# Skills, capabilities and change: are we keeping up with progress?

**Krassie Petrova** **Gwyn Claxton**

Auckland University of
Technology
Private Bag 92006
Auckland
Krassie.Petrova@aut.ac.nz

Advances in technology are changing rapidly the discipline areas of information technology and eBusiness. Keeping the curriculum up-to-date and relevant has become a challenge. A prime educators' task is the development of skills and capabilities meeting diverse employers' needs. The paper presents the results of a survey to study the relevance of the professional academic content. Three research hypotheses related to the specific learning outcomes of two major business specialisations were formulated and validated. The research models used in the study are derived from a general framework which can be applied to other disciplines. The results show an increased emphasis on technical skills and their integration in the business process within the workplace.

## Keywords

eBusiness, information technology, cooperative education, learning outcomes.

## 1. INTRODUCTION

For the last four years the Bachelor of Business (BBus) degree at the Auckland University of Technology (AUT) has been producing an increasing number of graduates looking for work placement specialising in Information Technology (IT) and eBusiness. Along with other educators, we are concerned as to whether students have the appropriate skills and capabilities to meet employers' Information System (IS) requirements (Couger, Davis, Dologite *et al*, 1995; Lee, Trauth & Farwell, 1995; Fedorowicz & Gogan, 2001; Lee, 2002). In addition, the IT and eBusiness areas are changing so rapidly that keeping the curriculum up-to-date and relevant has become a challenge. One of the ways to meet this challenge is to gather and analyse data on the processes evolving in New Zealand business organisations. This enables us understand these processes and to do our best to ensure our paper learning outcomes match the needs of the workplace (Petrova & Sinclair, 2000; Senapathi & Petrova, 2002; Claxton, 2003; Gutierrez & Boisvert, 2003).

The paper presents the results of a survey studying student perceptions of the relevance of the professional content with regard to their work placement; the survey was carried in Semester 2, 2003. The paper is organised as follows. The next section provides a background of the BBus degree and the majors. It discusses briefly the structure of the professional parts of the degree and formulates the central problem of the study. Section three introduces the research questions and the research models. It is followed by a section describing the data gathering process. The paper concludes with a discussion section, which analyses the results, identifies some of the limitations of the study, and suggests directions for future research and curriculum development.

## 2. BACKGROUND AND MOTIVATION

The BBus programme provides students with a broad understanding of business, with specialist knowledge, skills and professional capabilities (AUT, 2003). Professional skills and knowledge in the IT area are developed through the professional papers that comprise the IT major of the degree. The broad objective 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. In the relatively new area of eBusiness, focusing on Internet based technology concepts and their practical applications is the eBusiness major. Students graduating from the eBusiness major will have a good understanding of eBusiness models, the role and place of standards and protocols, legal and ethical issues, and "how to manage, market and make secure" eBusiness (AUT, 2003).

**Table 1. Core professional papers - IT and eBusiness**

| IT Major | | EBusiness Major | |
|---|---|---|---|
| ***Professional Paper Name*** | ***Level*** | ***Professional Paper Name*** | ***Level*** |
| eBusiness IT Infrastructure (eBITI) | 6 | eBusiness IT Infrastructure (eBITTI) | 6 |
| Information Engineering (IE) | 6 | Electronic Transactions and 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) (Level 7)** | | | |

Although the two majors, IT and eBusiness, are well differentiated within the BBus degree (they have only one common professional paper –see Table 1), it is not always easy for employers to distinguish between the two. One reason could be the changing role of IT in organisations and the use of intranet and Internet solutions to carry out business functions. Students from either major may find that their work assignment is based around some aspect of eBusiness or eBusiness infrastructure; in addition it seems that there exists a significant fusion of the skills and capabilities from the realms of the two majors (Katz & Safranski, 2003).

