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Research Article

Imparting Work Based Skills on Vocational Courses, Pedagogy of Using Industrial Simulation in Surveying Education

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Abstract

The paper relates to delivering vocational higher education to prospective building surveyors. Preparing students for the workplace requires inclusion of academic knowledge, workplace skills and practical vocational experience. This is reinforced by feedback from the four stakeholders to surveying education, learner, employer, education provider and professional institution. Successful delivery of learning to distinct vocational groups requires specific pedagogy. The paper analyses a realistic industrial simulation delivered to teach knowledge and skills to undergraduate building surveying students. Initial pedagogy was proposed by CEEBL, Centre for Excellence in Enquiry Based Learning. Work based skills requirements were taken from published work including leading building surveying academics and practitioners like Professor Mike Hoxley and Professor Malcolm Hollis. Data analysis is used to evolve future simulations. These become better suited to delivering appropriate learning, valid assessment and usable vocational skills, against academic, student focused and industrial criteria. An action research approach is utilised by the author to develop specialist pedagogy through analysis of outcome data and stakeholder feedback. Action research is undertaken through an approach using trial, evaluation and development. The paper concludes, simulation can be a valid tool for delivering teaching, learning, assessment and vocational skills training to surveying students and justifies further research.

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Introduction

Access to a professional surveying career in the UK mostly requires the entrant to gain an accredited degree. This allows entry on to the Royal Institution of Chartered Surveyors (RICS) and Assessment of Professional Competence (APC) programme. Completion of this programme then leads to becoming a Chartered Surveyor (MRICS). In the UK the degree would typically be a BSc honours or MSc in a surveying discipline from a RICS accredited institution, such as Sheffield Hallam University. Some, but not all, students studying the BSc/MSc courses might experience some element of industrial experience before graduation. This would be either through a year's sandwich placement or resulting from employment and part time study. Placement opportunities for under-graduate students are however more difficult to find due to the current economic difficulties. Graduates ideally go straight to a surveying employer, and embark upon their APC whilst working for that employer. Part time students on graduation might change roles from technician to more professionally focused work, in line with APC competencies. The lead in time between being a student and being required to become a fee earning surveyor can often be short. As with other vocational degree programmes there is a requirement for surveying degrees to meet academic standards in teaching, assessment and programme outcomes. There is however also a need for providing graduates and placement students with some vocational skills. This allows an employer to charge a fee for their work as they are able to apply the knowledge gained during their studies.

The paper will analyse work undertaken within the School of Built Environment at Sheffield Hallam University during the 2010/11 academic year, using industrial simulation as a means of delivering learning, assessment and vocational skills training. Simulations set require to deliver twin goals of meeting academic and module outcomes and also imparting usable work based skills. This paper focuses upon an industrial simulation designed for final year BSc Building Surveying students The simulation replaced a previous classroom based learning experience and traditional theory based assessment, which whilst meeting knowledge and academic assessment criteria offered little work based skills training. The subject simulation has evolved from three years of action research by the author, during which time similar simulations have been run, evaluated and data from outcomes and learner feedback used to refine pedagogy. The exercise will be analysed in terms of its success or failure in meeting academic outcomes, participant performance of work based tasks, and its success in engaging with the learner. Recommendations will be made in respect of whether this form of teaching can, if appropriately designed and adequately delivered, meet both academic and vocational skills outcomes from the one activity.

Use of action research techniques

> *Action research is the name given to a particular way of researching your own learning. It is a practical way of looking at your practice in order to check whether it is as you feel it should be. If you believe your practice is as it should be you will be able to explain how and why you believe this is the case; you will be able to produce evidence to support your claims. If you feel your practice needs*

> *attention in some way you will be able to take action to improve it and then produce evidence to show in which way the practice has improved (Mcniff & Whitehead, 2002).*

This quote from Mcniff and Whitehead describes the philosophy employed by the author over a period of three years to establish pedagogy used to design the activity discussed later in this paper. Carr and Kemmis state that action research is about improvement of practice, improvement of the understanding of practice and improvement of the mechanics of practice (Carr and Kemmis, 1984). This fits in exactly with the author's philosophy of producing the best possible practice for incorporating work based learning in to academic teaching.

