Work-Based Learning: Effectiveness in Information Systems Training and Development

David Walters, University of Central Lancashire, Anthony Greenwood, St Martin's College, Robert Ritchie, University of Central Lancashire

Abstract

The ability to use methodologies is an essential ingredient in the teaching of Information System techniques and approaches. One method to achieve this is to use a practical approach where students undertake 'live' projects with local client organisations. They can then reflect on the approach adopted with the aim of producing a 'reflective methodological practitioner'.

This paper focuses on the use of experiential learning in a modular course at the University of Central Lancashire to produce these 'methodological practitioners' and is based on the experiences of the authors in running this module. A model is presented which outlines three viewpoints of the project. This is in line with a 'soft systems' perspective in analysing the three views of the project or problem situation. It reports the results of investigations into one of those viewpoints [that of the students]. This is approached by a survey undertaken amongst students to obtain their views on the determinants of project success and failure.

Introduction

Previous research (Greenwood et al., 1997; Walters et al., 1999; Greenwood et al., 2000) has presented an overview of a 'live' information systems development project module. The module uses student-led group work as the primary focus for teaching and learning about information systems development. The principal aim is to engage the student in the context, processes and practicalities of information systems in real-life situations and improve their understanding of many of the 'softer' issues influencing effective systems development.

Prior to undertaking the group project, students complete an individual twelve-month sandwich placement. As with many New Universities, the University of Central Lancashire (UCLAN), concentrates on transferable skills and helps students develop attributes necessary for this skills development to take place. This dictates much of curriculum development and all modules are expected to contain some element of skill transferability. The sandwich placement does not necessarily

involve information-systems development but does equip students with the experience and transferable skills on which the group project builds.

Once in the final year, Business Information Technology students undertake projects in local 'client' organisations, working in groups of three or four members. This builds on students' placement experience and additionally presents them with the challenge of working reflectively in a small group of peers on a bounded project with a specific emphasis on information systems development. Furthermore, the project takes the place of a dissertation on the course, so it has to meet the intellectual as well as practical needs of the curriculum (QAA, 2001).

These projects create some complexity in the assessment process due to the different perspectives of the three parties involved, the students, clients and lecturers. For the client, a good project outcome may be measured in terms of their objectives and perspectives. This does not necessarily lead to the award of a good grade, where effectiveness is measured in terms of academic objectives and perspectives. The client view and the academic view do not necessarily correspond.

This paper initially develops a model articulating the three primary views or perspectives of the project. The project itself is divided into three components, problem area, project activity and project management. A matrix is constructed using these three components and the three perspectives, detailing the expectations from each stakeholder in the process. The focus of attention is then directed towards the student's perspective. This perspective is examined initially at a conceptual level then subjected to an empirical evaluation. The results of the empirical investigations into the learner's viewpoint are presented with an analysis that evaluates their views on the determinants of project success and failure. The students are concerned about the impact that group working has on their final grades and the influence of tutor and client perceptions of their performance. Observations on the contribution of this research to improving the learning outcomes and experiences in this type of learning situation are provided.

The learning context

The overall learning objective is to ensure that students develop the ability to deal with real life Business Information Systems problems. One approach to this is the engagement of students in the analysis and development of real-life practice-based systems. As far as possible, such projects attempt to replicate information systems development but within

an educational paradigm. As with a real systems development project, the outcome can be ambiguous and unclear (Curtis et al., 1998) and can change during the life of the project (Rolskov, 1990). Information-system problems require concrete experience. This concrete experience would best take place if the students could be involved in 'live' projects, which can enable them to use both their business and Information Technology skills. In essence, what we are attempting to develop is a reflective information systems practitioner (Schön, 1983) with strong business, technical and academic skills. Groups of students are therefore expected to approach their projects professionally and to draw upon the full range of resources they have mustered during the course.

In developing the project module, the course team drew on the 'reflective practitioner' work of Schön (1983) and Kolb's (1984) 'cycle of experiential learning'. Kolb's theory has a wide range of applications including helping students become self-aware (Bradbeer, 1999) assisting staff to become reflective teachers (Burkill et al., 2000) and it is this reflective area that we are most concerned with. Kolb's four learning cycle stages of concrete experience (CE), reflective observation, abstract conceptualization and active experimentation, allow for action to be followed by reflection. The cycle may be entered at any point, although the stages should be followed in sequence.

