

OR case studies effectiveness in developing workplace skills: practically useless?

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An LTSN research project (see Fig 1) conducted by staff at Paisley University has reached the conclusion that including OR techniques such as Linear Programming in business case studies may be inappropriate. In the long term, Business graduates gain a great deal from OR case studies, but not from the specific techniques themselves.

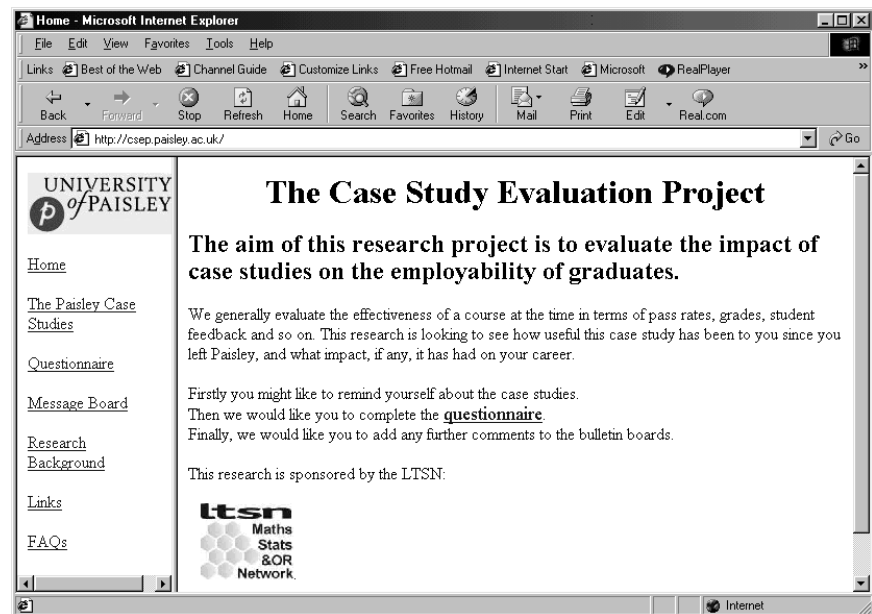


Fig 1 The project web site

Introduction

Case studies have long played an important role in OR courses, both at undergraduate and postgraduate level. The precise nature of these case studies varies enormously - both in method and content. However, the underlying rationale for using case studies is often much the same. Namely, it has always been considered that case studies are important because:

- they improve the motivation of students
- they increase the effectiveness of the learning cycle
- they are effective in developing skills relevant to the workplace

There has previously been much evidence to support the first and second of these assumptions. The aim of this research is to examine the third assumption. That is, to investigate what impact case studies have on the employability and working experiences of graduates, especially with regard to the current state of the workplace. In particular, it aims to identify those aspects of case studies which make the most positive contribution to employability. Based on the outcomes of the study, it would then be hoped to disseminate to the OR teaching community, guidelines and examples of best practice in case study teaching.

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Background to project

Between 1984 and 1995, several hundred Business¹ students undertook an OR module as part of their degree at Paisley. The module included techniques such as Linear Programming and Regression Analysis, and concluded with a major case study, where the students applied the theory to a particular workplace-based problem. One of the aims of the case study was to increase the students' self-confidence in tackling complex, quantitative problems. Most of these students subsequently graduated and have been in employment since.

The investigation has tried to address the following questions:

- What impact did the case study have on their careers? In particular, which of the following skills, do they consider it enhanced: group working skills, time and resource management, general problem solving skills and technical skills?
- On reflection how did graduates feel about the case study and what suggestions would they make for future case study development to improve employability?

The research was based on trying to locate ex-students, conducting in-depth interviews and using a web-based questionnaire.

Analysis

The initial in-depth interviews were used to design a structured questionnaire which aimed to see how the four different skill elements had been used by graduates in their working environment. It also aimed to measure how respondents felt about the case study in retrospect.

The questionnaire began with a brief description of the four main types of skill that the case study had been designed to develop; group working skills, time and resource management, general problem solving skills and technical skills. These short definitions were given up front so that all respondents should have been clear and consistent about the terms.

The first question asked how well ex-students recalled the four skill based aspects of the case study. The results, shown in Fig 2, were in line with the expectation, drawn from the in-depth interviews, that technical skills

would be recalled less well than the other three aspects.

Failure to recall may simply be a failure of memory rather than an indication that the skills had not been used or rehearsed since graduation. After all the respondents would have had a working life since graduation exceeding eight years, so they had in all likelihood done a great deal in the intervening time. Hence the following questions took each aspect in turn and decomposed it into a number of elements. For example, question 5 considered technical skills and asked how often the respondent had been involved in working with large amounts of information, had used numeric data, had used formulae, had used quantitative analysis, had used a large business model and so on. The aim was partly to further define what we meant by these skills and partly to help jog respondents memories.

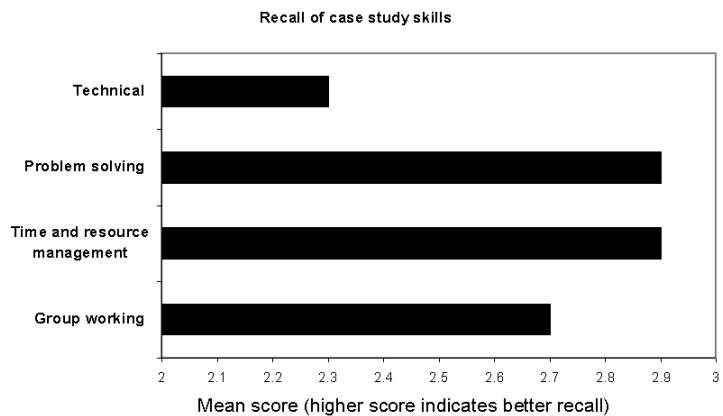


Fig 2 Technical skills were recalled less well than any others

The results indicate that generally respondents, in their working experience, had used their technical skills less than the other aspects. The most used skills were group working, followed by resource management and problem solving skills.

