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Practice-Based Learning in Information Systems: The Advantages for Students

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ABSTRACT

An evaluation is made of the impact of work-based experience during a placement year on the academic achievement of Information Systems students. The importance of practice in generating competence and confidence in students on placement has been understood for a long time. However, there has been little evidence that placement makes an important contribution to the primary indicator of achievement at degree level – the degree grade. In this paper we report on a longitudinal study on the relationship between placement and student achievement. Overall, 497 students from three Information Systems study programmes were included in the analysis, two thirds of which had completed a placement. Analysis through parallel lines ordinal logistic regression showed a substantially greater probability of graduating with a first class honours or second class (upper division) for students completing a placement against those who chose not to go on placement. In the large, highly competitive, modern graduate recruitment market, degree grade and recognised employability characteristics may prove vital for graduates pursuing IS careers. Knowledge gained by graduates locally while on placement, combined with transferable skills and a widely recognised, highly valued, certificated degree may give graduates and their employers' critical advantages in the local and global market. Placement student and graduate knowledge is situated in communities of professional practice in IS which may have social consequences in forming a firmer foundation for the intellectual life of a region.

Keywords: Information systems practice, Student placement, Academic improvement, Skills acquisition

1. INTRODUCTION

1.1 Academic Background

Information Systems development involves change, either in the processes or structures of an organisation or the perceptions of those involved with the organisation. During the course of an Information Systems education, students will need to acquire the competence and confidence to make appropriate interventions into the working lives of others. As this skill involves making connections between the mechanisms of information and communication technologies and particular work practices, there is a limit to what can be achieved through formal classroom activities. One way to foster this competence is through experience obtained through a student placement or internship. In this paper we report on a longitudinal study of final examination results of IS university students which suggests that working and learning accomplished in a student placement has a positive effect on degree classification. In discussion we further suggest that this type of engagement represents a crucial aspect of IS practitioner development that is distinct from other fields of academic study.

A second motive for considering the value of the student placement concerns structural changes within the higher education system and within the occupational fabric of the economy itself. "Massification" of the UK university structure - transformation of an elite to a mass higher education system (Fulton, 1996) – has occurred in response to a trend towards increased complexity and a need for skilled workers in the modern world. Between 1979/80 and 1994/95 student numbers in higher education in the UK rose from 12% of 18-19 year olds to 32% (Bolton, 2001), producing a student body that displays far greater social, cultural and aspirational diversity than in the past. These changes need a diversity of pedagogical strategies on the one hand and a requirement for universities to obey market imperatives in order to maintain a comparative competitive advantage.

Career paths for graduates are also now less determined by educational particulars, with "multipurpose" skills taking precedence over the more traditional university model of a narrow mastery of a subject or discipline. Although at first sight it appears that IS has affinities with other areas described as 'field studies', the IS mandate to intervene

means that conventional university in-depth reflective study alone will not lead to full practitioner competence. We suggest therefore that there are phenomena that belong within the IS educational remit that are best apprehended *in situ* rather than as abstract or hypothetical categories. In the final part of this paper we will discuss how institutions may gain market advantage through offering practice-based learning in applied fields such as Information Systems.

The pervasiveness of computing brings with it accelerated change in knowledge and techniques that makes both a 'one-shot education' and a professional career less feasible (Gray 2001). Paradoxically, at the very time when specialized knowledge is at a premium, it also becomes obsolete faster than ever before (Castells 2001), and individuals who want to be viewed as highly accomplished in digital environments will increasingly need to be able to develop and apply themselves across an ever widening range of expertise. This is already apparent as IS practitioners increasingly specialise, while at the same time are expected to reach out to knowledge beyond the narrow confines of that specialism (Schambach and Blanton 2002). This is a fundamental consequence of the spread of computing. The technological infrastructure is becoming increasingly complex, although paradoxically the technology itself is more forgiving, as more and more domains are yielding to digitization.

1.2 Vocational skills

A frequently made observation is that the occupational future of university graduates will be characterized by both uncertainty and variety of work and employment experiences in what are becoming increasingly flexible but frequently interrupted careers (Brown and Scase 1997; Gray 2001; Koong et al. 2002). Henceforth graduates have to be more 'flexible' in their attitudes towards work and more 'adaptive' in their behaviour in the labour market. They require a broader portfolio of technical, social and personal skills than the more job-specific skills which were emphasized in the past. Previously graduates would leave universities to join employers who would train them to exercise specific organizational tasks on the basis of narrow technical expertise. The acquisition of technical expertise has not diminished, but organizations are now demanding that university graduates acquire such skills as part of a broader collection of personal competences (Koong et al. 2002). This is not only a necessary requirement, given the increasing emphasis on team and project approaches to work in innovative organizations, but also because the acquisition of skills is essential for graduate employees to maintain their *employability* in both the internal and external job market. In place of bureaucratic or structured careers, graduates are now required to have the necessary skills, experience and contacts to construct career portfolios, which will inevitably be contingent and unstable (Brown and Scase 1997).