Action research utilises the action, in this case the simulation, to yield improvements and provide data, thus the action becomes the research tool (Waters-Adam, 2006). The author analyses feedback data from academic outcomes achieved, learner feedback, gained by questionnaire and focus group, and observations made on site. A cyclical model described by Arhar and Kasten (2001), and then drawn by Waters and Adam (2006), of four activities planning, action, monitoring and reflection, mirrors that employed by the author. Unlike Water-Adams' quite simplistic model however the researcher also incorporates external data from primary and secondary research into the reflection and planning stages. This would be endorsed by Stringer who states the importance of the participation of all of the stakeholders, (Stringer, 1996). In this research input from the professional body and employers could only be obtained through separate primary and secondary research. The data is evaluated and changes to the next simulation are made. In three years changes have been made to the nature of site chosen, provision of preliminary information and skills training, the approach to providing scaffolding to the participants, the form of the activity brief, allowing a choice of client briefs, affording access to sites, etc. Also incorporated in to the evaluation process are external factors such as changes to university health and safety practice and changes to statutory instruction in relation to surveying activity. The process of action research continues until the practitioner is confident that the practice can not be improved (Mcniff and Whitehead, 2002).

Mcniff (1998) noted an important issue with data collection for action research evaluation, is that it can be subject to variables. The author endeavoured to keep as many constants as possible, however in research which uses data from learner feedback the unavoidable variable is that the learner cohort changes annually. Even should practice become deemed acceptable, the same activity must be tested over a number of sample learner groups before it becomes accepted.

A further purpose of action research in education is elaborated upon by Nixon, who states that the research is a way of informing other teachers within the specialism of practice improvements (Nixon, 1981), thus encouraging change and improvement to overall practice (Mills, 2003). As an ex-surveying practitioner teaching specialist surveying modules, this to the author was an important factor, as previous research in to teaching specialist building surveying skills is scarce, and documented pedagogy can inform and improve practice.

In summary the author used an action research approach to understand and improve existing practice. From evaluation of feedback, academic outcome and research data over a number of activity cycles it was proposed to develop a specialist pedagogy which best meets the needs of the four stake holders in building surveying education. The case study to be analysed in this paper was evolved from three years of previous action research, supported by data from both traditional primary and secondary research.

Academic standards and module outcomes

In delivering surveying education the study must satisfy a number of stakeholders. The first is the university who require that the degree in all its parts is delivered to a comparable academic standard to all its other degree programmes, is of a standard comparable with similar degrees offered by other institutions and fully meets the academic and quality regulations it lays down for degree provision. The second would be the accrediting body the RICS who lay down regulations governing the content of the courses that they accredit for graduate entry on to the APC process. A third body would be industry as without the realistic prospect of graduate employment vocational surveying courses would face decline. A final body are the learners. Module outcomes are generally pre-set, and any industrial simulation based assessment must pass both internal and external scrutiny so that it demonstrates it meets the academic requirements of module and level of study and is presented to students in a way which is consistent, fair and unambiguous, in line with quality regulations.

An issue of particular relevance to industrial simulation is access by disabled students, and regulations such as Special Education Needs and Disability Act 2001 covers disabled students access to all forms of learning and assessment (Higher Education Academy, 2009). This area however could form a paper in its own right, and disabled access issues were dealt with on a bespoke basis within both the case studies with full consultation with specialist university staff.

