for IS and non-IS workers. For non-IS workers, overall organisational knowledge was second most important whereas IS workers saw overall IT knowledge as second most important.

What training is required per group

Table 5 and 6 gives the deficiency rating of the categories for the different levels of employees. The range here is from 5 to −5, with 5 showing a maximum need for knowledge/skill in that area and 0 showing a perfect match between the importance of an item or category and the knowledge/skill of the employees. A negative value indicates that the employee is overqualified in that particular area. It is assumed that any rating over 1 shows a need for intervention. The far right column of the table give an American average rating obtained by Nelson.

The highest deficiency ratings were in all the computer related categories. *IT/IS overview* knowledge was the most important overall (i.e. the competitive use of computers, the policies of IS and how this fits into company policy). This was executive management's most significant deficiency. Senior management saw this as a particularly large deficiency: a rating of 2.39 which is the highest deficiency rating in the table. Middle management also saw this as their most important deficiency.

IT technical skills were second ranking in deficiency – a high 2 by senior management, 1.90 by the professional level, and most important for supervisory management and clerical workers.

Of general organisational categories, *Organisational skills* ranked highest in deficiency for most levels personnel. In the case of technical personnel, *Organisational overview* knowledge was the greatest deficiency.

IS employees had lower deficiency ratings than non-IS employees. The average category ratings did not exceed 1, although certain employee level/category ratings did. Supervisory management and clerical staff showed the greatest deficiencies.

IS workers' greatest deficiency was in organisational skills, thus corresponding to the accepted profile of IS workers as technicians. The fact that they see these skills as necessary and important is a positive sign. Unfortunately this concern is manifested mainly by the upper levels (the executive and middle management).

Items requiring attention

Only items scoring above 1 are shown in tables 7 and 8.

The item of greatest deficiency was data communications, which was a somewhat surprisingly technical item to earn such a ranking. The reason for this may be that the importance and prevalence of networks is becoming more obvious.

The next item was the use of IT for competitive advantage, and then thirdly programming. Next in ranking is the fit between the strategies of the IS department and those of the organisation; and then access to company data.

Table 7. Non-IS employees

Overall deficiency rate per item	Total
Data communications	1.36
IS/IT Competitive advantage	1.35
Programming	1.35
Fit between IS and organisation	1.34
Data access	1.25
IS policies and plans	1.24
IS/IT potential	1.21
Privacy and security	1.19
Use of software packages	1.16
Database development	1.14
Use of specific application system	1.14
Use of operating systems	1.08
Model application	1.06
Model building	1.04
Use of office automation products	0.97

The importance attached to programming is disturbing. Benson [2] remarked on the same phenomenon in the USA: "A surprising percentage wished for programming and analysis".

Table 8. IS employees

Overall deficiency rate per item	Total
Interpersonal communications	1.07
IS/IT Competitive advantage	1.07
IS evaluation & maintenance	0.97

For IS workers the two items of significance were interpersonal communications and the use of IT for competitive advantage.

Table 1. Distribution of respondents

Company	Type	IS personnel	Non-IS personnel	Total
A	Manufacturing	2	11	13
B	Manufacturing	15	32	47
C	Public organisation	7	0	7
D	Manufacturing	6	31	37
E	Transport	0	26	26
F	Other	0	9	9
	Total	30	109	139

Table 2. Profile of respondents

Variables	Groups	IS	Non-IS
Sex	Male	68%	61%
	Female	31%	29%
	Unspecified	1%	10%
Age (mean)		31	39
Years in organisation (mean)		5.9	10.9
Education	<Matric		5%
	Matric	33%	39%
	Matric + diplomas etc	27%	18%
	Technical	16%	10%
	Degree	13%	12%
	>Bachelor degree	7%	7%
	Other	4%	9%
Organisational level	Executive Management	3%	5%
	Senior Management		3%
	Professional	23%	4%
	Middle Management	20%	36%
	Supervisory	20%	2%
	Technical	23%	8%
	Clerical	3%	28%
	Other	8%	14%