As a result of these trends, employers state a preference for graduates who are able to cope with these new demands. They need employees with good interpersonal skills who are able to engage in 'rule-making' rather than 'rule-following' behaviour, a change characterized by (Brown and Scase 1997) a shift from a 'bureaucratic' to a 'charismatic' personality. These are competences that can be nurtured with appropriate university support to produce a graduate who is "the creator of a new order as well as the breaker of routine order" (Brown and Scase 1997; Stephens and Beeson 2002). As IS specialists often encounter ambiguous and difficult situations which require decision making, this reflexive faculty is probably one of the most valuable attributes that students can graduate with and take into the wider world. This change is motivated not just by the spread of information and communication technologies (ICTs) into non-bureaucratic areas. Organizations themselves are searching for new ways of acting and interacting, and recognise they cannot confront increased complexity equipped with the traditional tools of bureaucracy, control, consistency and predictability. They must find new ways of interacting, such as empowerment, self-directed teams, and organizational learning, as well as exploring how to use new technologies for organisational purposes.

1.3 Practice-based learning

Inherent instability in the modern occupational environment indicates that the main purpose of higher education should be now more generally thought of as being "*to enable students to learn*" (Dimbleby and Cooke 2000). The "enabling" has seen a progressive shift from a teacher-centred to a learner-centred style, such as individual learning programmes, primary learning goals and personal training plans. Employers are also increasingly seeking graduate recruits with a wide variety of skills apart from those associated directly with their subject area. Communication, report writing, ability to manage their time and work in groups (Latham 2000) are highly ranked by employers, apart from specific subject skills, which in the IT sphere could be systems design skills and knowledge of development methodologies. How to best facilitate student learning is part of the academic education debate but "learning by doing", practice or experiential learning (Kolb, 1984), is an acknowledged part of the enabling strategy.

Historically, the notion of practice was embedded in an apprenticeship. All other learning forms directed towards practice are judged against this traditional approach. However, traditional apprenticeships, which were largely confined to engineering and artisan trades, have become unpopular with school leavers. Despite the British Government's attempts to revive the traditional mode of instruction in the workplace (Aldrich 1999) through Modern Apprenticeships (MA) (Saunders et al. 1997) only 15% of full-time students even considered doing an apprenticeship. Within even that small, interested group, many did not take up an MA because they wanted to stay in full-time education to keep their options more flexible (Saunders et al. 1997). On the other hand, many students who took up MAs, and a similar proportion who had never considered an apprenticeship, thought that learning real skills in the workplace was attractive and was likely to be beneficial in terms of job prospects (Saunders et al. 1997).

Traditional apprenticeships may appear to be relatively unpopular but the notion of practice-based learning has been flourishing in several different forms in higher education.

Different ways of increasing exposure to practice under restricted, more controlled conditions have included extended placement or internship for more than six months for many computing and engineering students, problem-based investigations in medical training (Maudsley, 1999), the use of case studies, and embedding practice modules and themes in degree courses. Control in apprenticeship rests with the master who has a clear relationship with the apprentice and the work to be assimilated and mastered. Without a scientific underpinning of some particulars of a profession, mastery could, and actually may, be gained simply from first hand experience. However, as complexity increases much of the scientific and general principles of the profession may lie outside the personal experience of any individual and formalised teaching is needed to augment first hand knowledge (Guile and Young 1999). This leads to a learning format that combines formal classroom-based instruction and work-based experience and it is into this balancing act that practice has been incorporated in many higher education institutes.

Exposure to practice is encouraged by many academics, governments and employers. Practice, as part of an academic programme, usually has higher resource demands which should be justifiable not only because students appear to be interested and be "livelier" (Kamm et al. 2000) but also in terms of academic achievement. Accountability is part of modern governance in most fields (Fry 1995) but there is little evidence beyond anecdotes to fuel the assumption that a good placement leads to a better degree grade. In the short-term, students need to be convinced that these forms of learning are not extra burdens or disadvantageous to one of their primary goals of attending university: namely securing a good honours degree.

