Pedagogy of Using Industrial Simulation in Surveying Education: A Study of Two Models Run at Sheffield Hallam University, 2008/9

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KEYWORDS

Industrial Simulation, Enquiry Based Learning, Academic Standards, Vocational Skills Training,

SUMMARY

This paper is written from the perspective of delivering vocational education to prospective surveyors. The author is conscious of the desirability of providing surveying students with practical surveying training in addition to academic knowledge and skills. After establishing desirable vocational skills requirements for new entrants to the surveying industry, the paper analyses two industrial simulation exercises delivered to completing surveying students, studying at both professional and technical levels, within Sheffield Hallam University. Both case studies utilise industrial simulation to facilitate both learning and assessment. Current academic literature in respect of using industrial simulation as a teaching method. and the author's personal experience of delivering industrial simulation exercises over many years are used to establish pedagogy for running successful models. Using data produced from these case studies, the author tests this form of teaching and assessment as being potentially suitable for delivering appropriate learning, valid assessment and usable vocational skills, against academic, student focused and industrial criteria. The methodology employed, academic outcomes met, student achievement and student engagement are analysed to establish if these case studies succeeded. The paper concludes that simulation can be a valid tool for delivering teaching, learning, assessment and vocational skills training to surveying students.

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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), 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. The number of under-graduate students obtaining placement work is however diminishing due to the current global 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.

Not all higher education students seek an honours degree and professional status, but some will look to gain employment at technician level after completing a Foundation Degree or Higher National Award. These students too enter competitive employment where specific skills and competencies are desirable, and early assistance in the earning of fees is considered desirable. Provision of students who arrive in the workplace ready to perform some of the required tasks of employment can cement an educational establishment's reputation in the industry, and make the passage of their students in to employment smoother. This has a knock on effect when prospective surveying students decide where they wish to study. Hence a marriage between meeting academic standards and outcomes and gaining some vocational competency is of benefit to student, employer and educational institution.

This paper does not concentrate wholly upon the advantages of using industrial simulation and enquiry based learning as a superior form of teaching vocational education, but rather tests it as a valid teaching and assessment tool to value add skills training without disrupting academic standards. Any advantages to successfully offering this form of learning in vocational courses will however be acknowledged.

The paper will analyse work undertaken within the School of the Built Environment at Sheffield Hallam University during the 2008/9 academic year, using industrial simulation as a means of delivering learning, assessment and surveying and construction skills training. These simulations needed to deliver the twin goals of meeting academic and module specific outcomes and imparting usable vocational skills. The paper focuses upon two industrial simulation exercises. One was designed for final year BSc Building Surveying students and the other for final year Higher National Diploma, (HND) students. Whilst the former are students looking to start professional employment on graduation, the latter are focused upon seeking technician level employment in predominantly surveying domains. Requirements for meeting academic and vocational competency targets are the same, only the required level of outcome differs. The reason for choosing to analyse these two exercises apart from the difference in level, is that the HND module involved was originally written to be delivered by means of actual industrial work experience. This is currently not easy to find due to economic conditions and outlawed by the school due to interpretation of current UK health and safety liabilities, in relation to students on construction sites. Even when two week work experience periods were offered in the past the quality of student experience often varied. This led to disadvantage amongst some students during completion of the assessment element of the module. The industrial simulation in this exercise in addition to providing learning and material to underpin assessment also replaces potentially variable vocational activity. The added value is that it offers a consistent experience, and constant access to an organised academic support mechanism. The tutor's challenge from this exercise is to provide an industrial experience sufficient for the student to meet pre-existing outcomes.

The BSc exercise replaced a previous classroom based learning and demonstration experience and traditional theory based assessment. Each exercise will be analysed in terms of its success or failure in meeting the required academic outcomes, and its success in engaging student interest. 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.

ACADEMIC STANDARDS AND MODULE OUTCOMES

In delivering surveying education the course 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 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 student customers of the university. Module outcomes are generally pre-set, and any industrial simulation based assessment must pass both internal and external scrutiny so that it demonstratably 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, (HEA 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 COMPETANCE 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) 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.

