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Building Student Skills and Capabilities in Information Technology and eBusiness: A Moving Target

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ABSTRACT

In discipline areas such as information technology and eBusiness, technology advances so rapidly that the issue of developing student skills and capabilities adequate to the demands of the industry becomes a moving target. Industry-related learning models such as cooperative education can help academic programmes meet the challenge of keeping the IT and eBusiness curricula up-to-date. This paper presents the results of an investigation into student and employer perceptions of the relevance of the professional academic content and outcomes of an undergraduate programme with specializations in IT and in eBusiness. The research models used in the study are derived from a general framework, based on a nomological net of constructs representing three major stakeholder groups: academia, students, and industry. The study found that while both employers and students placed an increased emphasis on technical skills, the need for better understanding of the processes of convergence and integration within the business was also evidenced. Areas in need of specialized curriculum development are identified, as well as a possible misconstruction of the eBusiness discipline as perceived by employers and students.

Keywords: Education, information technology, eBusiness, skills, capabilities, cooperative education, curriculum development

1. INTRODUCTION

The field of information technology (IT), information systems (IS) and eBusiness is known for constant change and rapid advancement. However there is a significant difference between the adoption of new technology by academia and the industry and the existence of an adoption gap has been recognized (Bamberger, 1986; Conner and De Jong, 1979; Moore and Streib, 1989). More recently, the phenomenon was investigated in (Chandra et al, 2000) and in (Davis, Siau and Dhenuvakonda, 2003). These authors believe that academia lacks the motivation of a "real-life" driving force and therefore tends not to respond automatically to current industry demands.

Another concern addressed in the literature is that undergraduate academic programmes are often too theoretical and out-of-date. As a result they do not produce graduates equipped with the skills and capabilities which industry values and requires (Bailey and Stefaniak, 1999; Roberts, 2000; Lee, 2002). However educators agree that it is vital to maintain a current IT/eBusiness curriculum informed by up-to-date developments in hardware and software technologies; knowledge of the current practice in terms of business models and applications would enable students to build the required competencies (Lee, Trauth and Farwell, 1995; Hunter, 1998; Berghell and Sallach, 2004).

The difficulties faced by curriculum developers are exacerbated by the trends towards the convergence of technologies that traditionally were grounded either in business (IS), or in software (computer science) (Shackleford et al, 2004). Attempting to bridge the resulting IT/business divide, a variety of "business cum technical courses" have been developed (Ramakrishnan and Ragothaman, 2001; Lei, Mariga and Pobanz, 2003). The inclusion of eBusiness/eCommerce in the IS/IT curriculum presents an additional complication: eBusiness is positioned within both the IS and IT areas but is also a knowledge area on its own. Main focal points are the virtual enterprise (Nayak, Bhaskaran and Das, 2001) and the integration between front-end electronic commerce capability and backend IT infrastructure (Zhu, 2004). Responding to the challenge of meeting the ever moving target of "being current" and "relevant", academic institutions are involved in an on-going curriculum

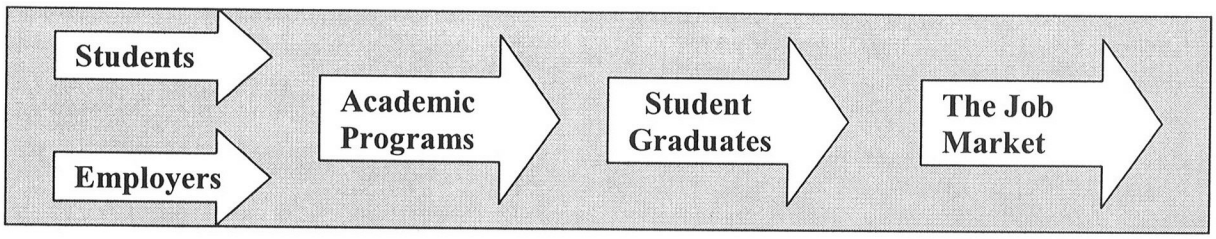


Figure 1. The Educational Value Chain (adapted from Oblinger and Kidwell, 2000)

development effort (Shakleford et al, 2004; Featherstone, Ellis and Borstorff, 2004).

It has been recognized that stakeholder input is important to curriculum development (Petrova and Sinclair, 2000; Fedorowicz and Gogan, 2001). While different forms of employer input into academic review processes have been considered (Lee, 2002), students have rarely been used in the role of stakeholders. However students can provide valuable feedback impacting on academic curriculum outcomes (Dressler and Keeling, 2004, pp. 221; Holt, MacKay and Smith, 2004). However student demands and expectations play a significant role as drivers of change in the educational value chain (Figure 1) as both industry expectations and student perceptions of industry expectations instigate demand for specific educational outcomes. Academic programmes would be successful in attracting candidates only if designed to meet industry requirements and to offer promising career paths.

A case illustrating the points made above is the Bachelor of Business degree offered by the Faculty of Business at the Auckland University of Technology (AUT) which comprises two separate IT/IS related specializations ("majors"): one in IT and another - in eBusiness. The programme includes a one-semester cooperative education course (hereafter referred to as "co-op"), which implements the so called "full immersion model" (Fincher et al, 2004, p. 116): each student completes a cooperative project undertaken in the workplace, under a contract negotiated between the student, the workplace and an academic supervisor. We felt that gathering relevant and timely data about the problems faced by students and employers in a cooperative education setting might help us ensure that curriculum learning outcomes meet the targets set by the workplace and address our major concern: do students majoring in IT and in eBusiness exit the walls of academia equipped with the appropriate skills and capabilities needed to meet employers' requirements and demands? Building on previous work (Couger, Davis, Dologite et al, 1995; Senapathi and Petrova, 2002; Claxton, 2003; Gutierrez and Boisvert, 2003), a two-staged survey of undergraduate students and employers in cooperative placements was undertaken in 2003/2004; it addressed the issue of integrating student and employer feedback and perceptions into the process of curricula design and development.
The article is organized as follows: the next section describes the structure of the undergraduate degree specializations and formulates the central problem of the study. The general research framework and the research questions are introduced next, followed by a description of the models and hypotheses used in each of the stages and a discussion of the results obtained. The last section focuses on the implications of the findings, identifies some of the limitations of the study, and suggests directions for future research and curriculum development.