However, care needs to be exercised in establishing that it is the experience gained from practice that is possibly of advantage to students who are electing to continue with a placement, and not simply their academic performance in their first and second year subjects. The apparent advantages, in terms of degree grade ultimately gained, could be a mirage created by the system. Good first year results and a strong expectation of the same in the second year might lead these students naturally to apply for placements as this is the expectation of these courses for successful students i.e. the good students go on a placement. Those students having difficulty getting through the first year and who make no apparent improvement in the second year, may not be banking on passing unhindered into a placement or third year of a programme. Lack of academic confidence might also spill over into lack of confidence of a student's perceived worth to internship employers or discontent with being at university and a desire to "*simply finish as soon as possible and get on with the rest of life*" (one response to the questionnaire). For some students, though, these decisions are made on non-academic grounds, such as they are simply mature students who have previously been in employment for a number of years or have settled accommodation and do not want to move to work for a year. This combination of academic and social reasons could lead students to actively select not to go on placement even though they would benefit from it. Alternatively, the apparent advantages a placement confers on final year students, resulting in better grades than non-placement students, might be real i.e. that they significantly improve their performance over colleagues who were similar to them before placement but who decided to take an internship.

Evidence is presented here that placements are highly beneficial for a large sector of students taking degrees in Information Systems at the University of the West of England (UWE), Bristol, UK.

2. MATERIALS AND METHODS

Within the Faculty of Computing, Engineering and Mathematical Sciences at UWE, subject schools have responsibility for degree programmes which are predominantly within their subject domain. For the School of Information Systems, students who follow a programme with two years' full time study at university, followed by a year on placement, returning for a final year of full time study, are termed sandwich degree students. Three programmes with the School of Information Systems at UWE fall within this category. All placements are monitored by a specialist unit within the Faculty and have to be sanctioned as appropriate learning environments by academic staff who visit all placement students once or twice during the placement year.

Graduation notifications and grades attained are made public in July and September. For this study, graduate results were taken from these public notices as the primary indicator of achievement for degree programme students is degree grade. However, degree classification could depend on many other educational factors, such as entry qualifications or placement experience. To control for such variation, second year (i.e. pre-placement attainment) assessment results were gathered from the June Award Board report sheets on all students on these three degree programmes. Degree grade attained was then considered as the dependent variable with second year, June Award Board average results as an explanatory variable. All degree graduates were considered in the analysis, except in a few instances where there had been direct entry to the final year (such as European Union exchange programme students run under the ERASMUS scheme).

Parallel lines ordinal logistic regression (McCullagh and Nelder 1989) was used to model the relationship between degree classification (ordinary, third class, lower second, upper second, first class) as the dependent variable and with average mark at level two (variable AVERAGE) and a dummy variable (X) to represent placement status were used as explanatory variables. Ordinal logistic regression is a well established and highly appropriate generic model to consider in an empirical analysis involving an ordered, categorical dependent variable (such as degree classification) and when potential predictor variables are factors (such as placement status) or covariates (such as average mark at level two). For a general description of ordinal logistic

regression see Agresti (1990). The structural form of the model considered is:

$$\log_e\left[\frac{\tau_{ik}}{1-\tau_{ik}}\right] = \alpha_k + \beta_1 \times \text{Average}_i + \beta_2 X_i + \beta_3 \times \text{Average}_i \times X_i$$

subject to $\alpha_1 < \alpha_2 < \alpha_3 < \alpha_4$. In the above $k = 1$ involving τ_{i1} and α_1 corresponds to a first class honours degree. Likewise $k = 2$ involving τ_{i2} and α_2 corresponds to an upper second or better. Similarly $k = 3$ corresponds to a lower second or better and $k = 4$ corresponds to a third class honours degree or better. In the model τ_{ik} denotes the cumulative probability of outcome k or better for case i (student i). Thus, for instance, τ_{i1}, denotes the probability of student i obtaining a first class degree, τ_{i2} denotes the probability of student i obtaining an upper second or better, τ_{i3} denotes the probability of student i obtaining a lower second or better and τ_{i4} denotes the probability of student i obtaining a third class degree or better. Since probabilities sum to 1, the probability of an ordinary degree for case i is $1 - \tau_{i4}$. In the model, Average_i denotes the average mark at the end of the second year for student i and X_i is a dummy variable to denote whether student i went on placement ($X_i = 1$) or did not go on placement ($X_i = 0$). This model permits an investigation into whether degree classification differs between those that go on placement and those that do not, after taking into account average marks at level 2. Note in particular if the coefficient β_3 does not equal 0 then the effect of average marks at the end of the second year on the predicted cumulative probability of final degree classification differs between those that go on placement and those that do not (i.e. not just a difference between the two groups but also a different relationship between average mark at level 2 and final degree classification). The analysis was carried out using Minitab 14 and SPSS 12.

