"Getting it write": the relationship between writing and computer skills

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The writing skills of undergraduate Information Technology (IT) students concern many educators (Utley, 1998, cited in Tench, 2001). This paper examines the relationship between students' business writing results and their technical computing papers results. Some unexpected findings are presented highlighting the need for the inclusion of a writing paper in an IT degree.

Keywords

Written skills, technical skills

1. INTRODUCTION

An overwhelming consensus in recent years regarding the importance of non-technical skills (also referred to as "soft skills" in information technology (IT) degree programmes) has been evident in the reviewed literature. Cappel (2002) in a survey of 27 employers in the United States found that employers rated non-technical skills higher than technical skills. This is consistent with other studies (Richards, Yellen, Kappelman & Guynes, 1998; Young, 1996; Van Slyke, Kittner & Chesney, 1998, cited in Weber, McIntyre, & Schmidt, 2001). Goodwin (2002) indicated that a common criticism of IT courses is that they concentrate on the technical side of IT and that students aren't receiving the appropriate balance of technical and non-technical skills to give graduates a head start in the work environment.

Numerous researchers have taken this further and have suggested that competent communication skills are a critical subset of the soft skills (Crockett, et al., 1993; Cusack, 1988; Fischer, 1994; Hildebrand, 1991; Pastore, 1993; Pitman, 1994; Ridgeway, 1987, cited in Becker, Insley, & Endres, 1997). Hughes (2001) describes employers wanting well-rounded candidates with excellent people skills, good oral and written communication skills and good work ethics. Research on the opinions of business executives and tertiary graduates reveal that the ability to communicate effectively in business is ranked at the top of the skills necessary for job success (Chandler, 1995; Harcourt, Krizan, & Merrier, 1995; Locker, 1995, cited in McPherson, 1998). This is reinforced by Bell (1994, cited in McPherson, 1998) who stated that the capacity to demonstrate excellent written and oral communication is vital in business. "Good communication is worth every minute it takes and every cent it costs" (McPherson, 1998, p.70) CEOs in a survey conducted by the International Association of Business Communicators stated that "communication yielded a 235% return on investment"(Allen, 1990, cited in McPherson, 1998, p.70).

Consequently, tertiary institutions must equip students with the communication skills employers demand if their programme is to succeed. Many IT degree programmes are integrating writing skills into course work to emphasise the mechanics and process of writing and to help students acquire the ability to communicate ideas effectively (Gersting & Young, 2001; Heil, 1999; Kaczmarczyk, 2003).

Anewalt (2003) supports that there are similarities between the software design process and the writing process and that if this analogy of similarities were presented to IT students maybe they would

feel more familiar with the writing process. Jackowitz, Plishka and Sidbury (1990), also propose that the organisational techniques used to write software are the same ones that should be used to write papers. If IT students were made aware of these similarities, they would be motivated to develop excellent writing skills. They argue that we should therefore be exploiting this similarity in skills to develop better writers.

The key questions raised by the current research project have arisen from the researcher's experience as a Business Communication Lecturer in an IT degree programme and her perception and that of her colleagues, that some IT students demonstrate a weakness in written language basics such as word selection and usage, sentence and paragraph construction and grammatical correctness. This is supported by Kaczmarczyk (2003) who conducted a study into IT students' perceptions of their writing and actual writing standards. Kaczmarczyk found that most students in the study had significant problems with grammar and related areas including paragraph construction and transitioning between ideas. This was contradicted by the students' perceptions of their own abilities.

If employers are seeking employees with competency in both technical and non-technical skills, are tertiary institutions sufficiently equipping IT graduates with these skills; are we getting it "write"?

2. RESEARCH QUESTION

Students' course marks were used to evaluate critically whether students who do well in written communication also do well in technical papers. The data generated from this study allowed the researcher to assess critically the trends amongst specific computer papers. For example, is there a stronger correlation between students' business writing results and their operating systems or programming results?

3. METHODOLOGY

Students' final results from their Written Communication paper (IT101) and other technical papers were collected. The IT101 paper included assessments in email, memo, letter writing, short report and an instructional document. The technical computing papers included programming, hardware, databases, mathematics, electronics and operating systems. These results are measured in marks out of a possible score of 100.