Table 1 illustrates the structure of the IT and eBusiness Majors, identifying the individual professional papers and their level of difficulty. Students majoring in IT or eBusiness complete three papers at Level 6 and three papers at Level 7 from the table. Level 6 papers can be defined as "year two" papers while Level 7 papers are broadly equivalent to "year three" papers as part of a standard three year undergraduate degree programme. The table also shows the capstone "Co-operative Education"; a compulsory one semester paper for BBus graduates that is typically undertaken during the last semester of their studies. The capstone paper is designed to place students in full time occupation, but also to provide them with the necessary academic support throughout their placement.

Given the background of the papers in Table 1 and the resulting content mix, we were interested to know whether these papers' learning outcomes were helpful to students in their work during the cooperative work experience. As discussed previously, our main objective was to investigate the relationship between the skills and capabilities of our graduates, and the requirements of the workplace. The central problem which motivated the study can therefore be formulated as:

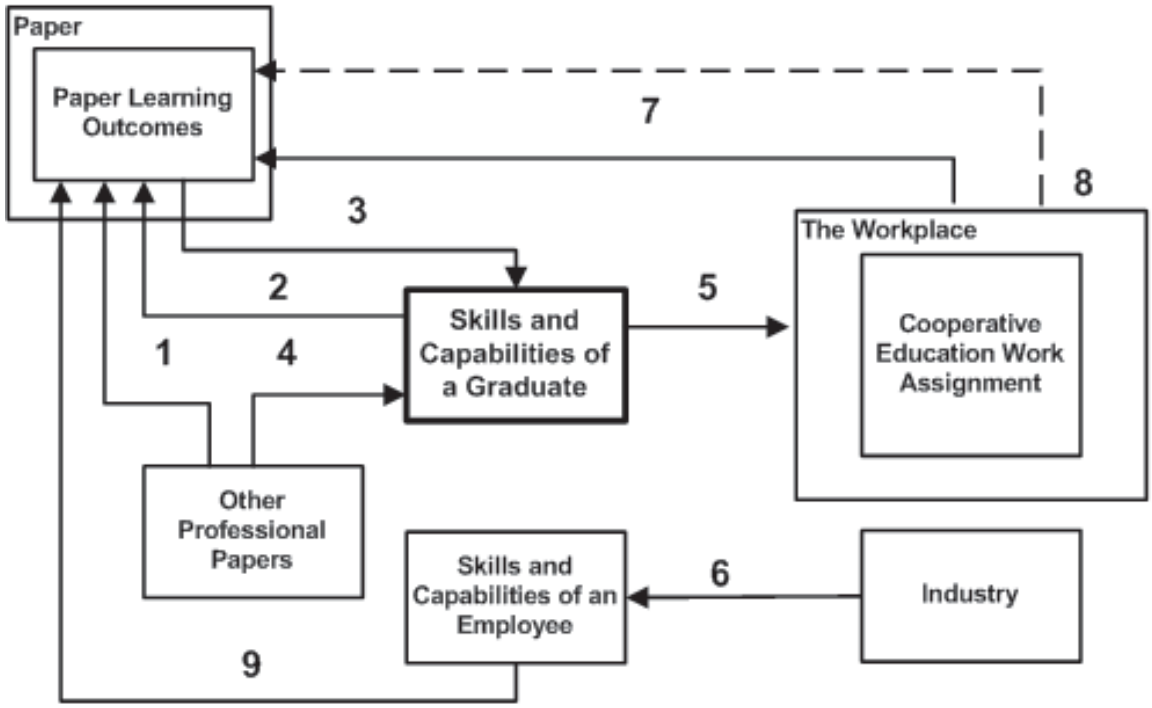
*Are we producing graduates with the relevant mix of skills and capabilities as required by the workplace?*

Work in that direction was carried on by Fedorowicz and Gogan (2001) and Lee (2002); these two empirical studies evaluate the eBusiness and IT curricula in each of the respective authors' institutions in the context of the job market. Data about industry was collected from job advertisements.

While these studies consider two major stakeholders - academia (curriculum developers), and industry (employers, managers), in the problem stated above we clearly identify three stakeholder groups: industry, academia and students. To represent them using appropriate constructs we designed a comprehensive research framework (Figure 1). The framework allowed us to generate research questions and hypotheses involving the relationships between the constructs. It also served as a basis for the creation of data gathering research instruments. The research framework and the research models are described in the next section.