The reasons why students elect not to apply, or not to engage with a placement in their third year at University were elicited through a questionnaire. The questionnaire was presented to a lecture group in the latter stages (March 2003) of a final year module which was a core requirement for two of the three programmes under investigation, and optional for the third programme, so students from all three programmes were questioned. The questionnaire was designed using a simple dichotomous response profile, with a limited provision for written opinion and feedback to the surveyor (Appendix 1).

3. RESULTS

In the four years between 2000 and 2003, 497 students graduated from the three programmes of study in the School of Information Systems at UWE. During that time, participation in placement by students on these degree programmes steadily declined (Table 1), despite the fact that initially all students on these programmes were registered by default as four year sandwich course students. In the graduation year of 2000, completing a placement had been the accepted progression route by students and academics, with few exceptions, which resulted in nearly 93% uptake. Increasing modularisation and a new set of regulations saw a step change by the graduation year of 2001, where less than three-quarters had completed a placement, and a steady decline subsequently to less than half (48%) for those graduating in 2003. Over the whole period, 66.6% of students had completed a placement before graduating.

Graduation Year	No. Graduating	No. of Placements Completed
2000	99	92 (92.9%)
2001	125	91 (72.8%)
2002	125	77 (61.6%)
2003	148	71 (48.0%)
Total:	497	331 (66.6%)

Table 1. Decline in the percentage of students taking up a placement.

During those four years, 86.5% of students graduated with first or second class honours. Placement students accounted for 87.1% of first class honours awarded, 80.5% of second class (upper division) honours, 41.4% of all ordinary degrees awarded over the four years but only 29.2% since 2000. Table 2 summarises the coefficients of the fitted ordinal logistic regression model and Figure 1 gives a graphical depiction of the estimated predicted probabilities relating to a second class (upper division) or first class degree under the fitted model.

All regression coefficients in the fitted model are statistically significant. An examination of the goodness-of-fit diagnostics indicate that there is nothing to cast doubt on the appropriateness of the model ([Pearson residual test, chi-square = 1380.14, df = 1385, p = 0.532], [Deviance residual test, chi-square = 712.44, df = 1385, p = 1.00]). The degree of concordance between predicted probability and degree classification is 85.9% (Somers' D = 0.72) indicating the model has captured a high degree of structure in the data and Cox and Snell pseudo R-square of 0.505, Nagelkerke pseudo R-square of 0.550 and McFadden R-square of 0.279 indicate the model has good predictive capability. (See Agresti, 1990, for a statistical description of these measures.)

In the above model there is a statistically significant interaction between average marks in the second year and placement status on final degree classification ($Z = 3.61$, $p < 0.001$) i.e. there is strong statistical evidence of a difference in the effect of average marks in the second year and final degree classification between those that go on placement and those that do not.

Under the fitted model the odds ratio for average marks in the second year for those not going on placement is 1.18 (95% confidence interval being 1.14 to 1.22). Under the fitted model the odds ratio for average marks in the second year for those going on placement is 1.28 (95% confidence interval being 1.23 to 1.32) and these differences are statistically significant. By way of illustration, Table 3 gives the predicted probabilities under the model of obtaining a second class (lower division) or better and a second class (upper division) or better for a selection of second year average marks for both placement students and non-placement students.

The questionnaire yielded 42 responses: 23 final year students had gone on placement and 19 had not, although the

Predictor	Coefficient	Standard Error	Z	Significance (p-value)	Odds Ratio
α_1	-13.5548	1.05256	-12.88	<0.001	
α_2	-9.77512	0.98441	-9.93	<0.001	
α_3	-6.22361	0.89439	-6.96	<0.001	
α_4	-5.02813	0.87742	-5.73	<0.001	
Average	0.16348	0.01851	8.83	<0.001	1.18
X	-3.76586	1.18647	3.17	0.002	0.02
Average x X	0.08171	0.02264	3.61	<0.001	1.09

Table 2. Parameter estimates for the ordinal logistic regression model.