Kolb (1984) describes the learning process from an individual perspective and as an individual process. The project we are dealing with here is group-based and it is important to be aware that the students share experiences and may also reflect collectively as well as individually. This echoes the work outlined in Nonaka and Takeuchi (1995) .

On the module, students first gain the concrete experience of undertaking a live project. This involves meeting with the client, setting out a Terms of Reference and undertaking the usual activities associated with information systems development. They then reflect on that experience together with their previous experiences on the course as a whole. It is intended that this reflection causes the integration of the theoretical and practical components of the course. In terms of the learning cycle approach, this reflection provides feedback, which is the basis for new action and evaluation of the consequences of that action. Students may have the opportunity to iterate around the full cycle; we will see below how this is encouraged by the use of formative assignments though there is not always the opportunity within the project to do this.

In addition to the 'technical' learning objectives, there is a need to develop the higher level skills which students need if they are to be prepared for work in a systems environment and if they are to learn how to apply methodologies to the development of systems. Following Hunter and Beck (1996) and Mathiassen (2002), students are required to:

- Develop a professional attitude and an ability to communicate

- Gain knowledge of the techniques of systems analysis and development

- Display an understanding of how to select and apply them

- Show an appreciation of how/why/when/whether a methodological approach leads to a better outcome

- Appreciate the dynamics of organisational structures, systems and processes

- Develop skills in managing different and often conflicting requirements

The module aims to develop both these technical and behavioural skills in the live project situation. Students are expected to consider the applicability of information systems techniques and the approaches learned throughout their degree course. As far as possible the students are encouraged to follow a rational development process (Parnes and Clements, 1986), rather than construct their own development process. This is an important issue as the use of an appropriate methodology in systems development is seen to be an important ingredient for the successful implementation of an information system (Avison and Fitzgerald, 2002). Students need to act as 'professionals' as they are working with clients external to the university and will be doing so once they leave the university and enter full-time employment. Reflection can be important in developing professional conduct. Macfarlane (1998), when writing about reflection in the context of the study of law, suggests that

'A reflective model encourages the development of both cognitive and affective theories of moral and ethical behaviour, challenging students to integrate these into their personal belief systems as a result of their experiences instead of (at best) passively absorbing the "rules" of professional conduct.'

Students on these projects are working with clients in different

situations, and that requires a particular flexibility of mind and range of responses. Schön (1983) claims that if you are dealing with a situation in which the boundaries are likely to change, there is a need for alternative strategies with which to cope with the situation. Schön used the terminology 'swamps' and 'high ground'. In the high ground, certain fixed situations can be approached by applying technical knowledge and skills. This is most often the case when the student applies the taught components of the course to standard, structured assessment processes. Dealing with clients requires 'reflection-in-action' and the situation is more often 'messy' than clear-cut, or as Schön termed: 'swampy'.

Eraut (1994) maintains that we should break down evidence of capability into three areas:

1. Knowledge and understanding of concepts, theories, facts, rules and procedures which underpin current practice.

The students gain this from the first three years of their course but only apply it, to a greater or lesser degree, in their placement year and not as a 'professional system developer'.

2. The personal skills and qualities required for a professional approach to the conduct of one's work.

3. The cognitive processes that constitute professional thinking.

In deciding how to carry out their project, student groups need to investigate the methodologies and techniques available to them and the appropriateness of these to their particular project. In doing this they need to think clearly about how they should choose a particular approach.

The student groups are expected to show a wide range of cognitive behaviour as they undertake their projects, in order to demonstrate that they are integrating the material taught on the individual modules that make up the course. For example, they are normally required to operate relevant software, which in addition to its psychomotor requirements demands comprehension and application (Bloom, 1964) of the documentation and the environment within which the software is being used. Similarly, they are expected to operate information systems development techniques, though in addition they must show analysis and synthesis skills as they break the situation down and then assemble an appropriate approach.

All projects involve dealing with a client or client group. This is an extremely important part of the systems methodology learning process as a methodology is not an isolated concept but something used in conjunction with a client, within a client organisation.