Table 3. Non-IS employees

Importance – in order to do the job properly									
Level/Category	Exec mgmt	Senr mgmt	Prof	Mid mgmt	Suprv mgmt	Techn	Clercl	Other	Total
Organisational overview	4.8	4.92	4.56	4.6	4.63	4.64	4.19	4.58	4.39
Organisational skills	4.6	4.67	4.38	4.44	4.4	4.58	4.17	4.17	4.35
Departmental overview	4.93	4.67	4.92	4.78	4.92	4.67	4.76	4.39	4.75
IS/IT overview	3.97	4.44	4.42	4.11	4.22	3.67	3.54	4	3.91
IT technical skills	3.26	3.9	4.11	3.87	3.98	3.49	3.56	3.88	3.69
IS product knowledge	2.88	3.42	4.1	3.46	3.64	3.36	3.35	3.39	3.39
Total	4.07	4.34	4.41	4.21	4.3	4.07	3.93	4.07	4.08

Table 4. IS employees

Importance – in order to do the job properly							
Level/Category	Exec mgmt	Mid mgmt	Suprv mgmt	Prof	Techn	Clercl	Total
Organisational overview	4.75	4.38	4.21	2	3.89	4.75	4.06
Organisational skills	4.5	4.29	4.43	3.5	3.9	4	4.12
Departmental overview	5	4.94	4.81	4.67	4.36	4.67	4.63
IS/IT overview	5	4.81	4.76	4.67	4.29	4.5	4.55
IT technical skills	3	3.86	4.52	3.71	4.03	4.43	4.08
IS product knowledge	2.17	4.14	4.46	3.67	3.79	4.33	3.98
Total	4.07	4.4	4.53	3.7	4.04	4.45	4.24

Table 5. Non-IS employees

Deficiency differential by categories and employee levels										
Level/Category	Exec mgmt	Senr mgmt	Prof	Mid mgmt	Suprv mgmt	Techn	Clercl	Other	Total	USA
Organisational overview	0.1	0	0.75	0.7	0.92	1.47	0.95	1	.83	.49
Organisational skills	0.25	1	0.81	0.64	1.1	1.08	1.05	.21	.86	.32
Departmental overview	0.27	-0.1	0.5	0.25	0.33	0.37	.75	0.11	.40	.25
IS/IT overview	1.27	2.39	1.5	1.09	1.46	1.2	1.19	1.61	1.21	0.96
IT technical skills	0.63	2	1.71	0.97	1.56	1.17	1.37	.19	1.19	.74
IS product knowledge	0.53	1.83	1.56	0.68	1.47	1.24	0.97	1.08	.96	.63
Total	0.51	1.19	1.14	0.72	1.14	1.09	1.05	1.03	.91	.60

Table 6. IS employees

Deficiency differential by categories and employee levels								
Level/Category	Exec mgmt	Mid mgmt	Suprv mgmt	Prof	Techn	Clercl	Total	USA
Organisational overview	0	0.48	0.82	-0.8	0.94	0	.69	.79
Organisational skills	1	0.88	0.79	0	1	0.5	.87	.47
Departmental overview	0	0.17	0.67	0	0.92	1	.64	.30
IS/IT overview	0.17	0.49	0.79	0.67	1.05	0.67	.81	.85
IT technical skills	-0.6	0.08	1.24	0.57	0.73	2.29	.72	.54
IS product knowledge	-0.2	0.4	1.12	0.83	0.65	1	.70	.39
Total	0.07	0.42	0.9	0.22	0.88	0.91	.74	.56

Items requiring attention per group

Examining the deficiency rates for the items by level, the deficiencies are less bland and differences exist between the levels. Again only those rates above .99 are shown in tables 9 and 10.

Senior management have many ratings of 2 and over, as do professionals. There is a remarkably high deficiency rating of 3.33 for using IT for competitive advantage, and also a 3 rating for the use of office automation products. This is evidently an area of great concern at that level. Technical personnel perceive the greatest deficiencies in organisational skills and knowledge.

Interestingly the technical level workers have greater need for intervention in the overall IT area. Supervisory management have greater gaps in the IS skills and product area. IS professionals have deficiencies in the IT overview and IS product areas.

4 Survey Results and Remarks

Statistical comparisons with the American survey

Statistically the difference between the USA and the SA findings indicated at the 99% confidence levels that the means of the samples differed significantly for all the categories of skill/knowledge except for the category of overall organisational knowledge. The computer related items in particular showed a marked difference at the 99% level, indicating that employees felt their deficiencies in knowledge to be much greater than those of their counterparts in the USA.