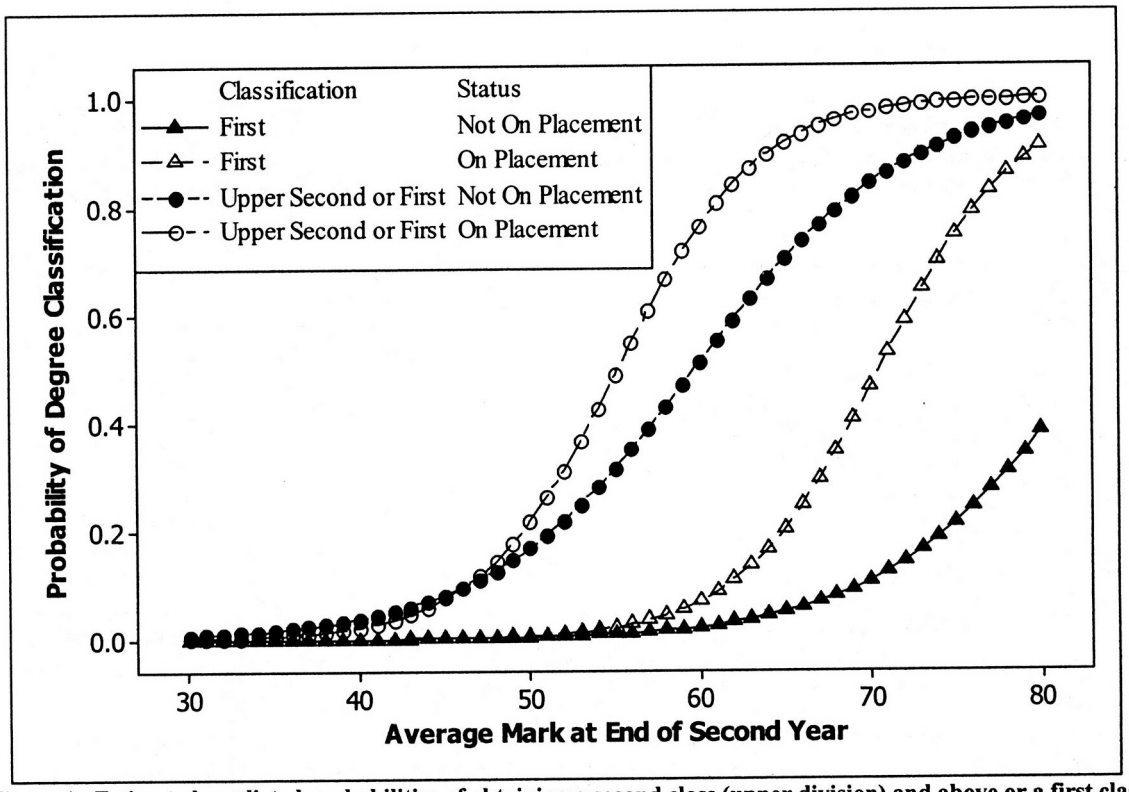

Figure 1. Estimated predicted probabilities of obtaining a second class (upper division) and above or a first class honours degree according to second year average marks and whether a placement has been completed.

	Probability of a second class (lower division) or better		Probability of a second class (upper division) or better	
Second Year Average	Study without Placement	Study with Placement	Study without Placement	Study with Placement
45	0.756	0.740	0.082	0.075
50	0.875	0.906	0.168	0.217
55	0.941	0.971	0.314	0.486
60	0.973	0.991	0.508	0.763
65	0.988	0.997	0.701	0.917
70	0.995	0.999	0.841	0.974
75	0.998	0.999	0.923	0.992

Table 3. Predicted probabilities of a second class (lower division) or better, and a second class (upper division) or better under the fitted model (95% confidence intervals for all these values are in Table 4 in Appendix 2).

latter included four part-time Computing students who only attended university one day a week so were already working most of the time. Effectively, therefore, there were 38 full-time respondents and 60.5% had done a placement, which is close to the overall partition of placement to non-placement students among UWE IS graduates in the period 2000 to 2003. All respondents who had completed a placement thought they had benefited from doing it and the vast majority of them (minimum response 69.6%) thought they had or would benefit from the placement in terms of their final year results, their immediate financial circumstances and their future career. Even though some respondents were not convinced they had benefited across the board from the placement, they all recommended that other students should take a placement.

Among those 15 students who did not go on a placement seven indicated that they were unable to take a placement - the other eight indicated they had chosen not to do one. Two of the eight students actively choosing not to go on placement thought they would change their decision concerning placement if they had the chance again. Eight of the 15 students not going on placement regretted that they had not chosen or been able to do a placement. Altogether, every sandwich student thought future students should do a placement and half of those that had elected not to complete a placement also thought the same. The main reason given for not choosing to do a placement was that they wanted to finish their degree as soon as possible.