Requirements for meeting RICS Competence Levels

APC is a process of structured training leading to achievement of specific discipline related competencies at each of three levels (RICS, 2006). The methodology is for a candidate to undertake a structured training programme, supported by a supervisor and monitored by a councillor (RICS, 2007). This structured training programme relates directly to the experience a candidate gains through employment. APC is only available to those with an accredited degree and who are in relevant employment. For a practicing surveyor completion of APC is the only route to professional membership. Chartered surveyor status results from satisfactory completion of the appropriate APC route and a successful final professional interview before a panel of existing chartered surveyors (RICS, 2006). APC is a measure that a surveyor is competent enough to join the ranks of chartered surveyors. Competency as assessed after APC is derived from technical knowledge, hard skills and professional skills. It is a combination of learning these three that the proposed pedagogy is evolved to facilitate. Evidence of achievement of competencies is provided through a diary of industrial activity. A graduate surveyor therefore requires some vocational skills to enable them to engage in professional activity which can be presented to achieve competency outcomes. A graduate trainee without any surveying training would in practical terms not be able to start to meet competencies without first gaining those basic skills.

Advantages of the use of industrial simulation

Industrial simulation when used as an educational tool in the context proposed is part of an enquiry based learning (EBL) approach to learning. EBL utilises student focused learning to resolve a given task (Khan and O'Rourke, 2004). Enquiry based learning is described by the Centre for Excellence in Enquiry Based Learning (CEEBL) as an environment where the process of enquiry is owned by the student. They go on to state that the process involves a scenario being set, supported by a facilitator, which allows students to identify their own issues and questions (CEEBL, 2009). Students would then utilise resources provided for them or sourced by themselves to research the topic. One feature of enquiry based learning is that it might, involve a small scale investigation involving field work and a case study adapted to meet the disciplinary contexts (CEEBL, 2009). This definition closely mirrors the activities described within the case studies analysed later in this paper. Self directed learning as advocated by EBL is believed by many educationalists to be a superior form of vocational training in comparison to traditional teaching. The reasoning being a belief that that things a learner has discovered through experience are more likely to be retained (Park *et al*., 2003). In both EBL the role of the teacher changes to facilitator (Bradbeer, 1996), Learning in the context of building surveying education should ideally include, academic outcomes, technical knowledge and practical vocational skills. The advantages EBL in surveying Education are shown below:

- Facilitates the acquisition of factual knowledge within the context it is to be used;
- Encourages mastery of general concepts and principles in a ways which allows their transfer to new situations;
- Encourages the use of previous knowledge to solve problems;
- Offers prompt student feedback;
- Encourages students to learn how to learn and to become life long learner (Bradbeer, 1996);
- Students are more likely to engage with the learning as it is perceived as being relevant to their own needs;
- Students can expand their knowledge by researching their own interests;
- Working within, and communication to, a group improves a student's employability;
- Self directed learning develops key skills and original thought processes (CEEBL, 2009).

In terms of vocational skills training industrial simulation exercises can contextualise any prior learning in to an industrial context (Khan and O'Rourke, 2004), where it is of value to future employers. It reinforces past learning as the learner can test knowledge against a real life scenario. By using the knowledge to resolve problems the learner is afforded access to a whole new canvass for that knowledge, which gives it a greater value. It introduces the concept that learning is not purely restricted to the classroom or within an educational establishment site. This form of learning would appear ideal when stated outcomes are the embodiment of key vocational skills. The use of a small scale simulated industrial exercise is cited by Khan and O'Rourke (2004), as ideal to focus learning directly in to a disciplinary context. Conventional theory would it seems suggest that industrial simulation in the given context could deliver a dual outcome of general academic and specific vocational learning.