Research Participants

The subjects were undergraduate IT students at the Otago Polytechnic School of Information Technology and Electrotechnology, a New Zealand tertiary institution. The researcher used the results from all current first, second and third year Information Technology students. This gave a database of 188 students all of whom had completed the compulsory first year paper of IT101 and a selection of first and second year technical computing papers. Some students were excluded because they had withdrawn from IT101 or failed to complete the paper. 82.5% of subjects were male.

Data Collection

Course marks were collected from the sample students' educational transcripts. Where students had taken a course more than once, only the first attempts were considered. Sample size ranged from 172 (Databases DB103) to 9 (Hardware IT211).

4. RESULTS

Correlations

The results summarised in Table A revealed that there are clear correlations amongst the grades of specific computing papers and the grades achieved in IT101. The correlation coefficients for the marks on the first year papers are listed in Table A.

Marks in 9 of the 10 first year papers are positively correlated with IT101. Only EL102 Electronic is not. This could simply illustrate a tendency for good students to do well and poor students to do poorly in all course subjects. There is a large positive correlation between the performance of students in IT101 and in Databases DB103 (r_{170}=. 460; p<.001). There is also a large positive correlation between scores in IT101 and in Operating Systems OS103 (r_{146}=.432; p<.001). There are also strong correlations among the technical papers. The strongest correlations are between the two mathematics papers LC105 and CA105 (r_{125}=.628; p<.001), and the two first year programming papers PR104 and OO104 (r_{93}=.604; p<.001).

Among the second year papers, there is a strong correlation between IT101 and Databases DB 206 (r_{42}=.324; p<.032) and Operating Systems OS210

Table A. Correlation between students' results of First Year Papers

Correlations with year one papers											
	IT101	EL102	OS103	PD103	DB103	PR104	OO104	LC105	CA105	ST105	MW106
IT101											
EL102 Electronics	0.148										
OS103 Operating Systems	**0.431	0.184									
PD103 Program Development	**0.386	0.136	**0.484								
DB103 Databases 1	**0.460	0.097	**0.539	**0.550							
PR104 Applications Programming	*0.214	0.131	**0.423	**0.371	**0.453						
OO104 Object-Oriented Software	**0.270	*0.236	**0.311	**0.380	**0.418	**0.604					
LC105 Mathematics	**0.267	**0.553	**0.378	**0.387	**0.362	**0.372	**0.418				
CA105 Mathematics	*0.196	**0.409	**0.275	**0.353	**0.273	**0.350	**0.467	**0.628			
ST105 Statistics	**0.246	**0.522	**0.399	**0.359	**0.307	*0.258	**0.420	**0.588	**0.565		
MW106 Computer Processor Hardware	**0.324	**0.393	**0.457	**0.540	**0.556	**0.425	**0.356	**0.494	**0.382	**0.489	

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table B. Correlations of students' results with Year Two papers and IT101

Correlations with Year Two Papers								
	IT101	IT202	IT203	IT204	SE205	DB206	OS210	IT211
IT101								
IT202 Data Communication Networks	0.107							
IT203 Object-Oriented Programming	0.014	**0.531						
IT204 Computer Technology	0.148	**0.507	0.247					
SE205 Software Engineering	**0.390	**0.599	**0.442	0.386				
DB206 Databases II	**0.324	**0.751	**0.745	0.634	**0.602			
OS210 Operating Systems	**0.336	**0.491	*0.438	0.366	**0.671	**0.633		
IT211 Hardware	-0.213	*0.815	**0.991	0.387	**0.855	**1	0.763	

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

(r_{48}=.336; p<.017). The hardware papers showed no significant correlation with Written Communication IT101 (Computer Technology IT204 (r_{34}=.148; p<.405) and Hardware IT211 (r_9= -0.213; p<.582)). SE205 Software Engineering showed the strongest correlation with IT101 (r_{65}=.390; p<.001). Again the strongest correlations were between the technical papers as shown in Table B.