Prior to undertaking the project, students have a grasp of the relevant techniques and tools but this does not equip them to understand or respond to the political and social environment within which information systems are designed and developed. The experiential learning approach facilitated by the short work-based projects aims to provide an opportunity for students to move from skills and knowledge to the understanding and appreciation of the issues.

In essence, by using a more methodological approach to their project, we as academics would expect a more successful outcome of the project and for the learning that should take place to be of more use in a later practical environment.

Project viewpoints

The project has certain similarities to the systems development process itself. Like this process, it is an alliance between the interested parties, which can sometimes be an 'unholy alliance' (Brooke and Maguire, 1998). Three major viewpoints of the project activity are identified, see Figure 1. There is the view that the students have of the project, the view that the project client has and the view that the academic tutor has.

It is argued that the academic, the client and the student (self or peer group) will have very different views of the project activities and outcomes (Checkland and Scholes, 1990). In Soft Systems Methodology terminology, this is a 'conflicting situation'. A client might be delighted with a computer system that meets many current requirements irrespective of how the analysis or design was done. An academic might wish to award a high grade to something that did not progress beyond the feasibility study stage but was done well, even though the client does not have the complete required system. Students may be keen to reward the hardest working members of the group irrespective of the purpose or outcome of the effort. Students often see the most important element of the project as producing a workable or 'neat' piece of software. This can be at odds with the academic viewpoint which although concerned with product, also is very much concerned with process and learning outcomes. Equally, such a solution may not meet the client needs of minimum cost and maximum functionality. In essence, all three

stakeholders in the process have different objectives and outcome expectations which may often appear incompatible. Equally, the different stakeholders may employ differential measures in relation to assessing the effectiveness or success of the project outcomes. The nature and scale of such differences are explored in more detail.

Within any project undertaken by the students there are three areas of activity:

1. The problem area: what the project is actually about?

2. Project management: how the project and the group are managed?

3. Project activity: the activities involved in completing the project.

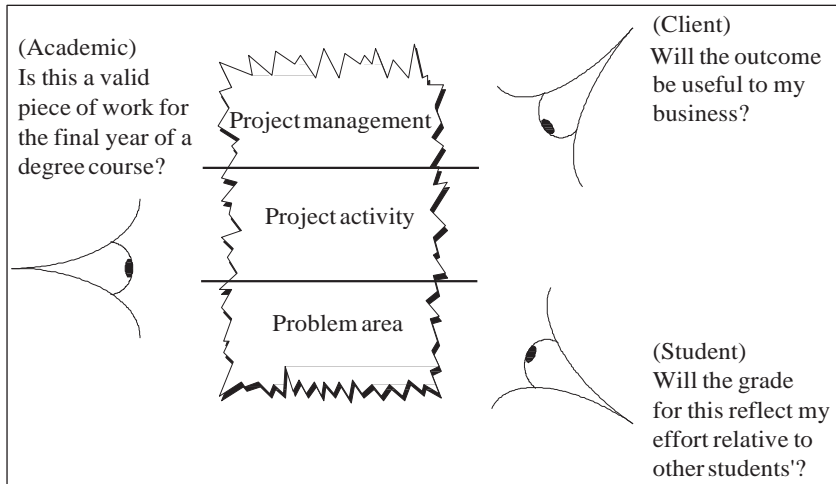The differing viewpoints related to projects can be summarized in Figure 1 below:

Figure 1 Project Viewpoints

In this paper we are largely concerned with the student viewpoint of project activity. It is incumbent on academics and students to recognise that there are different viewpoints of the activities of the project, especially the assessed activities. They must also be aware that staff in the client organisation may have several different viewpoints. Further, the client is unlikely to regard the academic or student viewpoints as having little more than curiosity value. Hence, the student has to recognise and potentially address nine sets of issues:

	Problem area	Project activity	Project
Client view	Students undertake investigations to identify a useful client view of the problem area	The client must be satisfied that the project is being undertaken professionally	The client must be satisfied that the project will be undertaken on time and within budget
Academic view	Students must explain the problem area to an academic audience. Although this can be artificial, the audience can be cast in the role of somewhat distant project managers	Students have been taught how to undertake a formal systems analysis and are expected to select and attempt to apply appropriate techniques	Students are taught the rudiments of project management. They will find it very difficult to apply techniques in an unknown area but are expected to explore this
Student view	Students are expected to reflect on the way in which this develops as the project progresses.	For example, students are often concerned with how project activity will result in a good grade.	Students are generally good at identifying where and why projects went off course.