2. BACKGROUND AND MOTIVATION

The subjects of the study were Bachelor of Business (BBus) students, specializing in IT and eBusiness. The academic curriculum provides these graduates with a broad understanding of business as well as with specialist knowledge, skills and professional capabilities. The objective of the IT major is to equip students with the ability "to solve business problems and add value to business through the application, implementation and management of IT in all its facets" (BBus, 2005, p. 13), including standards and protocols and their practical applications. The more recently introduced eBusiness major focuses on Internet based technology concepts, eBusiness models, legal and ethical issues, and "how to manage, market and make secure" eBusiness (BBus, 2005, p. 11).

Table 1 illustrates the structure of the two majors; each one comprises a core set of professional "papers" at two different academic levels – level 6 (year 2) and level 7 (year 3). Students majoring in IT or in eBusiness have to complete at least three papers at level 6 and three papers at level 7 from the relevant set. The table also shows the compulsory capstone "Cooperative Education" paper mentioned earlier. It is typically undertaken during the last semester of the course of study.

Although the two majors are well differentiated academically, some employers find it difficult to distinguish between their profiles. One reason could be the changing role of IT in organizations and the implementation of intranet and Internet solutions – a phenomenon based on the "complementarily of online offerings and off-line assets" (Zhu, 2004). Consequently students from either major may find that their co-op work assignment involves aspects of eBusiness or eBusiness infrastructure and of business information systems.

Typically IT students are given projects as novice business analysts including elicitation and interpreting client specifications for new or redeveloped systems. However,

IT Major		eBusiness Major	
Professional Paper Name	**Level**	**Professional Paper Name**	**Level**
eBusiness IT Infrastructure (eBITI)	6	eBusiness IT Infrastructure (eBITI)	6
Information Engineering (IE)	6	Electronic Transactions & Security (ETS)	6
Management of the IS Development Process (MISDP)	6	Project Management (PM)	6
		Economic Organisation (EO)	6
Strategic Data Management Architectures (SDMA)	7	eBusiness Management (eBM)	7
Human Computer Interaction (HCI)	7	Making the Web Work for Business (MWW4B)	7
Intelligent Business Systems (IBS)	7	eMarketing (eM)	7
		eBusiness Law in the Global Market (eLaw)	7
Cooperative Education (Co-op)	7	Cooperative Education (Co-op)	7

Table 1. Core Professional Papers – IT and eBusiness

occasionally we encounter situations where an employer assigns an IT student an eBusiness project (for example, developing a business Web site). It seems that there exists a significant fusion of the skills and capabilities required from graduates with IT or eBusiness specialization (Katz and Safranski, 2003).

We were interested to know whether such mismatches were the manifestation of a new phenomenon in need of investigation, and to understand how employers interpret the difference between IT and eBusiness as academic disciplines. Our main topic of enquiry was the relationships between the academic programmes, the skills and capabilities acquired by students graduating with one or both of the majors, and the requirements of the industry and the job market. The central problem that motivated the study can be formulated as:

Are we producing eBusiness and IT graduates with a mix of skills and capabilities that can satisfy the demands of the workplace?

Previous work in a similar direction includes two empirical studies (Fedorowicz and Gogan, 2001; Lee 2002), where the academic curricula in each of the respective authors' institutions are evaluated in the context of the job market (based on data collected from job advertisements). While both studies provide useful perspectives relevant to the two major stakeholder types - academia (curriculum developers), and industry (employers, managers) they do not include students as stakeholders.

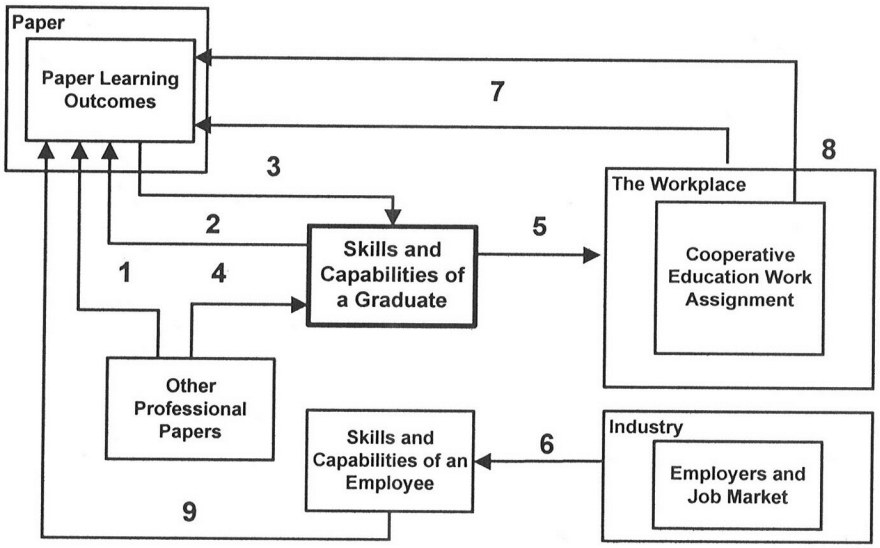
The general research framework developed for this study and described in the next section includes three stakeholder types. It was used to generate research questions and hypotheses involving the relationships between the stakeholders and served as a basis for the creation of data gathering research instruments.

3. RESEARCH PROCESS AND MODELS

The research methodology is based on grounded theory from an interpretive stance (Klein and Myers, 1999). We created a nomological net of constructs to develop and study the resulting relationships between the constructs and formulate hypotheses (Figure 2).

The study participants (students and employers) were chosen for their knowledge of and involvement in co-op. A general research framework was developed to include three stakeholder types: students, employers, and academia. It comprises six constructs and the general relationships between them. "Student" as a stakeholder is represented through the constructs "Skills and capabilities of a graduate" and "Skills and capabilities of an employee". The student possesses "skills and capabilities" that are acquired through studying papers, which achieve "Learning outcomes". Acquired student skills and capabilities are applied and tested through the "Work assignment". "Industry" is represented in two instances – as a general construct, and as the cooperative workplace ("Cooperative education work assignment"). Academia is represented through the constructs "Paper" ("Paper learning outcomes") and "Other professional papers".