4. DISCUSSION

The fitted regression model produces a simple interpretative and succinct description of the sample data by capturing the broad observable trends. It is clear from Figure 1 that for all students achieving an average second year mark between 50% and 78% there is an advantage to going on placement and receiving practical training in the subject domain. For students achieving an average mark of 60% in the second year (the threshold between the lower and upper divisions of second class honours degrees) the probability of graduating with a first class honours or second class (upper division) is substantially greater if they have completed a placement (probability = 0.75) than if they have not (probability = 0.50). For high achieving level 2 students, with an average second year mark of at least 70%, the advantages of completing a placement year are still beneficial but diminishing (down to 0.13) and continue to decline the higher the achiever.

On the other hand, for lower achievers in the second year of an Information Systems course at UWE there was apparently no academic advantage to going on placement. For students who consider themselves to be below the second class honours degree band, and whose second year results appear to confirm this, then final degree grade improvement is unlikely whether they go for a placement or not. However, even though academically there seems little justification for advising such low achieving students to apply for a placement, other opportunities can be important (Harvey et al. 1997), particularly job offers (over 80% of jobs in two Internet recruitment databases sought experience even for new hires (Koong et al, 2002)), increasing communication skills in a working environment and understanding of employment roles and characteristics.

In a verbal and participative, in-class survey of 109 UWE students from all three years on campus, opinions were canvassed concerning what becoming a graduate was about. All years agreed that the "certificate" – the degree - was an important goal, as well as gaining subject-specific knowledge and getting a head start on a good career. It was clear from student responses that certification was not just having a piece of paper but the recognised quality of the degree. This was reinforced by their explicit statements about "good" careers, rather than an opening in the job market. The results of this analysis indicate that furtherance of such aims and aspirations can be better obtained by students engaging in practice through a placement, rather than completing their degree programme in the shortest possible time.

Massification (Fulton 1996) of higher education in Britain during the 1980s has changed not only the numbers but also the profile of the students. Full-time home student numbers increased from 451,000 in 1979 to 563,000 in 1988 (Williams 1991). At the same time part-time students grew from 268,000 to 377,000, accounting for 38% of all students enrolled in the later year. The increasing number of graduates in the UK can only increase competition for jobs in all sectors, and practical experience as well as academic certification will be required to get into sustainable careers. The part-time route through higher education can successfully tie in employment and practice with academic training. It appears that sandwich courses offer a valuable, full-time alternative, leading to success particularly in academic terms but also probably in professional qualifications.

Professionalism is a combination of knowledge and practice, which has in the past been achieved through some form of apprenticeship. The "academisation" of professional knowledge means that examinations seldom test professional practice, even if they test the underlying subject material and theories. The problem has been compounded by moves towards modularisation and division of professional courses into separate credit bearing units. Decision making in a professional situation usually involves applying a wide range of integrated information gathered from experience and propositional knowledge (Eraut 1994). Modularisation often does not encourage integration of professional knowledge because of a mismatch between actual practice and the small packets of often inappropriate, credit based, highly partitioned information. The necessity of re-engaging with practice to ensure a measure of professional competence at the time of career recruitment or registration has given rise to new varieties of investigative study or experiential learning. One of these, more fashionable, approaches has been problem-based learning (PBL), first adopted by McMaster University in Canada to teach medical students over 30 years ago (Camp 1996). The "purity" of PBL can be debated but should be active, problem-centred, student-centred,

collaborative, interdisciplinary and integrated learning, usually accomplished in small groups of 5-10 students (Camp 1996).

Since McMaster began teaching using PBL the basic structures of higher education in the UK have changed little but the attitude to learning and teaching has. Whilst there has been a degree of "not wanting to miss the boat" reasoning behind adopting PBL in higher education, a driving force in its adoption has been constructivism in learning. The learning interface has formerly principally been one of "I tell, you learn" which has largely led to an "imitation" knowledge - knowledge which has application only in a very limited sphere, mainly that within the examination-assessment environment of higher education, not the world outside the confines of university. The core of constructivist principles are interaction with the environment, stimulation of learning through cognitive conflict and the evolutionary nature of knowledge through social understanding and negotiation (Savery and Duffy 1995). These principles fit well with learning in modern higher education through problem solving in an interdisciplinary context and attempt to answer Ramsden's plea: *"Why do students so often obtain quantities of knowledge, yet fail to change their understanding of what it means?"* (Ramsden 1992, p39). Perhaps the real advantage of completing a placement for Information Systems students at UWE is simply that they have a much clearer understanding "*what it means*".