A correlation analysis was performed to assess the validity of the data. The mean of students' final marks in all their papers excluding Written Communication 101 was computed, and then correlated with Written Communication IT 101. This analysis showed a strong positive correlation between marks in IT101 and the mean technical mark (r=.49, p<.001) indicating general performance consistency across students. The correlations and the Factor Analysis (discussed below) showed that there was a greater tendency for the technical papers to be correlated with each other than with IT101 Written Communication. The expected strong positive correlation between the two mathematics papers LC105 and CA105 (r_{125}=.628; p<.001) reinforces the validity and reliability of the data.

Factor Analysis

A principal components analysis with Varimax rotation was performed on 11 first year papers to

identify common factors. Analysis of the total sample (n=188) yielded four factors. The first factor comprised the four mathematics papers (Electronics EL102, Mathematics LC105, Mathematics CA105, and Statistics ST105). The second factor involves 3 papers (Program Development PD103, Databases DB103, Computer Processor Hardware MW106) reflecting a combination of programming, databases and hardware. The third factor involves the two programming papers (Applications Programming PR104 and Object-Oriented Software OO104). The fourth factor comprises one paper (IT101 Written Communication) and to a limited extent Operating Systems OS103.

Multiple Regressions

A regression analysis was performed to identify which of the technical papers best predicted the results for IT101 Written Communication. The optimal model included Operating Systems OS103 as the sole predictor.

5. DISCUSSION

Factor Analysis

In the Factor Analysis, the first factor incorporating Electronics and the three mathematics papers can be seen as a reflection of mathematical skills. The Electronics paper uses mathematical processes underpinning IT concepts and skills.

The second factor incorporating Program Development PR103, Databases DB103 and Microware MW106 could be considered a reflection of the mechanical and spatial abilities, with elements of transferring ideas into written form. All three papers look at resolving an issue by providing an ordered set of instructions, as determined by a different environment. For example, Program Development PD103 uses an operating system and Microware uses hardware. It is a reasonable expectation that these papers would be aligned.

The third factor linking Applications Programming PR104, and Object Orientated Programming OO104 (both programming papers) include elements of logical problem solving. It had been expected that these two papers would move together.

What is interesting for this researcher is that the fourth factor, situated alone, is IT101. The writing course still accounts for large variability in the marks. This paper is independent of all other papers in the programme; no other paper completely duplicates the writing skill set.

Thus, IT101 provides an important emphasis on writing skills not offered in the technical papers. The value of writing to the business community has been ascertained; it consistently ranks communicating effectively top of the skills necessary for job success (Chandler, 1995; Harcourt, Krizan, & Merrier, 1995; Locker, 1995, cited in McPherson, 1998). It is therefore essential to have an independent encapsulated writing programme in the curriculum.

Correlations

The data collected provide some insight into students' performance in written communication and other technical papers. Perhaps the most surprising result of this study was the strong positive correlation between IT101 and Operating Systems OS103 and Databases DB103. Why should there be a strong correlation between these papers? One possible explanation is that there is content commonality with a strong verbal component in each of these papers. The lecturer for each of these papers, R. Smit (personal communication, May 11, 2004) suggested that Databases DB103 requires an understanding of language and contextual analysis. There also needs to be a high level of self-awareness in Databases DB103. The paper requires the students to have an understanding of themselves, their own biases and perceptions. Students are challenged to look at words from a different viewpoint, not from a relatively fixed way of thinking which is familiar and a form of self-imposed pre-conditioning. For example, when students were asked to build a system to track the location of different music media, the term 'friend' is synonymous with bedroom in that both terms can be a location where the particular music media can be located.

Operating Systems OS103 also contains a large component of English understanding and interpretation of written material including the ability to handle large documents. R. Smit (personal communication, May, 11, 2004) describes the various operating systems as massive applications and suggests that no single individual can know every aspect of each operating system. The operating systems also change on a regular basis therefore the documents are never static. Part of the skill of operating systems is making your way through the documenta-

tion and the version control. R. Smit suggested that when teaching operating systems "we are actually teaching systems analysis".