Developing a successful industrial simulation exercise

One danger of such exercises over traditional classroom teaching is that they can take students out of their established comfort zones (CEEBL 2009). Whilst Nunnington (2009) views the challenge of this event as being the catalyst for enhanced learning, it can if handled poorly alienate students and detract from that learning. The student taken in to a challenge situation must therefore be supported. This support sometimes referred to in education text as scaffolding, is an essential factor. It must be visible and easily accessible, but also discreet, (Nunnington, 2009). If not it might overshadow the industrial simulation element. Tosey (2006) states the facilitator must "intervene thoughtfully". The author's experience following the running of many industrial simulations is that support on site should indeed be discreet, but still form a visible part of the simulation. This visibility allows the facilitator to exert some control, be on hand to render bespoke support, but not become the focal point which renders the simulation unrealistic. Support levels also need to be bespoke to the type of learner, and often to individual learners. One valuable scaffolding mechanism is peer group support by completing practical tasks in groups. This ensures that collective knowledge is brought to deal with any problem, and individual participants are not left isolated.

One issue is that Students traditionally expect to be taught and to have tutorial support. The role of a facilitator is described by Tosey as being one who acts in collaboration with the learner in a cooperative enterprise within which leadership roles dependant upon time and purpose may change, (Tosey, 2006). As direct leadership of all learning is mostly not required, the use of industrial simulation could be perceived by students as diminishing the role of the lecturer, (Askham, 2009). Khan and O'Rourke (2004) speak of the need for the tutor to be seen to establish the parameters of the student's work and remain central to the whole activity. One method of establishing the position of the tutor is by giving them a strong senior role within the simulation. This perception of the tutor as owning superior knowledge may be required to prevent a detachment between learner and teacher. These senior roles also allow the tutor/facilitator to nurture the participant students (Tosey, 2006).

Industrial simulation relies upon adequate prior knowledge and access to researched information pre-event, (Khan and O'Rourke, 2004). The activity designer must ensure that the students actually own the required basic skills and can easily gain access to any additional required information. Once again this is a vital part of the imposed scaffold. Industrial simulation is about using skills, and the author has found it may be necessary to run demonstration activities, to achieve or at least test basic skill levels, or run classroom activities to embody critical information before exposing the students to the main event. This helps prevent detrimental levels of individual challenge.

Whilst students will always be aware that the simulation is not real, and this is indeed another part of the support scaffolding in that potential failure does not carry industrial consequences, there is a need for as much realism as possible. It is a small leap for a final year degree student to adopt the role of a newly graduated surveyor, but a huge leap to adopt the role of an experienced chartered surveyor. Likewise the tasks need to be totally commensurate with the role. It is the belief of the author through experience of construction, design and surveying project work that often students told in an assessment brief that they are now an Architect, Chartered Surveyor, Site Manager or Site Engineer do not fully engage. due to a failure to believe in their capacity to fill the role, thus losing any simulation aspect the project might have sought. Such role elevation, whilst it may still work for academic learning in a theoretically based PBL context risks rendering an industrial simulation obsolete as a tool for preparing students for immediate vocational requirements. For a case study to be viable the tasks need to be achievable, if they are not it would send out the wrong signals to the participant students, about the industry they propose to enter.

In summary a successful industrial simulation exercise needs to be well scaffolded, needs for the tutor to adopt a role as facilitator which does diminish their effectiveness, requires realism to engage the students, needs to be bespoke to the level of the learner and needs to be fully supported by prior learning, prior skills training, current easily accessible supporting material and a physical tutor presence.

Specialist work based skills for building surveying

Following research in to skills required of a building surveyor, utilising the work of building surveying practice authors such as Professor Malcolm Hollis, Professor Mike Hoxley and others, as well as feedback from practice ideal skills for a graduate surveyor were established. The skills training brief was divided in to three parts. These are professional conduct whilst surveying, practical and technical surveying skills and professional report writing. The main underpinning skill is that of being able to focus recording and reporting towards the needs of an identified client, and being able to identify the impact of applicable statutory obligations to those client needs (Glover, 2009). Whilst a current pedagogy is available through the National Vocational Qualifications courses for assessing performance in a work based activity (Greatorex and Shannon, 2003), this kind of assessment is outside of the descriptors laid down for under-graduate assessment. Therefore academic assessment is based upon establishing outcomes which can be demonstrated through a vocational document. This is the production of a client focused building survey report written to meet a supplied client brief.