The student view of project activity

This aspect of the students' work seems to cause the most problems when it comes to assessing the work of the students in their project. The table above puts forward:

- a client view, that projects must be undertaken professionally;

- an academic view that the use of appropriate techniques taught on the course, both technical and behavioural contribute, to a project that is in some sense 'better' than a project that is lacking in these components. This is reinforced by the view that Kolb's (1984) 'cycle of experiential learning' is reflected in the project process itself.

If we accept these then the primary student view or aim is obtaining a good grade for the work. The student, however, is embarking on a time-constrained project in (normally) a new area with an unfamiliar client. It is therefore natural for students, particularly those with activist learning styles, to use ad hoc techniques to produce an early result for the client (Gibbs, 1988). One of the key functions of any formative assessment must be to encourage students to reflect on the project activities they have undertaken to date. Then they can take well-informed decisions about how to proceed further.

Student perceptions of group work

This section reports the results of a survey undertaken amongst students concerning their views of the determinants of project success. The intention was to identify those aspects of the project work which the students regarded as important, focusing on what makes a good project, what makes a good group, what makes a good client, what makes a good tutor and what gets a good grade.

Methodology

There appears to be an absence of prior work in this particular area. Although it is possible to develop perceptions of the student's viewpoint or lecturer's viewpoint it was not considered appropriate to formulate and test specific hypotheses at this stage. The primary methodology was exploratory, hence a number of issues were identified for use as the basis for a questionnaire based survey. Informal discussions and focus groups involving students and staff were employed initially to identify these issues prior to developing the questionnaire.

During the first stage, informal discussions took place with groups of invited students in order to identify issues which concerned them. The discussions were chaired by two of the authors, one of whom led an open-ended discussion while the other summarised the discussion at intervals and suggested items for further discussion.

These preliminary discussions identified important elements from the students' perspective and highlighted the areas that they considered were significant for the success or failure of their project. It also enabled us to identify several categories of questions, such as project, tutor, client and assessment. These initial discussions also enabled us to frame the questions that seemed to elicit the greatest importance for the second-stage questionnaire.

At the second stage, a series of statements was presented to all the students on the course in the form of a take-away questionnaire. There were 46 statements grouped under six subheadings. The first four headings were: what makes a good project, a good group, a good client and a good tutor. The other sections concerned the way in which success is measured and the evidence which should be used when setting grades.

Results

Students were asked to indicate the strength of their agreement with the statements using a five-point scale. Forty students responded to the questionnaire, representing approximately 80 per cent of the cohort. The results were elucidated by calculating the cumulative frequencies of responses to each question along the 'strength of agreement' scale using Microsoft Excel. The statements below (Table 1) all attracted strong agreement. In the table below, a four relates to very strong agreement and a zero relates to very strong disagreement. It is also worth noting that all the statements in Table 1 attracted no disagreement.

Table 1	Frequency (%)				
	4	3	2	1	0
A good group contains a range of skills	60	35	5	0	0
A good group has members who are reliable within the group	55	15	25	0	0
A good group has members who are reliable in dealing with the client	55	35	10	0	0
A good group has members who are available to each other	65	30	5	0	0
A good client is available to students	50	35	15	0	0
A good client has clear requirements	50	40	10	0	0
A good tutor has an understanding of students' academic responsibilities	50	35	15	0	0

It is notable that students value reliability and availability, characteristics which might be taken for granted in a commercial setting. Students also consider that a 'good client has clear requirements' even though the

taught part of the module stresses that clients rarely have clear requirements and that, from an assessment point of view, it is probably easier to get a good grade when the analysis stage of the project is non-trivial. Nonetheless, it is unsurprising that students want a clear briefing followed by a sequence of project activities unencumbered by the absence of colleagues or the client.

The statement about tutors understanding students' academic responsibilities appears rather odd on its own, but it was included for symmetry with the questions about the client. It is surprising that this statement attracted any disagreement at all, though possible explanations include:

- Some students finding the expression of the question difficult to understand, and therefore being uncertain as to whether or not they agreed with it in the project context.