From January 1st 2009, the Assessment of Technical Competency, (ATC), process has become simplified in that the previous technical membership of the RICS has been replaced by Associate Membership ,(ARICS) which makes this class of membership open to a wider audience, (RICS 2009). Completion of this utilises a process of written submissions to prove competency, rather than a strict assessment of experience and vocational achievement. The final interview is no longer mandatory in all cases. This means that for purposes of starting to prove technical competence there is, unlike APC, no longer a practical requirement for candidates to be as vocationally skilled. However the author's experience of practical surveying would suggest that the nature of technical surveying work would often give advantage to the applicant who brought evidence of having undertaken practical tasks to an interview.

ADVANTAGES OF THE USE OF INDUSTRIAL SIMULATION

Industrial simulation when used as an educational tool in the context proposed is part of a family of approaches to learning. These include problem based learning, (PBL), and enquiry based learning, (EBL). There is a strong overlap between the two. (Khan & O'Rourke 2004), and both utilise student focused learning to resolve a given task. Enquiry based learning is described by the Centre for Excellence in Enquiry Based Learning, 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 both EBL and PBL 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 PBL and 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 of PBL and 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 learners

(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 & 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 & O'Rourke as ideal to focus learning directly in to a disciplinary context, (Khan & O'Rourke 2004). 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 INDISTRIAL 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 views the challenge of this event as being the catalyst for enhanced learning, (Nunnington 2009), 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, states the facilitator must, "intervene thoughtfully", (Tosey 2006). 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, use of industrial simulation could be perceived by students as diminishing the role of the lecturer, (Askham 2009). Khan & O'Rourke 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, (Khan & O'Rourke 2004). 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 as advocated by Tosey, (Tosey 2006).

Industrial simulation relies upon adequate prior knowledge and access to researched information pre-event. Successful simulation requires the use of prior skills and knowledge, (Khan & 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.

CASE STUDY ONE ASPECT COURT, SHEFFIELD, UNITED KINGDOM

In this case study industrial simulation was used mostly as an assessment activity to support a regime of traditional teaching and practical tutor led demonstrations. The activity was however specifically designed to allow students with scant experience of surveying fieldwork opportunity to perform such work. The activity required students to respond to a specific client brief and perform a number of stock building surveys upon a vacant office block, previously used by H M Passport Office. The building while simple by design had a number of unusual features attributed to its previous user, which had to be assessed in terms of the stated needs of the prospective occupier. 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, Type 1 Asbestos survey, assessment of potential dilapidations liability, audit of fire provision and an access audit for disability. The choice of building ensured that none of these surveys required a 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.

Much of the underpinning technical theory had been pre-taught in other specialist modules. Students however performed a practice survey 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. Students were given the brief well in advance and required to perform a pre-inspection desk survey. They were also encouraged while on site to use available personnel and documentary resources to glean additional information.

Enquiry skills were set at all levels of Bloom's Taxonomy, (Anderson & 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 shows how the requirements for successfully running a simulation were met.

(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.	Aspect Court is a vacant commercial office property currently offered for lease, and requiring some element of conversion and adaptation to meet future tenant requirements. Students surveyed it 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 an inspection which will include at least 5 different stock surveys and audits. A report 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	Time management	A strictly controlled window for performing the survey

Table 3 Aspect Court 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 this exercise was as shown in table four.

Table 4 Student Achievement & Grades

TOTAL No STUDENTS	70%+	60-69%	50-59%	40-49%	REFER/DEFER
66	10	20	18	14	4 Only 1 did survey

Student achievement in terms of grades was in line with other elements of assessment for this module, i.e. a researched technical paper and a formal examination. 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 data produced that this did not occur. Whilst no formal written feedback was taken specific to this activity student feedback through staff/student course meetings, and later through the whole module feedback exercise was positive in respect of the value of this activity. Part of the scaffolding provided was a post survey debrief when students could air problems before writing up the report. No major difficulties were aired during this session.

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.