4.2 Limitations

The levels of workers were not defined clearly enough in the questionnaire – the difference between professional and technical, or professional and management were not clear and some confusion arose. This was a great limitation in attempting to differentiate between the needs of the various levels.

Self-assessment should be replaced if possible by objective tests to determine actual rather than perceived educational needs.

The profiles of the respondents in the USA and SA are different and therefore the differences may be less marked – a fuller study would clarify this issue.

Future research

Linking training requirements to what training has occurred and the effectiveness of that training is an important area of research. Extending this research into trying to establish what user involvement exists in system design, what training has occurred and how effective this participation is would also be of value.

5 Overall Comments and Recommendations

For non-IS workers

Table 3 shows that overall departmental knowledge is perceived as the most important for individuals to have to do their work properly. This may be an indication of a possible problem area in that the strategic goals of the organisation are not seen as sufficiently important by the employees.

Table 6 shows that personnel see their greatest needs in IT related areas. The findings support the necessity of

Table 9. Non-IS employees

Overall deficiency rate per item								
Level/Category	Exec mgmt	Senr mgmt	Prof	Mid mgmt	Suprv mgmt	Techn	Clercl	Other
Organisational goals and objectives						1.56		1
Primary organisational functions					1	1.44		1
Critical success factors						1.56		1.17
Environmental constraints			1			1.33	1.26	
Interpersonal communications					1.08	1.33	1.19	1.33
Interpersonal behaviour								1
Group dynamics					1	1.11	1	1
Project management		2.67	1.5		1.42	1	1.03	1.5
Departmental objectives								
Departmental problems								
Links to other departments								
IS policies and plans	1.4	2.33	1.75	1.26	1.67		1.06	2
Fit between IS and organisation	1.6	1.67	2	1.26	1.58	1.44	1.32	1.67
Existing IS applications		2.67	1.25		1.5			1
IS/IT potential	1.2	2.67	1.5	1.08	1.42	1.13	1.29	1.17
IS/IT competitive advantage	1.4	3.33	1.5	1.18	1.5	1.38	1.39	1.5
Privacy and security	1.2	1.67	1		1.08	1.63	1.29	2.33
Programming		2.67	2	1.08	1.83	1.38	1.52	1.17
Use of software packages		2	1.75	1.03	1.42	1.63	1.1	1.17
Model building		1.67	1.5	1.03	1.33		1.06	
Model application		1.33	1.5		1.42	1	1.19	
Data access	1	2	1.75		1.67	1	1.55	1.17
Database development	1	2	1		1.83		1.45	1.5
Data communications		2.33	2.5		1.42	1.44	1.7	1.67
Use of specific application system		2	2	1.1	1.3		1.2	1
Use of office automation products		3	2		1	1		1.5
Use of operating systems		1.67	2.33		1.5	1.78	1.07	
Documentation preparation		2	1.25		1.5	1.33		1.67
Usage of documentation		1.33			1.67	1.44		1
IS evaluation & maintenance		1	1		1.83	1		