- A belief that academic considerations are a side-issue in a live project environment and that the tutor's proper role relates to personal and practical support of team members.

- A call for tutors to be aware that students have other work to complete and deadlines to fulfil and thus there will be times when the project takes a 'back seat' as far as other work is concerned. There is indeed a risk that the project comes to dominate the course, in the minds of both students and tutors, given the sensitivities of dealing with external clients.

It is likely that many of the statements encompass a range of issues, and that some of the ranges overlap between statements. For example, four statements (Table 2) attracted a particularly wide range of responses.

These were:

Table 2	Frequency (%)				
	4	3	2	1	0
A good group includes a mixture of genders	5	40	25	10	20
A good client has an understanding of system design methodologies	5	20	40	20	15
The quality of group work can be measured by lack of complaints to lecturers	20	45	20	5	10
The client's view of students' individual effort is important in the setting of grades.	5	15	50	20	10

Students had differing views on the importance of having a mixed-gender group. It is possible that attitudes vary according to whether or not the student is currently working in a mixed gender group. The range of responses concerning client awareness of system design methodologies could be accounted for by variations in the nature of the projects being undertaken. Alternatively, students may regard client knowledge as a complement to (or a substitute for) knowledge within the group. Thus, a group with a preference for a methodological approach may have a different attitude from a group with a stronger preference for ad hoc techniques.

The other two questions that attracted mixed responses were phrased in a more complex manner, so in addition to variations caused by present or past experience; there may be an 'error' factor involved, in which more students than usual may have given inaccurate responses. The questions also share a somewhat negative connotation: the presence of the word 'complaints' may colour the responses, and there may be an implication in the 'client's view of students' individual effort' that individual effort itself is important but neglected.

When the individual subsections of the questionnaire are considered, it is possible to obtain an overview of students' responses under each

heading. In addition, their presence in the questionnaire intentionally steers students' understanding of the context of each group of statements. Each group is now briefly considered in turn.

What makes a good project?

Three factors were considered important: the opportunity to practice skills learned on the course, a client that is easy to work with and support from the tutor. Awkward clients, although a common phenomenon in practice, is always seen by students as a major problem in conducting a successful project which can interfere with the rest of their studies. Having a client who is not easy to work with puts pressure on students that they can find it difficult to cope with in the final year of their degree. This can be compensated to some extent by careful and considerate help from tutors. It is likely that the importance of the supervisor increases as the 'awkwardness' of the client increases, and it is noticeable that these were the two factors selected by the students. 'Awkwardness' here relates to situations where clients are difficult to contact, ignore students' emails or phone messages, or continually change their requirements.

What makes a good group?

This category attracted the strongest views of students, so it was indirectly discussed above when reviewing the points of strongest agreement. The concentration of strong views under this subheading may suggest that students see the group work aspects of the group project as being its most significant feature. It is certainly one of the key distinguishing features between the group project and most of the same students' sandwich placement experiences.

There was strong support for the statement that 'a good group contains a range of skills'. This is not surprising as each project requires the group to display a range of both technical and behavioural attributes, and this is reflected in the assessment process. Also, as noted more expansively above, students are particularly concerned about the reliability and availability of colleagues.

What makes a good client?

The statement that 'a good client has clear requirements' attracted strong support. This is notable given the attention that is paid in the course to the elicitation of client requirements. Again, there are various possible interpretations of this response. It may be that students simply appreciate being told exactly what to do, or it may be that students have

encountered problems during the course of the project as the clients' requirements naturally evolve. In either case, one possible implication is that students focus on the outcomes of a project even though the teaching on the module, and on the course as a whole, focuses on the process of undertaking the project. This is borne out by the importance that students attach to the clients' understanding of their academic responsibilities, which may indicate the students' awareness of the possible tension between the clients' requirements for a useful outcome, and the tutors' requirements for an academically rigorous approach.

What makes a good tutor?

As noted above, the statement attracting the strongest response from the students in this section was the tutors having 'an understanding of students' academic responsibilities'. Additionally, as with the client issues, students attached importance to the availability of the tutor and (to a lesser extent) the clarity of the tutor's requirements. The requirements of individual tutors are legitimately less relevant to students than the formal requirements of the module, so some equivocality here is understandable.