Professional Conduct is an essential part of a professional survey. It is vital that the learner adheres to strict ethical codes of practice, even during simulated activity. The RICS have made protection of the public, the profession and the reputation of the RICS as its key objectives (RICS, 2009). This is highlighted in the RICS competencies where completion of level one competencies require teamwork, level two require communication and negotiation and level three require adherence to the conduct rules and professional practice (RICS, 2006). Not all the code of conduct issues can be incorporated in to a building survey as skills training. The full list of code of conduct issues is shown below:

Table No. One, RICS Codes of Conduct
1. **Act honourably** and never put your own gains above the welfare of your clients or those to whom they have a professional responsibility, Always consider the wider interests of society in your judgements.
2. **Act with integrity**, and be trustworthy in all that you do - never deliberately mislead whether by withholding or distorting information.
3. **Be open and transparent in your dealings**, and share the full facts with your client, making things as plain and intelligible as possible.
4. **Be accountable for all your actions**, take full responsibility for your actions and don't blame others if things go wrong.
5. **Know and Act Within Your Limitations**, and be aware of the limits of your competence, and don't be tempted to work beyond these. Never commit to more than you can deliver.
6. **Be objective at all times**, and give clear an appropriate advice. Never let sentiment or your own self interest cloud your judgement.
7. **Always treat others with respect**, and never discriminate against others.
8. **Set a good Example**
9**. Have the courage to make a stand**
(RICS 2006)

Whilst not all assessable, these nine codes were stressed upon the learners through tuition and policed by the facilitator. Similar codes are provided by the educational institution for adherence by all who work and study at the university.

Professional performance training in respect of meeting client expectations was derived from the work of Professor Mike Hoxley. Using research based upon contact with clients Professor Hoxley produced a twenty-six point weighted scale for assessment of client perceptions of the service they received from surveying professionals (Hoxley, 2000). Four issues were cited as having the greatest client importance with ratings of over 0.8. These were; provides solutions which are technically correct, is always polite to me, has knowledge and competence to solve my problems, and has similar views of things which are important to me (Hoxley, 2000). Using this research the author concentrated upon guiding learners towards the professional skills of producing a strong client focus to technical reporting, being able to apply technical observations to the client's needs and expectations and applying current statutory obligations to the client's ability to meet them. Learner assimilation of these skills could be assessed through the resultant building survey report.

Technical Recording Skills **-** The building chosen was of simplistic construction form. Access was easily available around the property. The building had many areas where the structure had been exposed. The examples of defects covered many areas of typical building failure, without over challenging the novice pathologist, or creating an unsafe working environment. These included structural movement, rainwater water ingress, condensation, degradation of decorative surfaces, service failure, obsolescence of components, user damage, corrosion of metals, timber decay, pest control issues and failure of exterior brickwork. This afforded a varied technical experience and opportunity for learners to research many aspects of building pathology, without extending the weaker students too far beyond their technical level, and consequentially creating excessive challenge (Khan and O'Rourke 2004). Technical on-site recording ability and depth of technical experience could be assessed from the report.

Report Writing Skills - The final element of learning is report writing skills. It was cited by Hollis and Bright that failures in communicating important defects can sometimes be attributed to poor reporting, (Hollis and Bright 1999). As stated by Staveley, whilst the professional building surveyor should view the facts of a survey impartially they are also charged to favour the interests of their client (Staveley, 1998). Reports are graded by how they focused the technical information towards the needs and requirements stated in the client brief, (Hollis 2005). This examines the learner's skill in evaluation of features and defects observed on site, and an ability to report upon how they might impact upon the client. The report should focus upon the client with those issues which directly impact upon the client dominating the report, and those of little import to the client gaining only fleeting mention. One client's deal breaking defect, is irrelevant to another and a happy point for negotiation for another. The skill tested is knowing which type of client the brief relates to (Ilott, 2005), and that is something which elevates the chartered surveyor beyond just technical surveying.