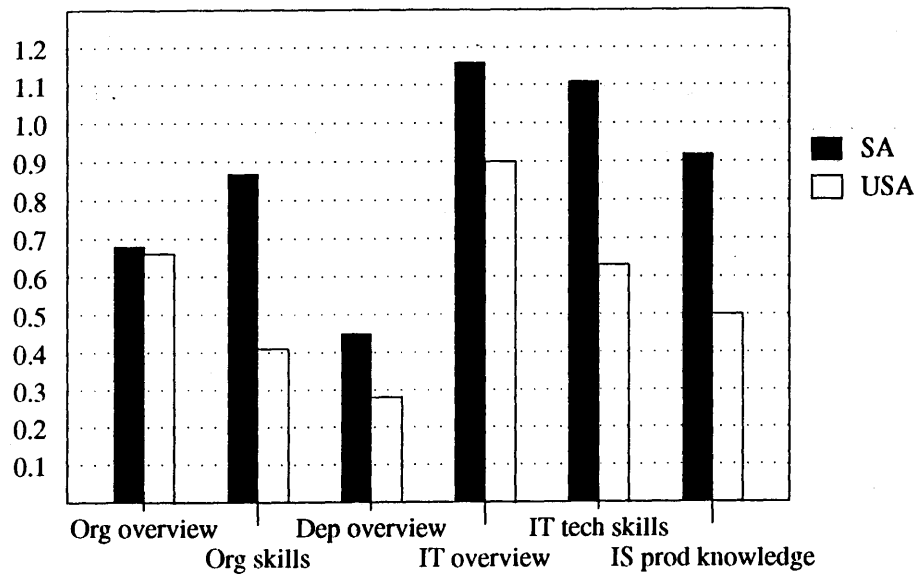

Figure 1. SA versus USA: Perceived deficiency differences

Table 10. IS employees

Overall deficiency rate per item						
Level/Category	Exec mgmt	Mid mgmt	Suprv mgmt	Prof	Techn	Clercl
Organisational goals and objectives			1			
Primary organisational functions						
Critical success factors	1				1.31	
Environmental constraints		1.17				1
Interpersonal communications	2				1.31	1
Interpersonal behaviour	1					
Group dynamics	1	1				
Project Management					1.15	1
Departmental objectives						1
Departmental problems					1.08	1
Links to other departments						1
IS policies and plans			1		1.17	1
Fit between IS and organisation				1	1.08	
Existing IS applications				1	1.15	1
IS/IT potential				1	1.15	
IS/IT Competitive advantage	1		1.29	2	1.08	1
Privacy and security						1
Programming			1.29			3
Use of software packages			1.29		1.15	3
Model building	1		1.67	1		2
Model application	1		1.57	1		2
Data access						3
Database development				1	1.17	2
Data communications			1.14	1	1.08	1
Use of specific application system					1	1
Use of office automation			1.57			
Use of operating systems			1.57	2		2
Documentation preparation			1.33	1		2
Usage of documentation				2		1
IS evaluation & maintenance		1.17	1	1		1

computer-related training particularly for senior management, professionals and supervisory management.

Professionals, supervisory management and clerical staff show the greatest need for IT skills training.

Executive management, senior management, and middle management see the greatest need for overall IT knowledge. Technical staff see the greatest need for IS product knowledge.

Senior management have disquietingly large perceived deficiencies in the computer-related categories. This may be related to the average age of senior management. Computer literacy may well be greater in younger employees. This finding is of importance to IS managers, since they need to 'sell' IT to senior management, and these are the managers who do not have the necessary knowledge to assess the importance of IT.

Worrying also is the perceived need for 'programming' at the higher levels – perhaps again pointing to a larger lack of IT knowledge than the respondents may be aware of.

IS workers

Table 4 shows that a departmental overview was on average seen as the most important knowledge. This is perhaps not healthy, again since the overall goals of the organisation are not being seen as a priority.

Their skills and knowledge needs were generally less than those of the non-IS workers. Surprisingly, their greatest need category (IS/IT overview) was also in the computer arena. However, organisational overview knowledge was perceived to be the next most important deficiency. This is a healthy perception and mitigates the departmental slant above.

Overall trends

The results from IS and non-IS workers differed significantly, as was also experienced in the American survey, pointing to different educational needs for the two groups of workers. Overall, South Africans have a significantly larger (at the 99% level – see Table 11) perceived deficiency rate particularly in organisational skills. This is cause for concern as we strive to maintain first-world standards.

Recommendations and conclusions

Some of the areas highlighted as requiring attention are easily remedied by management: data communications, data access, data security, use of software packages, model applications, and model building, and use of office automation can all be handled within the normal end-user training programs that presumably exist in most organisations. Also the need for more training in interpersonal skills can be outsourced fairly easily.

However, more of a problem exists in the other highly ranked items viz. IS competitive advantage; Fit between IS and organisational policies; Knowledge of IS policies and plans; IS/IT potential. The fit between the organisation's overall goals and IS/IT strategies is an area of concern for CIO's as highlighted in magazines and journals. Education in terms of training may not be the answer here. A partial solution could be closer communications between the IS executives and the rest of the organisation i.e. consultancy by the IS executives and also training tailored as closely to the job situation as possible.