The proposed framework is similar to the nomological net of IT/ IS constructs in (Benbasat and Zmud, 2003), a variation of which was implemented in (Claxton, 2003). It captures the processes involved in curriculum design and curriculum delivery with different relationships occurring between the constructs. It allows us to formulate the objectives of this study, based on the central problem: i) to investigate the relevance of academic programmes to workplace needs and requirements; ii) to identify true and perceived gaps in the academic programmes of the IT and eBusiness, and iii) to outline and justify implications for IT and eBusiness curriculum.



Legend for relationships:

1 Other Professional papers determine Paper Learning Outcomes
2 Student Skills and Capabilities determine Paper Learning Outcomes
3 Paper Learning Outcomes build Student Skills and Capabilities
4 Other Professional Papers build Student Skills and Capabilities
5 Student Skills and Capabilities are needed for Cooperative Education Work Assignment
6 Industry requires Student Skills and Capabilities
7 The Workplace may inform the Paper Learning Outcomes
8 Cooperative Education Work Assignments may validate Paper Learning Outcomes and identify gaps
9 Skills and Capabilities of an Employee required by an Employer convert to Paper Learning Outcomes

Figure 2. General Research Framework

To achieve the objectives, we investigated the answers to the following research questions:

Q1. ***Do IT and eBusiness students, through their professional studies, acquire the skills and capabilities needed in the workplace?***

Q2. ***What are the perceived gaps in students' knowledge?***

Q3. ***Do the skills and capabilities of future business analysts specialising in IT and in eBusiness meet the requirements of industry?***

The study was carried out in two stages. At the first stage, data about the effectiveness of individual papers' academic learning outcomes were collected. These were analysed with regard to the demands and expectations of the workplace. Curriculum development areas were broadly identified and a framework of IT/eBusiness related skills and capabilities was derived.

The framework was used in the second stage to identify the skills and capabilities expected from students by their industry employers and to study students' own perceptions about being able to meet industry expectations. Job types in demand by the industry were also highlighted. In the next two subsections we discuss in more detail the research models and the hypotheses investigated at each of the two stages, provide a synopsis of the data gathering processes and present the results obtained.

3.1 Stage 1: Identifying IT/eBusiness Skills and Capabilities

The first stage of the research focuses on the relationships between students and employers and between students and academia. We surveyed students who were undertaking the capstone co-op paper, where the student typically works on an independent project assigned by the workplace, but within the stipulations of an approved learning contract.

The "full immersion" cooperative workplace environment demands of students to use their knowledge, skills and capabilities and apply them to the assigned project. As research question (Q1) addresses the processes occurring in this environment, the following hypothesis (H1) can be formulated:

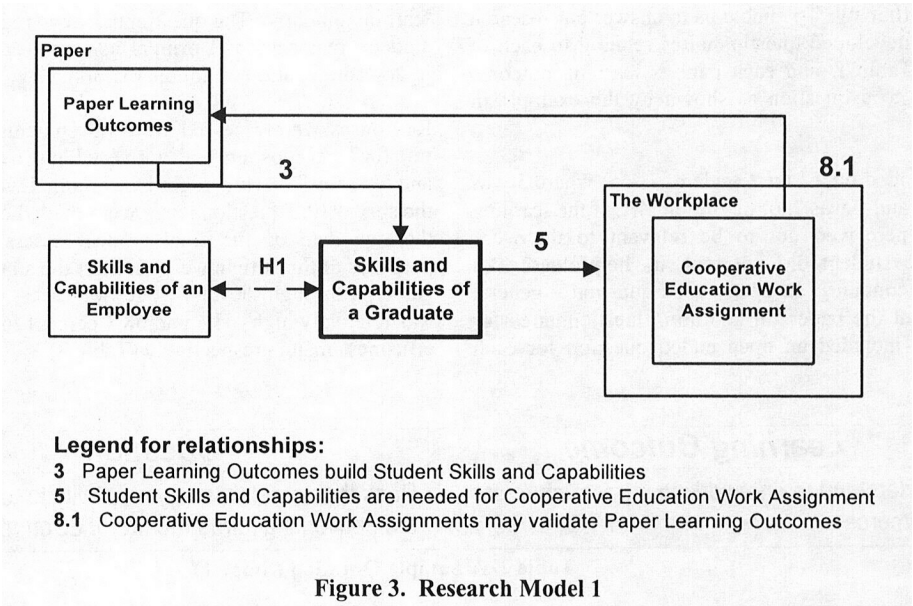


Figure 3. Research Model 1

H1. The skills and capabilities achieved through the learning outcomes of the professional papers match the skills and capabilities needed from students in the workplace.

Research Model 1 (Figure 3) incorporates the hypothesis (H1) and three relationships. It was derived from the general research framework (Figure 2). The model is designed to measure the perceived relevance of each paper's learning outcomes. Assuming that students' skills and capabilities are a direct consequence of the paper's learning outcomes (relationship 3), we will be able to make conclusions about the relevance of the learning outcomes with respect to the workplace assignment. The work assignment is determined by the workplace, and may or may not utilize all student skills and capabilities.

Hypothesis (H1) and the corresponding Research Model 1 both focus on the learning outcomes of individual papers and their relationship to skill and a capability building. To investigate the compound effect of all papers taken by the students, we used research question (Q2) and formulated two hypotheses:

H2.1 The papers taken by a student in their professional specialization leave recognizable gaps in terms of knowledge, skills and capabilities.

H2.2 The identified gaps in the learning outcomes from all papers may provide a coherent basis for the design of a new paper.

Research Model 2 (Figure 4) was derived from the general framework (Figure 2); it was used to collect data about these two hypotheses. The model was designed to identify the "gaps" in each paper. Assuming that students' understanding of the requirements of the workplace has matured as a result of their cooperative education, the research model implicitly takes feedback from the industry as "filtered" through students' perceptions. Arguably, students will have an innovative point of view compared to their employers' one (which might be more conservative).

Based on the two research models, a series of questionnaires were designed and distributed anonymously to students who were undertaking their co-op placements in Semester 2, 2003. The data gathering process is described next.