Respondents were then asked to evaluate the four skills in terms of whether they should be taught, whether the case study had enhanced the skills and how important those skills had turned out to be in the workplace. Finally there were a couple of questions on the holistic aspect of the case study, the concept of trying to teach all four skills together.

Significantly, it was the problem solving skills that came out of this evaluation best. They were ranked as being as important to the workplace as both the group working and resource management skills. They were

¹The majority of students were undertaking a Business Economics course although there were a small number taking other more mathematical degrees.

deemed to be the most useful for students and the case study had enhanced these skills more than any other. By comparison technical skills were rated the worst in every category. Respondents however thought that the teaching of all four skills together was a very good idea and had been delivered reasonably successfully.

The first half of the questionnaire had really looked at respondents' cognitive behaviours, what they remembered doing during the case study and in their subsequent work and what they thought about the case study. The second half, by contrast, considered affective aspects, trying to tap into respondents' overall feelings for the case study and its relevance to the workplace. It did this by taking a number of statements made by graduates during the in-depth interviews and asked respondents whether they agreed with the sentiments expressed. There were 25 such statements which could be divided into three sub-scales. The first sub-scale concerned the effect of the case study on the respondent's self-confidence, competence and enthusiasm for quantitative skills. The second sub-scale concentrated on the holistic aspect, the effect of the case study on the self-confidence, competence and enthusiasm for problem solving in a group working environment. The final sub-scale focused on the practicality of the case study, how similar it felt to the kinds of situations and problems encountered in their working lives.

Respondents generally empathised with the holistic aspects of the case study and to some extent the quantitative skills but surprisingly they did not feel that the case study was particularly practical.

Discussion

The project is still on-going and there are expected to be more respondents so the above results are tentative. However two general themes seem to have emerged, both based on apparent contradictions or inconsistencies in the responses. These same themes also emerged from the in-depth interviews so adding some credence to their substance.

The first major theme concerns the contrasting fortunes of the problem solving compared to technical skills. In the first section respondents recalled technical skills less well, they used them less often at work, they thought them less important and less useful. By contrast they reported that problem solving skills were used more often at work, were more important and more useful. They also judged that the case study had enhanced technical skills less well than problem solving skills. So graduates seem to value problem solving skills but not the specific OR or quantitative skills. It seems

somewhat curious then that, in the section on affective reactions, the case study seemed to have generally been successful in increasing confidence in dealing with quantitative problems. While most respondents disagreed with the statement that *'I generally find quantitative /mathematical problems easy'* they agreed that the case study had increased their confidence in quantitative problems, they are not intimidated by tricky technical problems and they don't try to avoid all maths at work. They also tended to agree with the statement *'the more experience I've got, the more I have found it is important to have good quantitative skills'*.

The second major theme to emerge is that the case study was not felt to be especially practical in the sense that it did not mirror the work environment. Respondents tended to disagree with the statement *'the case study taught me more about practical things than the rest of the course'* and also with the statement *'the case study taught me about dealing with real world problems'*. However in both the cognitive and affective sections they did agree that their work experience did include many of the things that they encountered in the case study. They often used problem solving skills in team situations under resource constraints. They agreed with the statement *'we often work on things which are a bit like the case study'* and in particular with *'to do your job properly you need all those things – technical, problem-solving, team-work, time management...'*. Once again there is an anomaly, this time between the fact that the case study does seem to replicate many aspects of working practices but at the same time is not seen as especially practical.

Why these anomalies? Perhaps part of the answer lies in differing conceptions of what constitutes relevant, practical, quantitative skills. In their work environment the sample most often applied straightforward arithmetical and statistical calculations to complex messy problems. In the case study however, students perceived the emphasis to be on the complex techniques, software or models.

This may also help explain the divergence of views between problem solving and technical skills. Maybe business graduates use the way of approaching a quantitative problem they practised in the OR case study rather than the specific techniques themselves. Of course you cannot teach a way of thinking in a vacuum, you need to use some techniques but the question arises, does it really matter very much what actual techniques are used? Do we need to teach techniques such as linear programming and regression to business students? Maybe the emphasis should be on complex problem solving.

In fact could the difficulty of the OR techniques have actually hindered effective learning from the case study and blinded students to the practical relevance of what they were doing? In this respect one must also bear in mind that the respondents to our survey all took their degree over eight years ago. Sadly the general level of mathematical competence of students arriving at University has decreased in the intervening period so that it is probably true that if these students found the technical aspects daunting then current students would find them even more so.

Conclusion

It would seem that specific OR technical skills don't make as big an impact on Business graduates as the other types of skill developed by the case study. In particular, graduates take away from the case study far more lasting and positive views of the problem solving aspects compared with the technical skills. What can be done to enhance the content of the case study to develop more effective workplace skills? Is perhaps the answer to change the balance of complexity from

quantitative techniques to problem solving? This may give a better match with what typical Business graduates (as opposed to Maths or OR graduates) will meet in their working environment.

Our initial speculative conclusion from this evaluation is that it may be more beneficial to develop a case study strand that encompasses an entire course or module, which includes a number of smaller, shorter, more varied, case studies covering a variety of quantitative skills. The focus should be on problem solving, team working and resource management rather than on technical skills.

The questionnaire and examples of the case study material can be found on our research project website <http://csep.paisley.ac.uk> (see Fig 1). There is also a bulletin board on the web site and we would welcome feedback from colleagues both in the UK and elsewhere. We would be particularly interested to hear from those who use OR case studies in their teaching and to hear about your experiences and whether they mesh with our conclusions.