# 3. RESEARCH FRAMEWORK AND MODELS

Our research focuses on some of the relationships between students and employers and between students and academia. We decided to investigate the problem by surveying students who were undertaking the capstone Cooperative Education (co-op) paper. A "co-op" student typically works on an independent project assigned by the workplace, but within the stipulations of an approved learning contract. The work placement creates a "full immersion" environment that facilitates learning and also demands the student to use their knowledge, skills and capabilities and apply them




**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 1. Research framework.**

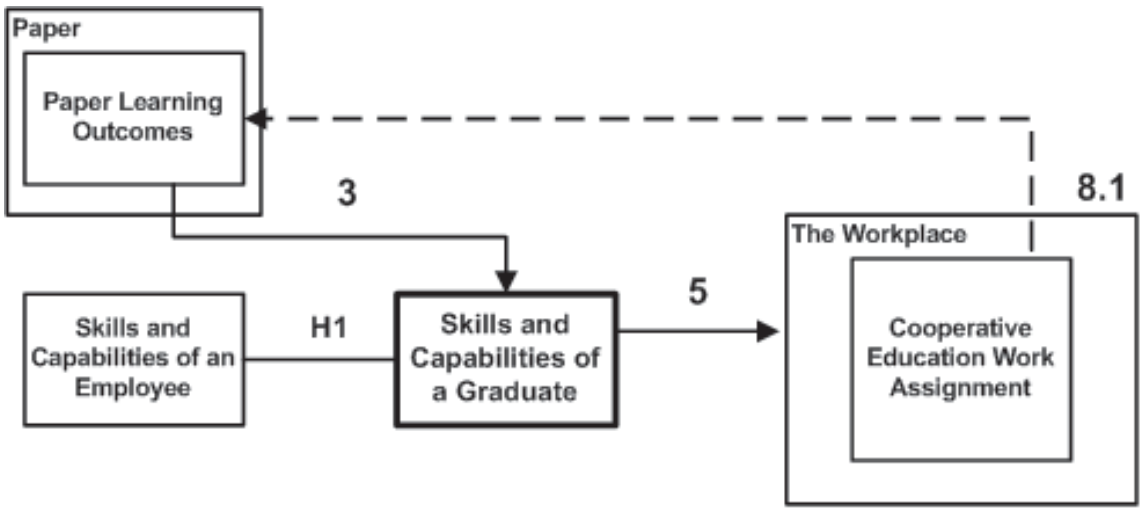
to the assigned project (Fincher, Clear, Petrova *et al,* 2004).

The research framework consists of six constructs and identifies 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 both 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 developed by Benbasat and Zmud (2003), a variation of which was implemented in (Claxton, 2003).

The need to use two constructs for each stakeholder group arises mainly from the need to consider two different processes - curriculum design, and curriculum delivery. Different types of relationships might occur during these processes. While relationships (3) and (4) are active during the time the papers are delivered and are instantiated during the semester, relationships (1) and (2) play an important role during curriculum design prior to delivery. In addition, building of student skills and capabilities occurs as facilitated by an individual paper (3) but also as influenced by other papers students take (4).

Relationship (5) shows how the converted learning outcomes become skills and capabilities that may be applied by the student during their cooperative education work placement. Relationship (6) shows that in-




**Legend for relationships:**

**3** Paper Learning Outcomes build Student Skills and Capabilities

**5** Student Skills and Capabilities are needed for Cooperative Education Work Assignment

**8.1** Cooperative Education Work Assignments may validate Paper Learning Outcomes

**Figure 2. Research Model 1.**

dustry requires their employees to possess certain skills and capabilities to carry out their work. Relationships (7) and (9) show how the workplace and industry inform paper learning outcomes (during curriculum design). Relationship (8) shows the outcomes of our research that will either confirm or reject the initial hypotheses.