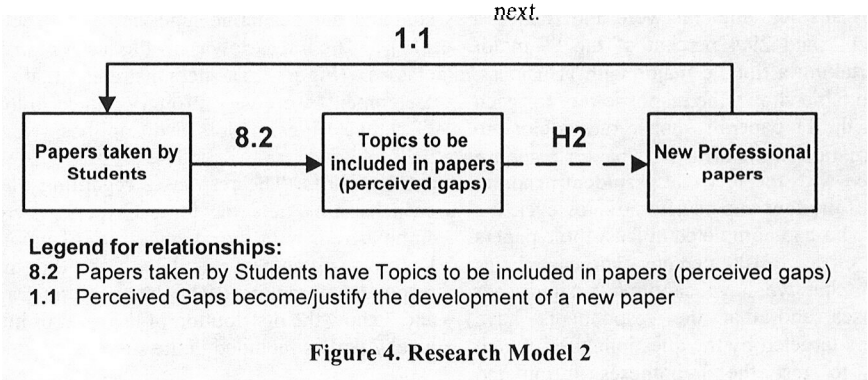


Figure 4. Research Model 2

3.1.1 Data Gathering: To enable us to answer our research questions, we developed questionnaires relating to each of the papers in Table 1, and each paper's learning outcome was converted to a question as shown by the example in Table 2.

Students responded on a Likert scale of 1 – 5, where 5 was "very helpful" and 1 was "not helpful at all". If the learning outcome was perceived not to be relevant to the work assignment the student did not rank its helpfulness. All questionnaires contained an open-ended question – general comments about the paper. In addition, questionnaires for level 7 papers included an open ended question for each learning outcome. The questionnaires were distributed to all students majoring in IT or in eBusiness (as a single major or in any combination of double majors).

Responses were received from 45 students. The response rate for level 6 papers was not very high (five for eBusiness and nine for IT). This might be explained with the timing of the survey (the questionnaires were mailed out very close to the due date of the final student assessment). For the purposes of this article we shall limit the analysis to the data gathered through "level 7" questionnaires, whose response was relatively high: 65.4 and 68.4 percent for the IT and the eBusiness majors respectively (Table 3).

Learning Outcome	Question
To understand the networking infrastructure of eCommerce	Rank the usefulness of your ability to understand the networking infrastructure of eCommerce

Table 2. A Sample Question (Stage 1)

	IT Major	eBusiness Major
General Response Rate	Students targeted: 26 Questionnaires returned: 17 Response rate: 65.4% Completed 3 papers: 94.11%	Students targeted: 19 Questionnaires returned: 13 Response rate: 68.4% Completed at least 3 papers: 100%
Double Majors	Students taking a double major combination: 41% Students taking IT/eBusiness: 29.5%	Students taking a double major combination: 92% Students taking IT/eBusiness: 46.1%
Individual Papers Response Rate	SDMA: 94.1% HCI: 100% IBS: 100%	eBM: 100% eM: 92.3% MWW4B: 92.3% eLaw: 38.5%

Table 3. Response Rates (Stage 1)

The data show that a significant number of the respondents were graduating with a double major: 41 percent in IT and 92 percent in eBusiness. The number of students with double majors including eBusiness is higher compared to the same indicator for IT. It is also of interest to note that 46.1 percent of the eBusiness students were undertaking a double major with IT, and 29.4 percent of the IT major students were undertaking a double major with eBusiness. The third row of the table shows the response rate for each paper. As expected, the IT papers response rate is close to 100 percent. The variation in the eBusiness papers response rate can be explained with the fact that a student needs to take only three out of the four papers offered. However, the number of students who had completed at least three papers in each major was close to 100 percent. These statistics allow us to assume that we have captured a significant number of responses and that the respondents have undertaken the papers targeted by the questionnaires, which in turn allow us to test the hypotheses formulated previously.

To be able to establish to what extent student responses related to the work undertaken in the co-op placement, we analyzed the type of work they had been assigned by the employer. The evidence was based on student learning contracts that were signed off by co-op work supervisors, students, and academic supervisors (Fincher et al, 2004, pp. 117). The breakdown of the co-op projects into three classes (Figure 5) demonstrates that the workplace assignments were very strongly related to the profiles of the IT and eBusiness majors as disciplines.

3.1.2 Results: The responses regarding the helpfulness of each learning outcome for each paper were tabulated and summarized, with the average rate of helpfulness for each learning outcome calculated as the average of all respondents' rankings. The data analysis graphs in Figures 6 and 7 show the distribution of the level of helpfulness for all level 7 papers included in the survey.

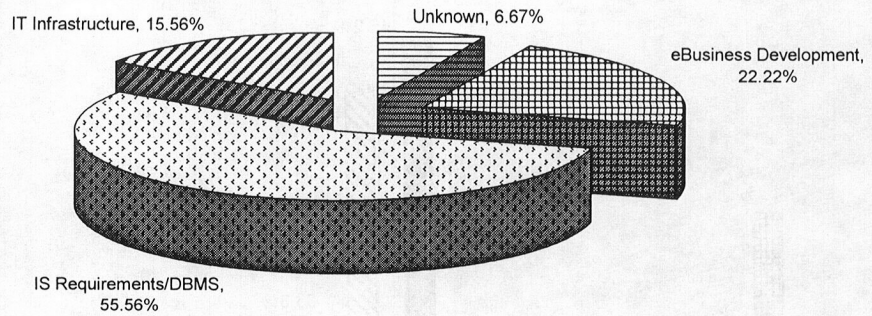


Figure 5. Co-op Projects Classification (Stage 1)