It remains to consider the role of placement-based learning in the emerging mass higher-education environment. Our study suggests there are clear benefits for a certain class of student, but this alone may not be enough to convince policy makers or warrant institutional support. A diversity of teaching strategies introduces economic and administrative burdens that will probably need more than just pedagogic justification, particularly as university expansion is often assumed to deliver economies of scale. Some related departures, all seen as a consequence of globalization and the diffusion of ICTs throughout the workplace and society, lend support for the adoption of placement-based learning. Goddard and Cornford (2002) argue that globalization means the local environment becomes at least as significant as the national macro-economic environment in nurturing industry that can compete globally. The local availability of knowledge and skills will be critical to local comparative competitive advantage in the global economy, and regionally engaged universities will be a key structural economic asset. Goddard and Cornford consider the universities' role in the 'knowledge economy' to be servicing the local economy by responding to changing skill demands, lifelong learning, building links between research and teaching and engaging with end-users.

Student placements and extended coupling to workplaces (Agre 2000) begin to fulfil this requirement. Much of IS learning is most effective in real world situations, but the university can also provide a sanctuary for more detached analytical thinking and innovative intellectual work. This duality of engagement and detachment could be facilitated in both directions by ICTs and give students far greater discretion over the direction and pace of their learning. This may be attractive to the students are not too sure what they are doing in higher education, and to those who do not wish to incur long-term debt. Again, this would strengthen a university's regional presence, which is probably the institutions' best comparative advantage in an education market.

The student placement can be seen as one component of the 21st century university's contribution to the information society. As part of their degree programme the student is initiated into communities of practice and regional networks based on professional practice in IS. Well designed and administered computing networks may make it easier for universities to maintain existing work-related networks, and also increase the institutional incentive to invest in building such networks (Agre 2000; Gomez et al. 2004). Such networks would necessarily be cross-disciplinary, but converge on the idea of communities of practice that have an investment in work-related ICT. Ideally, such networks could provide the foundation for the intellectual life of a region, and also the basis for a market in continuing education.

5. CONCLUSION

Internship or placement for students studying Information Systems has significant academic benefits. In an increasingly competitive graduate recruitment market, degree grade is likely to become more important, possibly to employers but particularly to the graduates themselves. Complex working practices and environments require individual practitioner self-confidence in order to work flexibly and productively, learning new skills and adapting established talents. Demonstration of these abilities can be gained on placement and recognised academic success, in attaining a second class upper division degree, or better, is a confirmation of these talents, a transferable certificate of a successful student. The provision of practice in undergraduate degree courses in the UK continues to be under threat because of per capita resource constraints and modularisation of courses, which makes an integrated approach to Information Systems learning difficult to achieve.

The results here indicate that efforts to maintain placement opportunities and increase the exposure of Information Systems to practice are beneficial to both their perception of the realities of the subject but to their academic careers and, probably, their long-term careers. However, there are a number of limitations to these findings. We cannot discount the possibility that placement students do better in their final year compared to their colleagues who go directly into the third year because they are simply a year old, another year more "mature". We are also unsure whether such academic improvements would be found on postgraduate programmes of study.

These findings were not the result of an experiment: there was no "control group" selected not to go on placement so

there is the possibility that more able students respond better to encouragements to do a placement and respond well again to the stimuli in the working environment. More importantly, though, we cannot be sure that gaining a good degree grade, having attended placement or not, translates into a good graduate with the skills and confidence to be successful in the working environment. This is a research area which will be the subject of further work in a long-term study.

6. RECOMMENDATIONS

The notion of apprenticeship is out of favour with students with academic ambitions. Practice-based learning, internship and placement are essentially modified forms of apprenticeship but need to be labelled in these new guises to remain attractive to modern students. For practitioners, though, it is essential to recognise that apprenticeship still matters and exposure to practice is important. Courses in Information Systems should have a focus on practice and expose students as much as possible to the complexities that entails. Controlling the conditions of Information Systems practice, for learning as well as assessment purposes, is the challenge, but should not be abandoned simply because practice is difficult to incorporate in a highly competitive Higher Education market and placements become difficult to find when the ICT business environment periodically slumps. The creative application of new learning methods can help alleviate such difficulties but ultimately learning by doing in Information Systems appears to yield good graduates.