The following research question was formulated to fit within the constraints of the cooperative education environment and to allow us to build a model to investigate the problem stated previously:

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

A hypothesis to correspond with the research question is H1 below.

*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 2) was derived from the research framework. It incorporates hypothesis H1 and three of the framework relationships. It is important to note that relationships (3), (5) and (8.1) correspond to relationships (3), (5) and (8) in the research framework. 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 (3), we are 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 utilise all student skills and capabilities.

Hypothesis H1 and the corresponding Research Model 1 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 formulated a second research question:

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

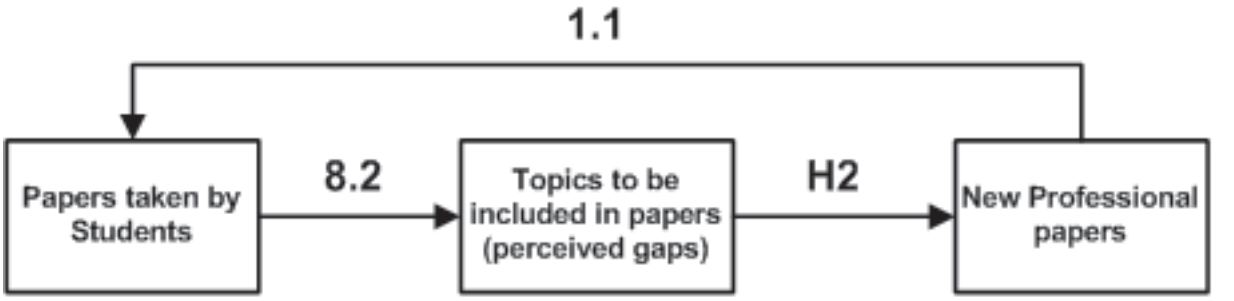
With respect to this research question, two hypotheses were formulated:

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

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

The corresponding Research Model 2 is shown in Figure 3. As before, relationships (8.2) and (1.1) correspond to relationships (8) and (1) in the research framework. Data collected to investigate these two hypotheses are interpreted not at the level of the individual paper, but at the level of the discipline majors.

The model is 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 im-




**Legend for relationships:**

**8.2** Papers taken by Students have Topics to be included in papers (perceived gaps)

**1.1** Perceived Gaps become/justify the development of a new paper

**Figure 3. Research Model 2.**

plicitly 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). The outcomes of this research model can be used to inform the development of the professional academic curriculum.

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

# 4. DATA GATHERING

We developed 13 different questionnaires to accommodate the learning outcomes of each of the papers in Table 1. Each 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 a particular learning outcome was perceived not to be relevant to the work assignment the student did not rank its helpfulness.

The questionnaires related to papers at Level 6 were complemented by one open ended question – general comments about the paper. The questionnaires for papers at Level 7 were more sophisticated:

- an open ended question about the specific learning outcome was added for each learning outcome-oriented question, and
- for each paper, an open ended question about suggestions for additional topics to be included in the paper was added.

The relevant questionnaires were distributed to all students majoring in IT or eBusiness (either as a single major or in any combination of double majors) and responses were received from 45 students.

**Table 2. A sample question from the eBITI questionnaire.**

| *Learning Outcome* | *Question* |
|---|---|
| To understand the networking infrastructure of eCommerce | Rank the usefulness of your ability to understand the networking infrastructure of eCommerce. |

The response rate for Level 6 papers was not very high (five for eBusiness and nine for IT). The low response rate 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 paper we shall limit the analysis to the data gathered through the "Level 7" questionnaires. The response rate for "Level 7" questionnaires was relatively high (Table 3): 65.4% for the IT major and 68.4% for the eBusiness major.

The data show that a significant number of the respondents are graduating with a double major: 41% in IT and 92% in eBusiness. The number of students with double majors in eBusiness is higher compared to the same indicator for IT. It is also of interest to note that 46.1% of the eBusiness students were undertaking a double major with IT, and 29.4% of the IT major students were undertaking a double major with eBusiness.