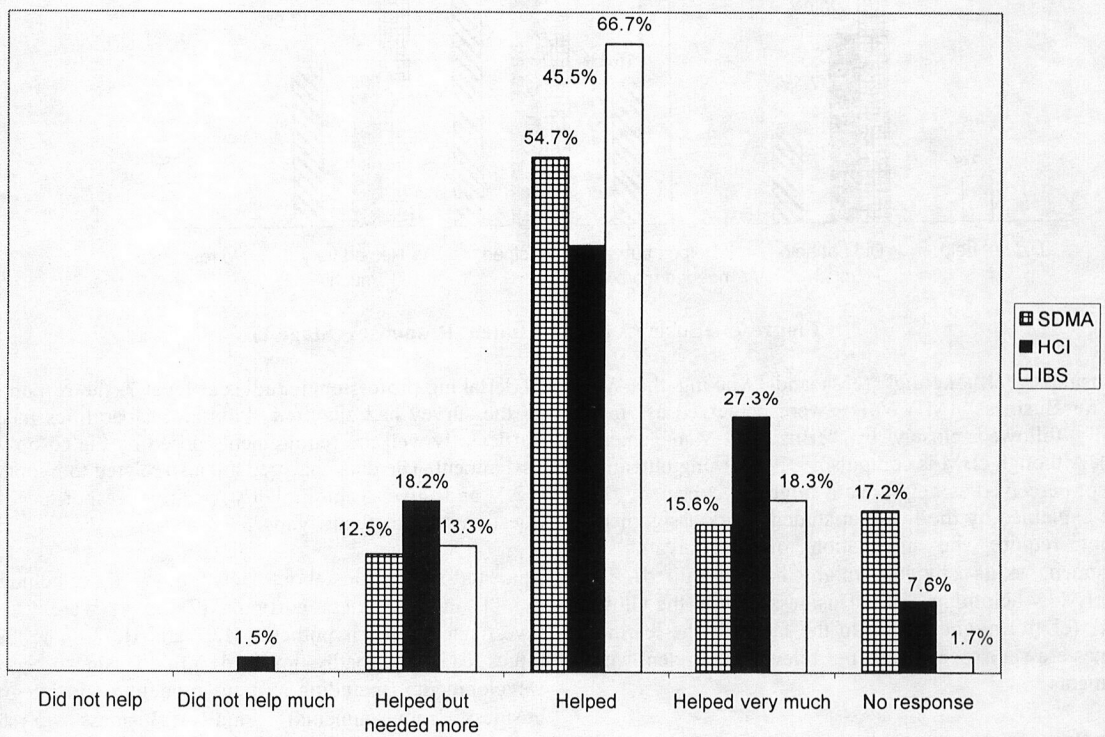


Figure 6. IT Major Student Responses (Stage 1)

From the summarized results, we identified "Strategic Data Management Architectures" (SDMA) as the perceived "most helpful" paper in the IT major. In particular the learning outcomes related to database management systems, relational database design, and database administration were found "most helpful". In general students found all learning outcomes (level 7) to be helpful. An interesting result is the score for "helped but needed more". A reason for this could be that students were unsure of how to apply the theories they had learned in a work situation, requiring guidance before they were confident in their own abilities.

In eBusiness, "eMarketing" (eM) and "Making the Web Work for Business" (MWW4B) were perceived as "most helpful", followed closely by "eBusiness Management" (eBM). Although eBM is compulsory, its learning outcomes were not perceived as helpful as it might be expected. This can be explained by the fact that student work assignments did not require the application of the breadth of management skills students might have acquired. The relatively low helpfulness of "eBusiness Law in the Global market" (eLaw) might be due to the fact that the learning outcomes are very specific and not relevant to student work assignments.

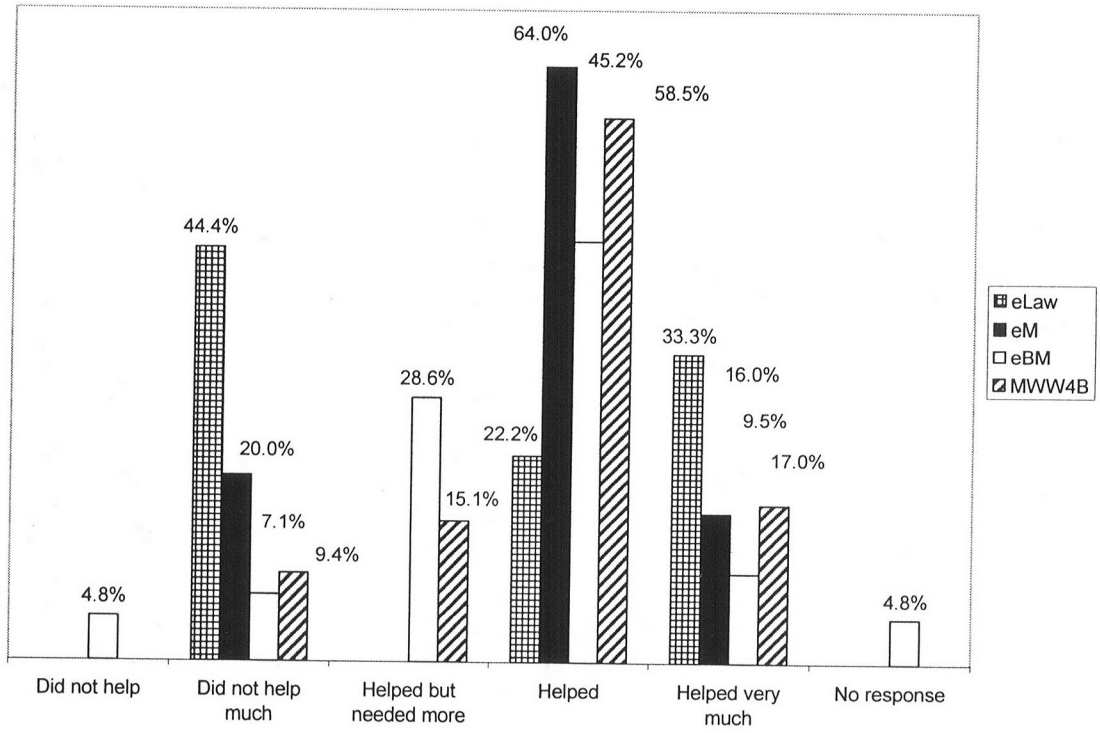


Figure 7. eBusiness Major Student Responses (Stage 1)

In eBusiness, "eMarketing" (eM) and "Making the Web Work for Business" (MWW4B) were perceived as "most helpful", followed closely by "eBusiness Management" (eBM). Although eBM is compulsory, its learning outcomes were not perceived as helpful as it might be expected. This can be explained by the fact that student work assignments did not require the application of the breadth of management skills students might have acquired. The relatively low helpfulness of "eBusiness Law in the Global market" (eLaw) might be due to the fact that the learning outcomes are very specific and not relevant to student work assignments.