Success and satisfaction

The responses under these headings were more diverse. On the basis of the frequencies of responses, no one statement stood out as being more important than the other statements, though subject to that remark, there was relatively strong agreement that 'clients measure success entirely by project outcomes'. In addition, nobody disagreed that 'students measure success entirely by the final grade awarded' and 'lecturers measure success entirely by project processes undertaken'. The three-viewpoint model was strongly supported by the evidence.

The students reported a range of evidence that they felt should have an influence on their grade. Based again on a frequency distribution and an absence of disagreement, these can be tentatively ranked thus:

1. Lecturer satisfaction with project process.

2. Student satisfaction with project process.

3. Client satisfaction with project outcome.

The first point mitigates against taking an overly cynical interpretation of the assertion that 'lecturers measure success entirely by project processes undertaken'. Although that statement appears to overstate the case,

students do in fact agree that 'lecturer satisfaction with project process' should be taken into account. The second point could be taken to support this further, especially given that student satisfaction is not formally taken into account in assessing the projects. Alternatively, it could represent a misunderstanding of the purpose of the individual reflective report that students submit at the end of the project, though many students were indifferent to the view that the individual report should be taken into account in grading the project. This last point is significant, given the requirement for students to demonstrate a reflective approach to the work undertaken.

Conclusion

Previous papers have mapped out the area of the investigation using a three-viewpoint model. The present paper outlines an empirical investigation into one of those particular viewpoints, that of the student.

The questionnaire results show that students are concerned about group working issues and these tend to confirm informal feedback that we have had from student groups over a number of years. Student expectations and concerns have some similarity to those of the lecturers in that both are looking at what makes a good group, a good project and a good client. However, the lecturer is very concerned with the learning experience whilst the students focus on issues related to getting a good grade. An important aspect of these projects is the divergence of student expectations and concerns with those of the client. Clients tend to focus on getting a satisfactory project completed in the available time-span. The student experience, or the grade that the students achieve is only occasionally of any interest to the client, and even then only on an informal basis. These different viewpoints or perspectives of the student, lecturer and client offer a clear challenge for the management of these projects and for preparing students to gain from the collaborative experience so that they can develop the knowledge and skills to benefit their future working lives.

Aladwani's (2002) work on the role of social integration in system development projects could contribute to the analysis, although it was noted above that there may be considerable differences between a student project and a commercial project, particularly in the area of variable student engagement in project activities. The results also supported the three-viewpoint reference model: students see three different views of project success. We are unsure how this links to

previous literature and are we saying that the students see the three different views and are themselves distinctive in supporting the use of 'student satisfaction with project process' as a legitimate source of assessment evidence? Perhaps this view could be caricatured as: 'I think this went well on your terms, therefore I should get a good grade!'

The conclusions about students' attitudes to group work have been based on the findings from a relatively informal questionnaire. Clearer conclusions could be drawn from a formal attitude study as seen, for example, in Newby and Fisher (1997), or by closer ongoing involvement with the student groups, taking the approach used by Spalding et al. (1999).

The exploratory research highlights broader considerations relating to work-based learning initiatives of this kind. The diversity of perspectives of the three partners involved and their different objectives has the potential to generate conflict. At one level this may be acceptable and possibly desirable in providing the 'real' practical context. On the other hand, if not controlled, this may jeopardise the learning and experiential objectives of the process and inevitably demand significant amounts of the tutor's time simply to manage the interface. Building ongoing relationships and partnerships with client organisations and managing their expectations is an increasingly important role for the tutor. This has clear resource implications for both the HE institution and the client organisation.

The benefits gained by the student go beyond the direct tangible outcomes generated for the client in relation to the particular project. The process is designed to improve the awareness and understanding of the often 'fuzzy', conflicting and changeable nature of client specifications in practice and to develop attitudes and skills to engage with this effectively. It is difficult to replicate such challenges in the more sterile environment of the computer laboratory. Less directly measurable benefits involving greater reflexivity and preparedness for life-long learning are also engendered in the process. Perhaps the fact that it is a novel exercise and that the outcomes are less predictable than in the laboratory is the important feature for both staff and students to manage.

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