It is essential that a professional surveyor protects both the client and the profession, (RICS, 2010). The report must therefore be an irrefutable representation of the agreement established between surveyor and client (Wilson, 2006)). Reports submitted gained credit for including appropriate terms of business and clearly stated limitations and caveats, (Wilson, 2006). Professional reports which show ambiguity in their purpose, can become part of a future action against the surveyor, and the learner needs to ensure that their report is competent and contractually correct (Wilson, 2006). Wilson stresses the importance of including all express terms within the report, using a comprehensive terms of business section, (Wilson, 2006). Submitted reports which do not include such express terms were down-graded to show the learner how important this issue will become in practice life.

The ideal professional reports were written in a language befitting the surveyor's professional status, but also in a language understandable by a layman client (Glover, 2009). Such reports needed to be well organised, presented to a profession enhancing standard and make use of appropriate mediums of presentation such as photographs, maps, floor plans, etc.

Grading reflected how much of the requirements for professional building surveying and the resultant client report the learner has assimilated.

Whilst providing a form of assessment the survey report also affords a way of teaching a final valuable skill to prospective building surveyors. A surveyor must not make comments that can not be fully substantiated (Ilott, 2005). Professional surveying negligence does not wholly relate to making an error, providing that error is made reasonably (Wilson, 2006). A surveyor viewing a roof from ground level can not be expected to pick up defects hidden from view. However, if that surveyor was to pronounce that roof to be in good condition, in spite of not being able to closely inspect it, and if there were to be such hidden defects that diagnosis might be considered negligent (Wilson 2006). Where such potential overstating of condition appears in submissions this is used, by means of feedback, to illustrate the errors of this approach to the learner. The teaching method for this skill is to allow the student to make the overstatement and then explain the reasons why it might be professionally unsound. This works on the educational theory that things that a learner has discovered through experience are more likely to be retained (Park, Chan and Verma, 2003), and for the professional building surveyor this is an absolutely vital lesson to learn (Wilson, 2006).

Summary of case studies used

In this case study a commercial building owned by the university was used. The building was located in Sheffield's industrial quarter, originally an engineering works as part of the steel industry, it had latterly seen use as a coatings testing centre and currently lay mostly redundant, used purely as a furniture store. Advantages of using this building included its ability to allow large numbers of students to work safely, previously undertaken hazardous materials survey, close proximity to the university campus to allow students to fit survey work in to a congested timetable, and possibility of revisiting the property.

The Activity Design - The activity was specifically designed to allow students with scant experience of surveying fieldwork opportunity to perform such work. The activity required students to respond to their choice of a number of specific client briefs and perform a number of stock building surveys upon a commercial building.. The building whilst simple by design had a number of unusual features and defects which had to be assessed in terms of the stated needs of the client. Survey types required either by professional obligation or consequential to the terms of the supplied client brief included, measured survey, condition survey, appraisal of suitability for purpose, visual only Asbestos survey, audit of fire provision and an access audit for disability. The choice of building ensured that none of these surveys provided a technical complexity beyond a newly employed surveyor's abilities. The assessment outcome was a bespoke survey report written to an, RICS, industry approved format which addressed the express requirements of the client, all statutory obligations and the requirements of professional surveyor status.

Preparation & Assessment Design - Much of the underpinning technical theory had been pre-taught in other specialist modules. Students however performed a practice surveys under direct supervision as part of prior module teaching and had also looked at length in to the professional conduct and responsibilities of a Building Surveyor Student. They were given the briefs well in advance and required to perform a pre-inspection desk survey. Participants were also encouraged while on site to use available personnel and documentary resources to glean additional information. Enquiry skills were set at appropriate levels of Bloom's Taxonomy (Anderson and Krathwohl, 2001). The requirement for use of industry accepted formats and wording, became established. From this an academic level was developed and this allowed the creation of a baseline performance level, for academic grading, and an appropriate assessment criteria to grade the submissions, at levels which had parity with traditionally produced research essays and reports. Tutor support on site was purely background, designed to be of a level that a young surveyor could achieve by ringing his office for specific technical advice, however tutor presence was allowed to be visible.