References

1. D M Arnoudse and L P Ouellette. 'An introduction to the information centre concept'. *Information Strategy: The Executive's Journal*, p. 11, (1986).
2. D H Benson. 'A field study of end user computing: Findings and issues'. *MIS Quarterly*, pp. 41–42, (December 1983).
3. P H Cheney, R I Mann, and D L Amoroso. 'Organisational factors affecting the success of end-user computing'. *Journal of Management Information Systems*, **3**(1):75–76, (1986).
4. Computerweek, March 1992.
5. J D Couger. 'Key human resource issues in IS in the 1990's: View of IS executives versus human resource executives'. *Information & Management*, **14**(3):161–174, (1988).
6. R R Nelson. 'Educational needs as perceived by IS and end-user personnel: A survey of knowledge and skill requirements'. *MIS Quarterly*, (December 1991).
7. R R Nelson and P H Cheney. 'Training end users: An exploratory study'. *MIS Quarterly*, pp. 547–556, (December 1987).
8. J F Rockart and L S Flannery. 'The management of end user computing'. *Communications of the ACM*, **26**(10):783, (October 1983).
9. M K Sein, R P Bostrom, and L Olfman. 'Training end users to compute: cognitive, motivational and social issues'. *INFOR*, **25**(3):237, (1987).

Table 11. Z test

	SA			USA					
	count	avg	std dev	count	avg	std dev	z	5%	1%
Organisational goals and objectives	135	0.79	0.97	275	0.80	0.98	0.11		
Primary organisational functions	133	0.77	1.02	275	0.43	0.92	3.29	*	*
Critical success factors	136	0.79	1.00	275	0.64	1.10	1.36		
Environmental constraints	136	0.87	0.99	275	0.76	1.16	0.98		
Interpersonal communications	136	0.97	0.87	275	0.46	0.77	5.83	*	*
Interpersonal behaviour	137	0.72	1.04	275	0.51	0.97	2	*	
Group dynamics	137	0.84	0.84	275	0.22	0.85	7.03	*	*
Project Management	136	0.97	0.91	275	0.44	0.88	5.64	*	*
Departmental objectives	136	0.51	0.75	275	0.29	0.70	2.93	*	*
Departmental problems	137	0.42	0.83	275	0.26	0.73	1.95		
Links to other departments	137	0.43	0.76	275	0.30	0.90	1.54		
IS policies and plans	136	1.21	1.15	275	0.94	1.05	2.34	*	
Fit between IS and organisation	137	1.3	1.01	275	1.08	1.14	1.98	*	
Existing IS applications	136	0.93	1.11	275	0.83	1.12	0.89		
IS/IT potential	136	1.14	1.10	275	0.99	1.14	1.32		
IS/IT Competitive advantage	136	1.32	1.11	275	0.99	1.07	2.9	*	*
Privacy and security	136	1.07	1.20	275	0.58	1.00	4.14	*	*
Programming	136	1.21	1.28	275	0.43	1.08	6.14	*	*
Use of software packages	136	1.1	1.30	275	0.68	1.10	3.26	*	*
Model building	135	0.96	1.19	275	0.62	1.06	2.79	*	*
Model application	134	0.96	1.21	275	0.58	1.08	3.1	*	*
Data access	135	1.17	1.14	275	0.74	1.05	3.65	*	*
Database development	134	1.13	1.01	275	0.72	1.20	3.61	*	*
Data communications	135	1.27	1.30	275	0.66	1.19	4.58	*	*
Use of specific application system	114	1.05	1.21	275	0.46	1.17	4.45	*	*
Use of office automation products	134	0.93	1.31	275	0.51	1.26	3.04	*	*
Use of operating systems	133	1.05	1.27	275	0.60	1.03	3.55	*	*
Documentation preparation	135	0.79	1.41	275	0.43	1.18	2.57	*	
Usage of documentation	134	0.87	1.28	275	0.39	0.94	3.83	*	*
IS evaluation & maintenance	136	0.85	1.31	275	0.58	1.08	2.05	*	
Org Overview	135.4	0.69	0.239	275	0.66	0.78	0.5		
Org skills	136.5	0.88	0.103	275	0.41	0.66	11.4	*	*
Dep Overview	136.7	0.46	0.041	275	0.28	0.63	4.62	*	*
IT overview	136.2	1.16	0.134	275	0.90	0.73	5.81	*	*
IT technical skills	135.0	1.11	0.11	275	0.63	0.65	12	*	*
IS product knowledge	131.0	0.92	0.099	275	0.50	0.72	9.53	*	*

Notes for Contributors

The prime purpose of the journal is to publish original research papers in the fields of Computer Science and Information Systems, as well as shorter technical research papers. However, non-refereed review and exploratory articles of interest to the journal's readers will be considered for publication under sections marked as Communications or Viewpoints. While English is the preferred language of the journal, papers in Afrikaans will also be accepted. Typed manuscripts for review should be submitted in triplicate to the editor.