The third row (Table 3) shows the response rate for each paper. As expected, the IT papers response rate is close to 100%. 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.

Due to the inbuilt flexibility of the BBus programme, some of the questionnaires may have been returned

**Table 3. Statistical data**

| | IT major | eBusiness major |
|---|---|---|
| General response rate | Students targeted: 26<br>Responses: 17<br>Response rate: 65.4%<br>Completed 3 papers: 94.11% | Students targeted: 19<br>Responses: 13<br>Response rate: 68.4%<br>Completed at least 3 papers: 100% |
| Double majors | Students taking a double major combination : 41%<br>Students taking IT/eBusiness: 29.4% | Students taking a double major combination : 92%<br>Students taking IT/eBusiness: 46.1% |
| Individual papers response rate | SDMA : 94.1%<br>HCI:100%<br>IBS: 100% | eBM: 100%<br>eM: 92.3%<br>MWW4B: 92.3%<br>ELaw: 38.5% |

blank as the student may have not taken a paper. However, the number of students who had completed at least three Level 7 papers in each major was close to 100%.

The statistics presented here 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 allows us to test the hypotheses formulated previously. We discuss some of the outcomes of the survey in the next section.

# 5. DISCUSSION AND CONCLUSION

To be able to establish to what extent student responses were related to the work undertaken in the co-op placement, we analysed the type of work assignment they had been given by the employer. The evidence was based on student learning contracts signed by co-op work supervisors, students, and academic supervisors (Fincher *et al*, 2003). The breakdown of co-op assignments into three classes as shown in Figure 4 demonstrates that the workplace assignments are very strongly related to the profiles of the IT and eBusiness majors as disciplines (AUT, 2003).

The responses regarding the helpfulness of each learning outcome for each paper were tabulated and summarized as follows: the average rate of helpfulness for each learning outcome was calculated as the average of all respondents' rankings. The graphs in Figures 5 and 6 show the distribution of the level of helpfulness for all Level 7 papers included in the survey (for the IT major and for the eBusiness major, respectively).

From the summarized results we identify SDMA as the perceived "most helpful" paper in the IT major. In particular learning outcomes that related to database management systems, relational database design, and database administration were found "most helpful". In

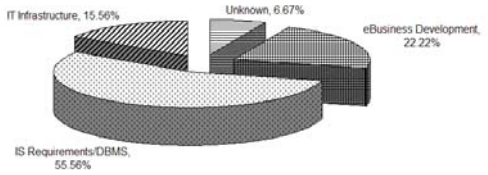



**Figure 4. Classification of Work Assignment.**

general students found all learning outcomes from the IT professional papers at Level 7 to be helpful. An interesting result is the high score for "helped but needed more". A reason for this could be that students were unsure of how to apply, in a work situation, the theories they had learned, requiring guidance before they were confident in their own abilities. The scores for "did not help me much" are relatively high for HCI and IBS which indicates the need to redevelop some of the learning outcomes for these two papers or add new and more relevant ones.

In eBusiness two papers were perceived as "most helpful" (eM and MWW4B), followed closely by eBM. Although eBM is a compulsory paper, its learning outcomes were not perceived as useful as it might be expected. This can be explained by the fact that student work assignments did not require them to apply the breadth of management skills they might have acquired. The relatively low usefulness of eLaw is easily explained by the fact that the learning outcomes are very specific and are typically not applicable in co-op placements. The scores for "helped but needed more" are not particularly high, but the scores for "of little help " are significant. This might be explained with the lack of confidence (as in the case of the IT major respondents), but could also indicate a strong need to replace some of the learning outcomes with better fitting ones, or add new and more relevant outcomes.

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,

**Table 4. New topics suggested by respondents.**

| Business Systems Development | Business Systems Infrastructure |
|---|---|
| • Information systems<br>• Decision modeling<br>• Integrated systems (2)<br>• Data modeling (2)<br>• Process modeling<br>• SQL<br>• Web design (3)<br>• Marketing principles<br>• Web Services (3) | • Networking (6)<br>• Wireless concepts and devices (2)<br>• Servers (2)<br>• Router technology<br>• Network management<br>• Software (2)<br>• Programming (5)<br>• Macromedia Flash (2)<br>• HTML |

the respondents to the survey had acquired skills and capabilities meeting sufficiently well the requirements posed by the co-op work assignment. The answer to research question Q1 is therefore affirmative.