(Table One) How the Requirements for Successful Simulation Were Met

	Requirement	**How Met**
1	Students need full support before during and after the simulated activity	- Students were given the brief early and allowed time to allow them to be fully prepared. - The building chosen was one which once belonged to the university was well documented. - Students had access to qualified technical support on and off site. - A debrief session post event reinforced key issues, pre completion of the assessed work. - Students worked on the practical tasks in small groups, - The weighting of the assessment was designed not to confer disadvantage to non-experienced students, with only 20% available for proof of technical surveying abilities.
2	Tutor's role must not diminish following the change to facilitator	- Tutor adopted the role of health and safety officer on site, a role with authority, but outside the simulation - Tutor ensured a discreet but still leading role as the senior colleague from whom technical advise could be sought.
3	Simulation must be realistic and the roles capable of conceptualisation	- Building is an actual property for commercial lease. - Brief is realistic in terms of the nature of the client's business and appropriate for the building. - Student roles appropriate for the level of work expected in the first year of practice life. - Simulation used real life personnel from the building.
4	Students need adequate prior learning, basic under-pinning skills and access to any required information	- A demonstration practice building survey was run pre-event - Classroom discussions on professional conduct were run - Access to current information and written guides on surveying were made available on a learning portal

There was a requirement to meet module specifications and outcomes. Table two, as shown below outlines those outcomes and how the simulated assessment met them. Table three shows how the assessment was graded to reflect module outcomes and professional skills whilst providing guidance to students on the requirements of the exercise.

Table 2 How the Module Requirements Were Met		
	Assessment Outcomes	**How These Were Met**
1	Carry out a Building Survey of a traditionally constructed commercial building and critically appraise its condition.	All three buildings are accessible commercial property Students surveyed them in the role of a graduate fee earning surveyor.
2	Analyse the condition of a building, formulate and communicate an appropriate course of action to a client.	Students will as graduate surveyors perform inspections which will include at least 5 different stock surveys and audits. Reports to a given client brief will be written to industry accepted format and standards.
3	Identify and apply to a given context, the legal rights and obligations of property owners, leaseholders and tenants.	Included in the client brief are concerns over shared obligations, dilapidation liabilities, requirements for disabled access, and costs of making fit for purpose.
4	Apply the design process to a given scenario and critically evaluate design options	Students will suggest design solutions to meet specific client accommodation requirements and particular access issues.
5	Demonstrate an understanding of current topical issues within the profession.	By adoption of a professional role students become obligated by professional actions and current liabilities such as identification of potential Asbestos
	Vocational Requirements	**How These Were Met**
1	Perform stock surveys in industrial settings	Surveys exactly mirror those to which a young fee earning surveyor may be expected to undertake.
2	Apply current statutory obligations to a given scenario	The brief or previously stated surveyor obligations include all the major statutory obligation facing a surveyor and his/her client
3	Write professional reports to industry accepted standards	Report to be written to previously discussed industry accepted format.
	Skills Training	**How Achieved**
1	Working in a team	Surveys, and prior research were undertaken in small teams
2	Use of stock surveying equipment	Distance measures, endoscopes, damp meters, handheld thermal imaging, tapes, 2m rods, torches, binoculars, etc were provided on site
3	Apply survey findings to the context of a client's needs	All reporting was to be directly focused towards a detailed client brief

Table 3 Assessment Grading Criteria

	Criteria	**Weighting**
1	Organisation, presentation & use of graphic media and illustration	20%
2	Appropriate technical recording of the survey notes.	20%
3	Ability to focus the report towards the client's requirements and circumstances, as given during the client briefing	20%
4	Appreciation of your client's potential statutory and other liabilities in respect of the building and site	20%
5	Application of professional principles of report writing	20%
	Total	100%

Student achievement in terms of grades can be seen in Table 4.