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Manuscripts for *review* should be prepared according to the following guidelines.

- Use wide margins and $1\frac{1}{2}$ or double spacing.
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  - title (as brief as possible);
  - author's initials and surname;
  - author's affiliation and address;
  - an abstract of less than 200 words;
  - an appropriate keyword list;
  - a list of relevant Computing Review Categories.
- Tables and figures should be numbered and titled. Figures should be submitted as original line drawings/printouts, and not photocopies.
- References should be listed at the end of the text in alphabetic order of the (first) author's surname, and should be cited in the text in square brackets [1–3]. References should take the form shown at the end of these notes.

Manuscripts accepted for publication should comply with the above guidelines (except for the spacing requirements), and may be provided in one of the following formats (listed in order of preference):

1. As (a) LaTeX file(s), either on a diskette, or via e-mail/ftp – a LaTeX style file is available from the production editor;
2. As an ASCII file accompanied by a hard-copy showing formatting intentions:
   - Tables and figures should be on separate sheets of paper, clearly numbered on the back and ready for cutting and pasting. Figure titles should appear in the text where the figures are to be placed.
   - Mathematical and other symbols may be either handwritten or typed. Greek letters and unusual symbols should be identified in the margin, if they are not clear in the text.

   Further instructions on how to reduce page charges can be obtained from the production editor.
3. In camera-ready format – a detailed page specification is available from the production editor;
4. In a typed form, suitable for scanning.

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Letters to the editor are welcomed. They should be signed, and should be limited to less than about 500 words.

Announcements and communications of interest to the readership will be considered for publication in a separate section of the journal. Communications may also reflect minor research contributions. However, such communications will not be refereed and will not be deemed as fully-fledged publications for state subsidy purposes.

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Contributions in this regard will be welcomed. Views and opinions expressed in such reviews should, however, be regarded as those of the reviewer alone.

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References

1. E Ashcroft and Z Manna. 'The translation of 'goto' programs to 'while' programs'. In *Proceedings of IFIP Congress 71*, pp. 250–255, Amsterdam, (1972). North-Holland.
2. C Bohm and G Jacopini. 'Flow diagrams, turing machines and languages with only two formation rules'. *Communications of the ACM*, **9**:366–371, (1966).
3. S Ginsburg. *Mathematical theory of context free languages*. McGraw Hill, New York, 1966.

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Contents

GUEST CONTRIBUTIONS

Ideologies of Information Systems and Technology
LD Introna 1

What is Information Systems?
TD Crossman 7

RESEARCH ARTICLES

Intelligent Production Scheduling: A Survey of Current Techniques and An Application in The Footwear Industry
V Ram 11

Effect of System and Team Size on 4GL Software Development Productivity
GR Finnie and GE Wittig 18

EDI in South Africa: An Assessment of the Costs and Benefits
G Harrington 26

Metadata and Security Management in a Persistent Store
S Berman 39

Markovian Analysis of DQDB MAC Protocol
F Bause, P Kritzinger and M Sczittnick 47

TECHNICAL NOTE

An evaluation of substring algorithms that determine similarity between surnames
GdeV de Kock and C du Plessis 58

COMMUNICATIONS AND REPORTS

Ensuring Successful IT Utilisation in Developing Countries
BR Gardner 63

Information Technology Training in Organisations: A Replication
R Roets 68

The Object-Oriented Paradigm: Uncertainties and Insecurities
SR Schach 77

A Survey of Information Authentication Techniques
WB Smuts 84

Parallel Execution Strategies for Conventional Logic Programs: A Review
PEN Lutu 91

The FRD Special Programme on Collaborative Software Research and Development: Draft Call for Proposals . . . 99

Book review 102