ACTIVITY TWO, BLACK COUNTRY LIVING MUSEUM & NOTTINGHAM TRANSPORT HERITAGE CENTRE, UNITED KINGDOM.

These activities took place at two fully risk managed heritage centres, each with ongoing property development and maintenance projects. Student activity directly reflected work required by these projects. The nature of tasks was set at technician level where the student would in unsupervised teams gather information as part of a larger surveying task or work directly with an existing construction professional on a more complex task. This differs from many of the PBL exercises set for these students where they are often asked to adopt the title of a professional and work upon totally fictitious designs, tasks and projects. The nature of enquiry reflected Blooms Taxonomy to stage four, (Anderson & Krathwohl 2001).

Professional support and participation included current or recently practicing construction professionals namely a Site Engineer, Construction Manager, Building Surveyor and Quantity Surveyor, all with practice experience as a RICS or Chartered Institute of Building, (CIOB), professional member. Unsupervised tasks included completing an access audit proforma, completing a health and safety audit, performing a measured survey, completing a maintenance assessment proforma, gathering information for assessment of cultural significance, and performing a simple site evaluation. Supervised work included assisting in estimating cut and fill volumes for required site levelling, setting out proposed buildings from an existing plan, setting out the access road, a development appraisal and a condition survey. In line with likely technician level output, students were not required to produce client reports, but merely provide field notes and illustrations that could be used in the generation of client and internal reports. Assessment consisted of producing these field notes, a set of researched reports based upon the nature of the professional disciplines the tasks related to and a reflective diary covering their experiences whilst undertaking the work. These were in line with the pre-stated outcomes for the module. Underpinning theory for each task had been imparted within other module outcomes and teaching, and the basic vocational skills tested within another project based module. More specialist material was made available on the university's learning portal. A pre-activity assessment briefing was conducted, to ensure full understanding of the simulation.

Conscious efforts were made by the supporting professionals to show students actual site practices rather than running a purely text book activity, and events like a group builder's breakfast and briefing by officers of the heritage trust were incorporated to make the activities even closer to an actual industrial experience. Table five. below, shows how the requirements for a successful simulation were met, while table six shows how the module specifications and outcomes were met.

Table 5 How the Requirements for Successful Simulation Were Met

	Requirement	How Met
1	Tutor's role must not diminish following the change to facilitator	- The tutors maintained the role of the senior qualified professionals with a managerial role in the exercise. - Tutor ran a pre-activity briefing and post activity de-brief, during which parameters for the simulation and assessed output was set.
2	Simulation must be realistic and the roles capable of conceptualisation	- Tasks were commensurate with level of a newly appointed technical surveyor. - Both sites were currently being developed, and tasks were commensurate with that development and maintenance.

3	Students need adequate prior learning, basic under-pinning skills and access to any required information	- Skills required were pre-taught in previous modules. - Skills required had been pre-demonstrated and pre-used in a previous PBL project and were therefore tested
4	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. - Multiple tutor support was used. - Students had access to qualified technical support on and off site. - Support on site was visible and easily available - Students worked in groups and were not isolated - A debrief session post event reinforced key issues, pre completion of the assessed work.

Table 6 How the Academic & Vocational Requirements Were Met		
	Module Outcomes	**How These Were Met**
1	To enable the student to gain an insight into the day to day operation of companies operating within the construction and surveying industry	Engaging in real project industrially simulation of tasks likely to be undertaken by technical level employees
2	Develop personal skills and qualities essential for future academic study and/or employment.	Learn new skills by undertaking the tasks or through supervising professional's input
3	To enable students to place their academic studies in the industry	Enable students to use theory gained from other modules in a practical work based scenario.
	Assessment Outcomes	**How These Were Met**
	Reflect upon professional and personal skill development	Within submission brief
	Identify future personal development requirements	Within submission brief
	Investigate and research a technical topic	Preparation for industrial simulation tasks
	Prepare a professional report	Within submission brief
	Develop referencing Skills	Requirement of submitted material to be referenced in Harvard system.
	Skills Training	**How Achieved**
1	Working in a team & working under supervision	All work undertaken within teams Current construction and surveying professionals used for supervision of some tasks
2	Use of stock surveying equipment	Distance measures, endoscopes, damp meters, handheld thermal imaging, tapes, 2m rods, torches, binoculars, theodolites, EDMs Levels, etc were provided on site
3	Time management	There was a strictly controlled window for performing the tasks