Table 4 Summary of Academic Outcomes

80% +	70-79%	60-69%	50-59%	40-49%	>40
2	15	20	10	1	1
Student numbers (49) Assessment outcome success % (98%)			Average grade (65.1%) Standard deviation (10.24)		

The primary purpose of undertaking such an industrial simulation exercise was to add vocational skills value, not specifically to test PBL's ability to raise achievement levels, however it was important that the industrial simulation did not detract from academic achievement which might have been gained by traditional assessment methods, and the author is confident from the outcome data when compared to a traditional research based assessment given to the same students that this did not occur.

Meeting the vocational outcomes is assessed in two ways. This is by evaluation of the outcomes achieved from the submitted survey reports (Table 4), and by feedback of client satisfaction from a questionnaire of participant learners (Table 5).

Illustration One Participant feedback sheet

	STATEMENT	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
1	I feel this activity is relevant to becoming a Building Surveyor				
2	I felt I was given enough information to undertake this activity				
3	This activity was too advanced for my level of knowledge				
4	I felt I learned/practiced important skills while undertaking this activity				
5	I felt undertaking this exercise was challenging				
6	I fully understood what was expected of me				
7	I felt I could call upon support if I had needed it throughout this activity				
8	The activity and assessment brief was clear and easily understandable				
9	My role in the activity was realistic.				
10	I enjoyed taking part in this activity				
11	This knowledge could have been better achieved through lectures, seminars and a theoretical assessment				
12	I felt tutorial support was available throughout this activity				
13	On graduation I intend to seek employment as a Building Surveyor				
14	Please make any observations and comments which you feel might improve the learning experience for future Building Surveying activities of this nature -				
	This questionnaire will be used exclusively by your tutor to inform future activities for delivering this topic/module. Your genuine opinions will be valuable in ensuring that future simulated activities of this nature are designed to achieve optimum learning outcomes and experience.				

Table 5 Summary of Participant Feedback

QUESTION No	% POSITIVE	% NEGATIVE
1	100	0
2	94	6
3	88	12
4	91	9
5	97	9
6	88	12
7	91	9
8	94	6
9	94	6
10	91	9
11	79	21
12	91	9
13	91	9

Conclusion

In summary this industrial simulation was successful in meeting academic requirements for assessment of the module. The production of an industry approved format report did not detract from it being an assessable academic submission. Use of a specific client brief controlled the parameters to include material required to complete the stated outcomes, whilst skills such as performance of surveys, time management, professional report writing, client/surveyor relationships, writing bespoke survey reports, use of prior technical learning and professional conduct were practiced by the students. The exercise generated material which could be used post-grading as evidence of some practical experience and aptitude for surveying. Student engagement, participation, achievement levels and feedback showed this type of exercise was successful with this class of student.

The nature of the simulation matched the definitions relating to enquiry based learning. The organisation and pedagogy controlling the simulation reflected an evolution consequential to an action research based planning and evaluation of simulations methodology which had began in 2008. This refining of practice by trial, research and evaluation, had produced measurable improvements to pedagogy. The evidence that was generated from this activity to support the value of the practice, positions this work as action research. The success of the research methodology thus far evidences that action research is an appropriate methodology to use.

Evidence from learner performance and feedback showed that this type of activity and assessment engages surveying students, who engage with meeting the outcomes, while enjoying the practical elements of the learning experience. The nature of the feedback and outcome data makes it ideal for evaluation as part an action research approach. Action research is a process of practice improvement by evaluation of data, therefore running this activity and employing action research methodology allows the author to move towards the eventual goal of producing pedagogy for successfully providing work based skills training and academic knowledge to produce building surveying graduates that the profession and its employers require.

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