The points made above relate to the validation of hypothesis H1, and allow us to conclude that in the process of undertaking professional studies at level 7, the respondents to the survey had acquired skills and capabilities meeting sufficiently well the requirements posed by the co-op work assignment. The data analyzed are also related to hypothesis H2.1 and give a preliminary positive response to the question "Are there any gaps?"

Students' suggestions about "new" topics to be included in the IT and eBusiness curricula (Table 4) were used to investigate further hypotheses H2.1 and H2.2. The "new" topics can be broadly grouped into "Business Systems Development" (including systems modeling and integrated business environments) and "Business Systems Infrastructure" (including advanced networking and elements of programming).

Business Systems Development	Responses	Business Systems Infrastructure	Responses
Information Systems		Networking	6
Decision modeling		Wireless concepts and devices	2
Integrated systems	2	Servers	2
Data modeling	2	Router technology	
Process modeling		Network management	
SQL		Software	2
Web design	3	Programming	5
Marketing principles		Macromedia Flash	2
Web services	3	HTML	

Table 4. Topics Suggested by Students (Stage 1)

Considering this grouping, we can conclude that the data collected confirm the two hypotheses H2.1 and H2.2 and provide a foundation for the development of a new paper.
Our results compare well with other suggestions for new course development in IT, IS and eBusiness (see for example Lei, Mariga and Pobanz; 2003; Ramakrishnan and Ragothaman, 2002).

The second stage of the research complements the study of student perceptions of the helpfulness and relevance of the academic curriculum with respect to industry related cooperative projects by developing a research model to incorporate employers and the job market. This is discussed in the next section.

3.2 Stage 2: Identifying Industry and Job market Requirements

This stage focused on the job market and the ICT industry requirements. Data were gathered from students, from employers and from independent sources (job advertisements), ensuring that independent evidence supports the participants' viewpoints and contributes to the validity of the study (Bazeley, 1999). The data collection process was carried in Semester 1, 2004, targeting the new class of students enrolled in co-op.

A research model (Figure 8) was derived from the general framework (Figure 2) to address research question (Q3). In Research Model 3, the construct "Industry/Employers" relates to the cooperative workplace and "Job market" relates to the ICT industry. The central construct "Academic programmes" is used to represent in a general way the academic outcomes of the two IT and eBusiness majors. The model was designed to capture the expectations of industry and students and to provide a direction for further academic development.

Three hypotheses were formulated:

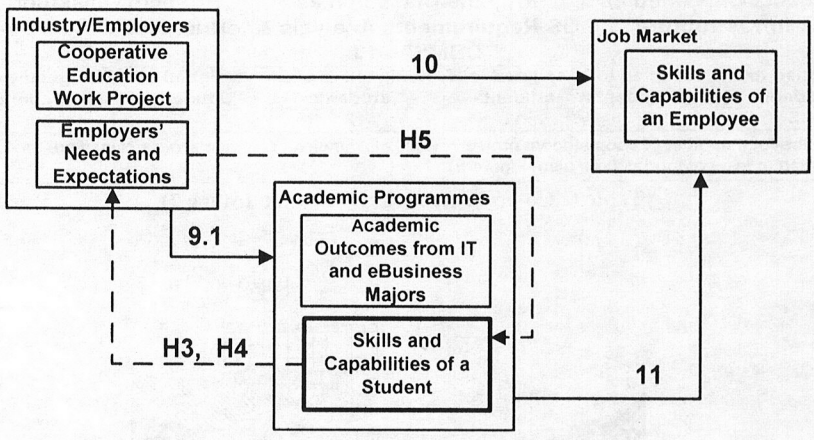
H3. Most skills acquired by students may not be needed in the workplace and meet employers' expectations.

H4. Skills and capabilities needed by employers may not be part of academic outcomes.

H5. Student perceptions of skills and capabilities needed by industry/employers may not be well aligned with academic outcomes.

3.2.1 Data Gathering: Ten co-op employers were sent anonymous questionnaires of which seven were returned. Ten students attended a focus group and were given an anonymous questionnaire each, of which nine were returned. The new topics summary produced at Stage 1 (Table 4) was adapted and used to code all responses (Table 5). Similarly to Lee (2002), we defined three skill categories: "Business Systems Design", "Business Systems Development" and "Generic".

Students were asked to indicate what IT and eBusiness skills and capabilities acquired through their studies proved to be helpful in their coop project, and what other skills they might have benefited from. Similarly co-op employers were asked what skills and capabilities brought from academia they thought were helpful for the students undertaking coop projects, and what skills students did not seem to have developed sufficiently.



Relationships

10 Industry/employers' needs translate into Job Market Requirements
11 Academic Programmes prepare students to enter the Job Market
9.1 Employers' expectations inform and contribute to the Academic Outcomes and determine skills and capabilities developed by a student

Figure 8. Research Model 3

Perceptions about Skills and Capabilities (Number of Responses)				
	Student Perspective		Employer Perspective	
	Useful	Lacking	Useful	Lacking
Business Systems Design				
Information systems	2	7	6	5
Data & process modeling	3	3	2	1
Web design		1		3
Marketing principles	3	1		1
Project planning	7	1	1	2
Human Computer Interaction	3			
Business System Development				
Networking concepts	2	9		9
Software applications	1	2	2	4
Programming & SQL	1	4		
Web development	2	4		1
eBusiness development	4	1	1	4
Generic Skills				
Communication	5	4		4
Self confidence			2	1
Real life experience	1	7	2	9
Independence & learning			1	2

Table 5. Employer and Student Perceptions of IT and eBusiness Skills and Capabilities (Stage 2)

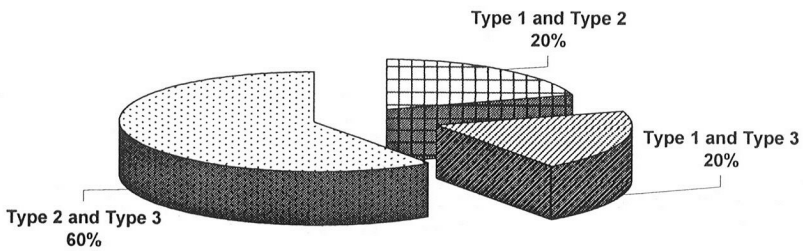
Compared to Stage 1, several new areas of IT, eBusiness and generic skills and capabilities were identified: "Project planning", "Human Computer Interaction", "eBusiness development", "Communications", "Real-life experience", and "Independence & learning".