Other factors may have contributed to these two papers having a strong correlation with IT101. First, the strong positive correlation could be due to the style of assessment. In both OS103 and DB103, students must be able to articulate their answers on paper; therefore, students with poor writing skills would be more likely to have poor results. The lecturer remarked that international students find this paper difficult because of the language component. Second, it could be due to something more inherently semantic or verbal in the symbolic nature of how the material is taught. E.g. success in the assessment requires verbal interpretation. Third, it could be due to the fact that the same lecturer takes both Databases DB103 and Operating Systems OS103.

This pattern of correlation with IT101 was repeated in year two with Operating Systems OS210 and Databases DB206. However these correlations were weaker than those with the year one papers (Databases DB 206 r_{42}=.324; p<.032) (Operating Systems OS210 r_{48}=.336; p<.017).

The strongest correlation with Written Communication IT101 in year two was with Software Engineering SE205 (r_{65}=.390; p<.001). Again this paper has a strong writing component in its content. Students in this paper are required to understand and apply the use of development methods in information system development. There is an element of technical computing where students use a mixture of pseudo-coding, databases and software engineering process tools for charts and diagrams. A project management document is produced for an external client and also for end users and a high standard of documentation is expected. The method of assessments in Software Engineering SE205 may have contributed to the strong correlation. Assessments include an exam, an essay and a large project management document.

The current study found no evidence to suggest that the organisational techniques used to write software are the same ones being used to write papers as has been suggested by some authors (Anewalt, 2003; Jackowitz, Plishka, & Sidbury, 1990). This could be because students are not consciously aware of the similarities in the two processes as depicted by these authors and therefore are not exploiting them, or it could mean that the similarities do not exist.

This study is not without limitations and the findings from the present research should be treated with a degree of caution. First, it should be noted that with the exception of IT101 different lecturers have taught the papers at different times. What individual lecturers are looking for may differ when marking papers. The results must, therefore, be viewed as indicative only, rather than conclusive.

Second there are some validity concerns with the sampling. There are a small number of students in the sample who have English as their second language. It would be expected that these students would do better in the technical papers where a high element of written content is not required. Additionally, there is a strong skew towards males in this course, which may also influence the results (Hyers, 2001). The sampling units comprised 82.5% males and 17.5% females. This study has not looked at issues of gender and writing abilities.

Third, the priority IT students put on their writing should be considered. If it is a low priority then students may spend a limited amount of time preparing for the writing assessments and so their writing result may not be a true indication of their ability.

As is clear from the discussion, there are many opportunities for future research. One study could assess the impact of changing the measurement instrument used in this study. To continue study in this area, the researcher would separate out the assessments of skills. For example, when comparing students' writing skills with their programming skills a well-validated metric of writing ability and programming ability would be used.

It would also be useful to investigate students' perceptions of the importance of writing in future job success and see if the findings are similar to those found by overseas studies. In addition, greater investigation is needed of the perceptions of the IT lecturers towards the need to produce competent writers in the IT programme. It would be interesting to see how this correlates with their agreement to integrate writing into their paper's curriculum. Teaching strategies, and the environment in which they are presented, can encourage or inhibit the development of these factors (Graham, 1999).

6. CONCLUSION

Both professional and corporate institutions continue to emphasise the importance of communication skills in graduates. The written communication skills of undergraduate IT students concern many educators. This study shows that the inclusion of Written Communication IT101 in the course is essential to meet this requirement, given that the other technical papers in the degree do not subsume the skills of that paper.

The results of the statistical analysis did indicate strong correlations between IT101 and the first year papers of operating systems, databases, program development and microware, but as discussed these are not enormously predictive. There is no strong evidence that there is a strong relationship between the writing skills of an IT student and their technical skills.

This type of study would be an interesting one for any department to replicate. First, the correlations could be examined and papers that use written communication skills could be analysed. Second, it could be used as a check that papers that contain common content are receiving similar marks. Research that clarifies and extends this study will assist in developing an IT degree programme where all graduates can value and improve their writing skills. We can then be confident that we are getting it "write"!

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