The responses analyzed are also related to hypothesis H2.1 and give a preliminary positive response to the question "Are there any gaps?" The data used in the further investigation of this hypothesis and also of hypothesis H2.2 are presented in summarized form in Table 4. The suggested "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).

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 Ramakrsihnan & Ragothaman, 2002; Bartholome & Olsen, 2002; Lei, Mariga & Pobanz; 2003).

Thus we were able to isolate two sets of learning outcomes that answer research question Q2. The resulting topics will be used as the foundation upon which to develop the descriptor of a new elective paper (Level 7). As the topics were perceived as "gaps" by students from both majors, the new elective will become part of the professional core for each of the majors.

We can identify three important limitations of this study:

■ Our research models do not include explicitly the employers and their perceptions of the required skills and capabilities of students. The framework allows for the development of a suitable research model for conducting a survey of employers which may be undertaken in future research.

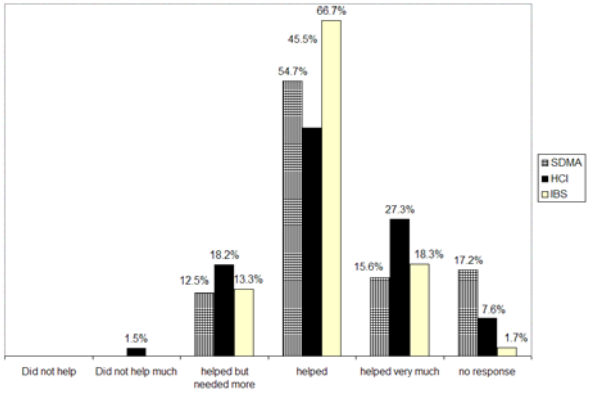



**Figure 5. Data analysis – IT major.**

■ We assume that the co-op work placement and employment would give us comparable results if studied as separate work environments. The research framework allows a survey to be conducted targeting employed graduates rather than co-op placement students. Such a survey would be technically more difficult and it might be argued that the respondents might be influenced by their work experiences to a much greater extent than co-op students.

■ We were not able to collect sufficient data about Level 6 paper learning outcomes 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 pre-requisite structure of the two majors (AUT, 2003). 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 found "not helpful". This new hypothesis could be explored in a further study.

To summarize; we developed a research framework to investigate the relevance of our curriculum design and implementation from which we were able to extract two working research models. The analysis of the data allowed us to reach useful conclusions affecting our further work as IT and eBusiness educators. The research framework is general and can be applied to all programmes which offer cooperative education, a capstone project or other forms of academically rel-

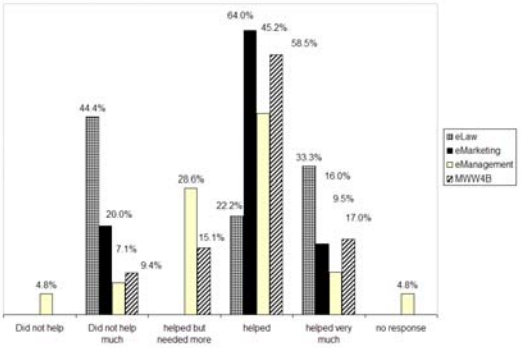



**Figure 6. Data analysis – eBusiness major.**

evant work experience (for example, the Bachelor of Information Technology at AUT), as well as to individual papers. It can also be expanded to cover factors influencing the acquisition and development of skills and capabilities - such as gender, culture, background, part-time or full time study and others.

We will continue the process of monitoring the effectiveness of the learning outcomes of our professional papers. A multidisciplinary team has been formed to proceed with the development of the proposed elective paper in consultation with industry focus groups selected on the basis of the classification shown in Figure 4.

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