The second source of data was the student co-op projects, which were classified according to the project topic and to the specialization of the student. A sample of 21 co-op assignments were analysed (with seven students majoring in eBusiness and 14 in IT) and classified using the categories identified at Stage 1. It can be seen that eBusiness "majors" were mostly assigned eBusiness development project types, while IT majors were typically assigned IS requirements analysis/database management systems types (Table 6).

A number of IT students were involved in eBusiness development projects, and some were given IT infrastructure projects. Five of the projects fell into two categories (Figure 9).

Projects Classified as "IT Infrastructure": 2		Projects Classified as "IS Requirements Analysis & DBMS" : 13		Projects Classified as "eBusiness Development": 11	
Assigned to IT students	Assigned to eBus students	Assigned to IT students	Assigned to eBus students	Assigned to IT students	Assigned to eBus students
2	0	11	2	6	5
Note: the total number of coop student projects was 21 ; however 5 projects were classified as belonging to two categories (see also Figure 9).					

Table 6. Co-op Projects Classification (Stage 2)



Type 1 - IT Infrastructure
Type 2 - IS Requirements Analysis & Database Management Systems
Type 3 - eBusiness Development

Figure 9. Co-op Projects in Two Categories (Stage 2)

For the purposes of data triangulation (Orlikowski, 1993) and following the approach in (Lee, 2002), three job advertisement sources were scanned for positions related to IT/IS and eBusiness (www.netcheck.co.nz, www.seek.co.nz, and the daily newspaper The New Zealand Herald) in April-May 2004. A total of 449 relevant job advertisements were identified. We were able to classify the job descriptors, applying two of the categories already identified during the co-op projects analysis. As shown in Tables 7, 8, and 9, the job descriptors vary significantly, with most job types available in the "Information Systems" category. The number of job descriptors in the eBusiness concentration is also significant.

www.netcheck.co.nz	www.seek.co.nz	The NZ Herald
Data administrators Data analyst, Software database support, Reporting analysts.	Database coordinator, Marketing database analyst, Financial report analyst, Information Analyst, SQL DBA/ developer.	Data administrator, Database Info Analyst, Quality assurance, applications support analyst Reporting analyst, Information Tech adviser, Oracle guru
Senior analysts, Business analysts, Systems analysts, Software testers, Operations analyst, Help desk analysts/ administrator, Service desk analysts, Trainer/document writer, SAP development team leader, Project administrator, IT project manager.	Accounting information systems, Business analyst, Business System Analyst, Business process specialist, Customer operations help desk, Help desk coordinator, Application support analyst	Senior Analyst, Analyst accounting bias, Business Analyst, Systems Analyst, Information systems/ business process specialist, Marketing & Business analyst, Information Manager Management advisor, Test analyst, Operations analyst/ coordinator, Help desk analyst, Technical writer, SAP development team leader, Project administrator/analyst/ coordinator/manager, IT project manager.

Table 7. Job Classification: Information Systems/DB and Information Systems

www.netcheck.co.nz	www.seek.co.nz	The NZ Herald
Web marketer, Web designer/editor, Desktop publishing consultants	eBusiness solution consultant, Internet design & Development, Search engine marketing consultant, Web developer, Web/new media designer, Website marketing consultant, eCommerce systems specialist.	Web designer, Web designer & technical writer, Web developer, Website content manager, Web developer, eLearning community manager

Table 8. Job Classification: eBusiness

www.netcheck.co.nz	www.seek.co.nz	The NZ Herald
Technical consultant, Support manager, Network engineer, NT systems administrator, Network administrators, IT director, Software developer, Systems developer, VB net developer, Mac support operator.	Technical consultant, IT support analyst, Intranet administrator, IT administrator, IT analyst, Software development manager, Business support specialist, Mac operator, Desktop support, Operational security specialist, Security analyst.	Technical manager, Technical services Mgr, Technical support, IT advisor, IT director, Web friendly mac operator.

Table 9. Job Classification: IT Infrastructure

3.2.2 Results: To investigate hypotheses H3 and H5 we analyzed the data in Table 5. We conclude that useful skills from a students' perspective are "Data & process modeling", "Marketing principles", "Project planning" and "Human Computer Interaction".

The lack of response from employers to "Human Computer Interaction" may indicate a certain lack of understanding of this area (by employers). While most employers consider "Communication" could be improved, more than half of the student responses show that respondents are confident in having these skills.

However "Real life experience" elicited a strong negative response from both groups. Although the co-op project is designed to address the need for real life experience and develop further student capabilities in independent problem solving, it needs to be noted that not all co-op work projects align with already acquired skills and capabilities. This might explain the high rate of negative responses and confirms an earlier observation (section 3.1.2) that students were unsure of how to apply theories in a work situation.

Both employers and students indicated that there was a noticeable lack of skills in four particular areas; "Web design", "Software applications", "Self confidence" and "Independence & learning". "Web design" and "Software applications" are related to constant technological change and the responses reflect the slower uptake by academia of innovative technologies that in turn might lead to reduced student self-confidence and inability to learn independently.

Two areas of skills and capabilities indicate a perceived gap in student learning: "Information systems" and "Networking concepts". Student perceptions of the lack of these skills may be related to the lack of self-confidence mentioned above as the topics are certainly among the focal points of several academic courses which co-op student would have undertaken as part of their programmes.

However employers' responses also point out the lack of skills and capabilities in networking concepts and, to a lesser extent, in information systems concepts - which might indicate that academic curriculum outcomes in these two areas are not adequately aligned with the demands of the industry.

Students think they need more skills in "Programming and SQL" and "Web development", however this need is not perceived as important by employers who consider students need more skills in "eBusiness development". In other words, students perceive a need for more concrete programming skills, while employers are looking for more generic skills in the area of eBusiness development.