Table seven, below, 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 7 Grading Criteria		
1	Field notes, drawings, maps, photographs supplied ready for assimilation in to a client/technical report	20%
2	3 x professional referenced reports outlining the student's personal pathway to the status of professional in each of three of the construction disciplines to which the tasks related, i.e. Building Surveyor, Development Surveyor, Construction Manager, Quantity Surveyor, Site Engineer	45%
3	Personal reflection on the student's performance of the various tasks	35%

TOTAL		100%

In respect of the outcomes all students engaged in the work and all completed the module, with the following results shown in table eight.

Table 8 Student Achievement & Grading				
TOTAL No STUDENTS	**DISTINCTION**	**MERIT**	**PASS**	**REFER/DEFER**
19	6	9	4	0

This industrial simulation exercise provided 100% of the assessment and most of the learning activities for this module. Thirteen of the nineteen students subsequently completed a university student module evaluation survey and module approval was 100% across all major teaching and learning issues.

In summary this exercise succeeded as it was possible to simulate industrial experience as a teaching activity, and to control the quality of that experience. In contrast the quality of short work experience placements can be variable, and not always of a standard that module outcomes demand. It was also possible to control health and safety issues which had prevented traditional work experience in an industrial setting. Whilst different from case study one in that the simulation replaced the intended learning medium rather than primarily being the assessment medium, it was however appropriate to underpin previously set assessment requirements. Student engagement, participation and achievement levels proved excellent. This was possibly due to support and safety net mechanisms put in place which reflected the nature of the student cohort, as while it is acknowledged that challenge can enhance the learning experience, over-challenge can negate it.

CONCLUSIONS

Both exercises showed that the use of industrial simulation can be very effective at meeting existing academic outcomes, for both learning and assessment. This is evidenced by the fact that academic standards were provably maintained, and the module outcomes were fully met. If correctly planned and executed it can engage student interest, and result in high achievement and satisfaction levels. This too could be evidenced from documented student achievement and satisfaction data. Reference to educational literature evidences that industrial simulation requires a much greater attention to detail and longer planning than traditional classroom activity and research based assessment. Failure to apply this detail can compromise the reality of the simulation, and detract from the academic value of the activity. Evidence gained from student performance data and subsequent external verification of the process and results would support that this had not occurred. As added value students were able to take their experiences and outputs to prospective employers and talk of work they had undertaken, and of surveying areas they had some degree of practical experience in.

In a factor consequential to the background of the tutors running these simulations, the exercises proved satisfying to the staff that supported them. Two chartered building surveyors supported the first case study and professionally qualified ex-practitioners from multiple disciplines supported the second. A seldom acknowledged feature of construction and surveying education is that many of those who teach it are current or recently practicing industry professionals. Opportunity to deliver some of those practical skills in an industrial scenario, proved satisfying to the tutor team in both case studies. It could be argued that this form of teaching suits the type of tutor as well as the nature of vocational requirement. Overall based upon these two exercises the author would conclude that the evidence generated would suggest that industrial simulation can be an effective technique for teaching and assessing vocational and in particular surveying education. As with all less established teaching practices, more work needs to be undertaken to ensure that the maximum benefits are being realised and that those looking to incorporate industrial simulation in to their future teaching practice have access to information which will ensure their efforts are well rewarded.

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Simon Mclean is a senior lecturer in Building Surveying at Sheffield Hallam University in the UK. He joined higher education teaching in 2000, but still maintains some practice and consultancy work as a Chartered Building Surveyor, (MRICS). In addition he is the managing editor of the international Journal of Building Appraisal, published in the UK by Palgrave Macmillan. He is currently researching building surveying education, towards a future PhD.