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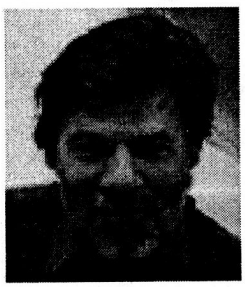

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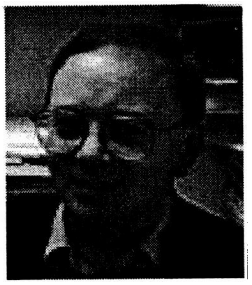
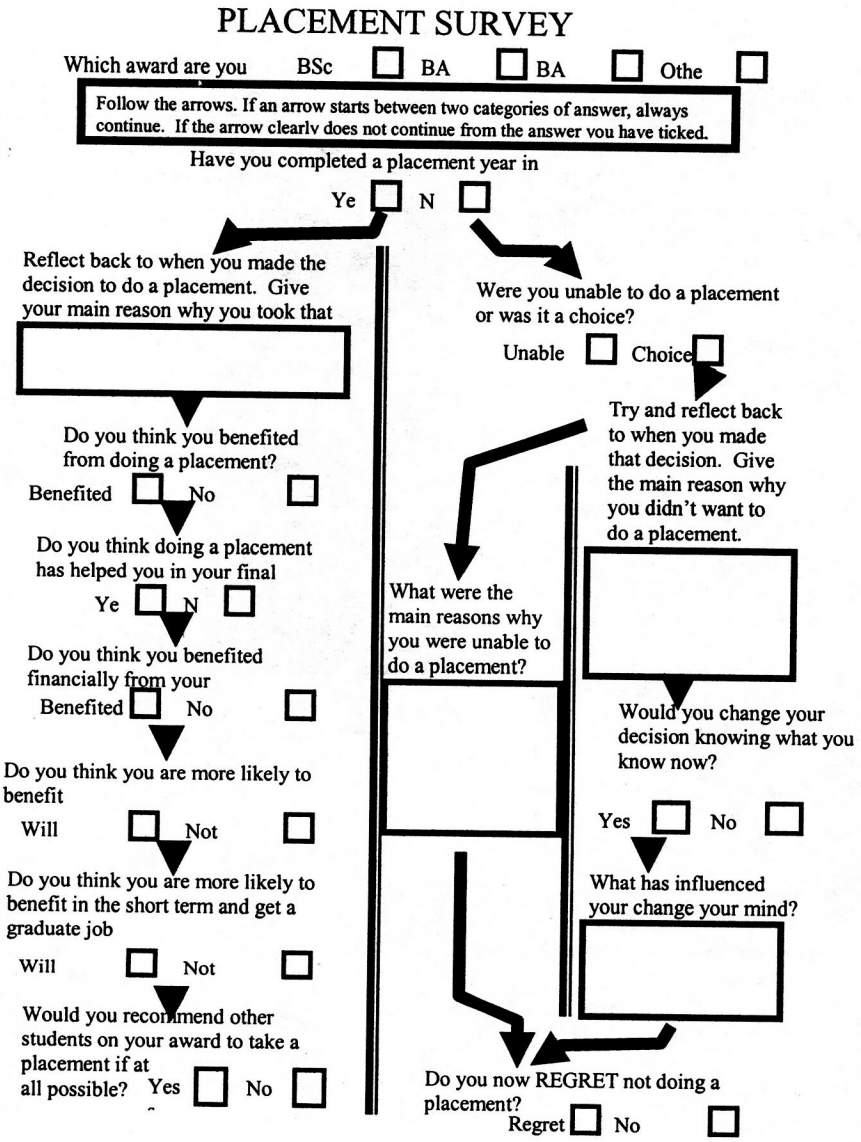


Paul White is an applied statistician providing statistical support to researchers at UWE through collaborative research, staff training, data buddy support and supervision of statistics students working in research teams. Paul holds a PhD in statistics and teaches statistics and research methods to both under- and post-graduates. His external consultancies arise as a member of Applied Statistics and Quantitative Methods Consultancy Unit at UWE.

Robert Stephens holds a PhD in information systems and teaches in the Information Systems School at UWE. He is Director of the Community Information Systems Centre at UWE and has research interests in social informatics.

APPENDIX 1.



APPENDIX 2.

Second Year Average	Probability of a second class (lower division) or better				Probability of a second class (upper division) or better			
	Study without Placement		Study with Placement		Study without Placement		Study with Placement	
45	0.666	0.829	0.653	0.811	0.054	0.122	0.050	0.111
50	0.830	0.910	0.868	0.934	0.123	0.225	0.169	0.275
55	0.917	0.954	0.955	0.980	0.239	0.398	0.421	0.552
60	0.958	0.983	0.985	0.995	0.396	0.619	0.670	0.817
65	0.979	0.933	0.994	0.999	0.566	0.808	0.874	0.945
70	0.989	0.997	0.998	1.00	0.717	0.917	0.953	0.985
75	0.994	0.999	0.999	1.00	0.830	0.967	0.983	0.996

Table 4. 95 percent confidence intervals for the predicted probabilities of a second class (lower division) or better, and a second class (upper division) or better under the fitted model.

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