The data and observations above confirm the first part of hypothesis H3: most skills acquired by students are needed in the workplace. Regarding the second part of the same hypothesis, we can conclude that while employer expectations are met sufficiently in the area of "information systems", the subject areas of "eBusiness development" and possibly "networking" need to be integrated more tightly into the current curriculum of both the IT and eBusiness majors. We conclude also that student perceptions of skills and capabilities expected by employers (hypothesis H5) do not necessarily match employers' requirements. The two stakeholder groups disagree on the skills needed for eBusiness and Web development. This issue needs to be addressed through an appropriate curriculum design - to include hands-on experience as well as understanding of business process models. The challenge would be to identify the correct mix of programming and analytical capabilities in need of further development.

To investigate hypothesis H4 we analyzed data about co-op projects and compared the co-op project classification (Table 6) with employer and student perceptions (Table 5). The categories identified in Table 6 match the factual content and learning outcomes of the IT and eBusiness majors, as stated for example in (SCIS , 2005, pp. 28-30). Most IS projects were undertaken by students majoring in IT, while an equal number of IT and eBusiness students were assigned eBusiness projects. This indicates that some employers do not distinguish between IS, IT and eBusiness skills. Only two projects involved work related to network infrastructure and therefore the notion about lack of skills in networking concepts (Table 5) is not sufficiently supported. The number of projects in IS and eBusiness development are consistent with employers' responses regarding lack of skills in these areas (Table 5).

These observations confirm hypothesis H4 and indicate that there exists a gap in student learning (both in eBusiness and in IT). The eBusiness discipline plays the role of a 'catalyst' for change, driving the need to redefine the sets of capabilities relevant to IT and to eBusiness, and to redesign the related curricula (Shackleford, 2004).

In Stage 1 and partially in Stage 2 the co-op environment was used as a substitute for the industry environment, therefore we needed to investigate further the issues above and to find evidence confirming the need for curriculum change. As mentioned, triangulation of data was achieved through the analysis of job advertisements and the comparison of the results obtained with the results on co-op projects analysis and student and employer responses.

It can be seen that the job position types in Tables 7, 8, and 9 fit well within the previously identified categories of co-op projects (Table 6). We can conclude therefore that the co-op work environment represents well the 'real world' and that our findings, based on the analysis of data collected from the co-op environment, are credible and applicable to the industry and the job market as a whole.

4. SUMMARY AND CONCLUDING REMARKS

The data analysis provided in the previous section allows us to answer positively the study's research question formulated earlier. While there are some gaps, student skills

and capabilities acquired in academia meet the needs of the co-op work environment to a significant extent (Q1). In that respect the most helpful academic content was found to be concentrated in papers on database management, and Web business development and management. Both students and employers value highly some general skills and capabilities such as project planning.

One noticeable difference between the workplace environment and academia was the value placed on skills in human computer interaction, which some employers did not recognize as "needed". Some of the students' perceptions about "lacking" skills and capabilities can be explained by a certain lack of confidence in applying theoretical knowledge. This was also noted by employers. In some areas such as networking concepts, while students have acquired a theoretical background, they have not built skills related to the practical implementation of their knowledge.

The important gaps in student learning found both by employers and students are related to two areas: business system development and business system infrastructure (Q2). Employers do not distinguish between skills and capabilities of IT and eBusiness students but perceive these as related to the profile of each one of the specializations (Web development skills are one such example). An important finding was the fact, that while students perceive the lack of specialized technical knowledge (such as programming) as an impediment, employers were looking for better understanding of the processes of integration and technology conversion occurring across a business.

The study of the job advertisements demonstrated the job types align well with the co-op project classification derived from results across the two stages described earlier; this supports the use of the co-op environment as a test bed for the research undertaken. The data collected about employers' perceptions of students skills and capabilities allow us to draw the conclusion that IT and eBusiness graduates will be successful in meeting the expectations of the industry when they enter the job market (Q3).

Overall we reach the conclusion that the IT and eBusiness programmes equip graduates with an appropriate mix of skills and capabilities and that as future business analysts they will become valuable employees in a competitive job market.

With regard to the implications of our findings to curriculum development, we identified two sets of learning outcomes, which will be used as a backbone to develop the descriptor of a new elective paper at level 7 (Table 4). The new elective will become part of each of the two majors, IT and eBusiness. We identified eBusiness development as an important area for curriculum change, which will affect the academic programmes of the two majors.

We also found that the content definition of this area is not straightforward as the two stakeholder groups have different perceptions of the skills required: we observed on numerous occasions that co-op employers do not distinguish sufficiently between IT and eBusiness as specializations with different academic profiles. This observation is in line with the "lack of conceptualization" of IT as noted in (Tippins and Sohi, 2003), and with the overlap between IS capability and eCommerce capability in contemporary organizations (Peppard and Ward, 2004; Zhu, 2004).

The implications for curriculum development are that it needs to be done in close collaboration with industry. To address the issue, we will also continue to monitor the effectiveness of the learning outcomes of the professional papers and have set up a multidisciplinary working group to proceed with the development of the proposed elective paper in consultation with industry focus groups. We would recommend also that extended academic supervision is needed in co-op placements to ensure students and employers achieve a common understanding of the nature of the co-op project.

The study reported here has some limitations. First we studied students in co-op placements rather than graduates employed as new business analysts. Although the general research framework allows a survey to be conducted targeting directly employed graduates, such a survey would be technically more difficult. It might be argued also that the respondents might be influenced by their work experiences to a much greater extent than co-op students.

Secondly, we were not able to collect sufficient data about level 6 paper learning outcomes (Stage 1) and did not include the responses received in the data analysis. However we feel confident that the exclusion of these data does not influence level 7 results due to the structure of paper pre-requisites. In addition, the analysis of the data suggesting new topics shows that level 6 learning outcomes that have not been re-enforced at level 7 seem to have been "forgotten". This new hypothesis could be explored in a further study.

The general research framework and models could be applied to all programmes that offer cooperative education, a capstone project or other forms of academically relevant work experience. It could also be expanded to cover other factors influencing the acquisition and development of skills and capabilities - such as gender, culture, background, part-time or full time study. The framework could be extended to generate predictions for the future based on data grounded in reality, and to serve as a vehicle for curriculum change.

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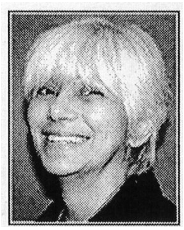

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