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Knowledge production within the innovation system: a case study from the United Kingdom

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This paper focuses on a key issue for university managers, educational developers and teaching practitioners: that of producing new operational knowledge in the innovation system. More specifically, it explores the knowledge required to guide individual and institutional styles of teaching and learning in a large multi-disciplinary faculty. The case study presented outlines a sustainable approach for achieving quality enhancement of teaching and learning and producing new operational knowledge. Sustainability is achieved by linking to, and being sympathetic to, the innovative activity-led concept of learning reported in this paper. This leads to the identification of elements of evaluation that are appropriately aligned to the teaching and learning behaviours, attitudes and approaches that are critical for the innovation to be successful. Such context-sensitive evaluation elements allow meaningful feedback for the purposes of creating new operational knowledge that may then be applied and tested for on-going refinement and learning.

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Générer de la connaissance au sein du système d'innovation : une étude de cas au Royaume-Uni

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Cet article se concentre sur un problème clé rencontré par les directeurs d'universités, les conseillers pédagogiques et les praticiens de l'enseignement : celui qui consiste à produire une nouvelle connaissance opérationnelle au sein du système d'innovation. Plus précisément, il explore la connaissance requise pour orienter les méthodes individuelles et institutionnelles d'enseignement et d'apprentissage au sein d'une faculté multidisciplinaire. L'étude de cas présentée souligne une approche durable permettant d'améliorer la qualité de l'enseignement et de l'apprentissage et de produire une nouvelle connaissance opérationnelle. La durabilité est obtenue en étant associée et en harmonie avec le concept innovant dirigé par l'activité d'apprentissage exposé dans ce document. Cela permet d'identifier les éléments d'évaluation appropriés qui s'alignent sur les comportements, les attitudes et les approches d'enseignement et d'apprentissage essentiels pour parvenir à l'innovation. Ces éléments d'évaluation contextuels fournissent des informations significatives pour la création d'une nouvelle connaissance opérationnelle qui pourra ensuite être appliquée et testée afin d'assurer un suivi permanent de l'amélioration et de l'apprentissage.

Introduction

A recent OECD report highlights the implications for institutional actors of engagement in quality teaching. In particular it emphasises that:

> A quality culture at institutional level can be better achieved through diverse initiatives, the consolidation of bottom-up initiatives, small-sized experiments at course or programme level, replication of success stories, the evaluation of quality teaching as a vehicle of discussion, and the participation of technical and administrative staff to provide mediation between academia and students. (OECD, 2009, p. 8)

The Faculty of Engineering and Computing (EC) at Coventry University is instituting the above activities within an activity-led vision and concept of learning (Wilson-Medhurst *et al.,* 2008; Wilson-Medhurst and Glendinning, 2009). This vision aims to develop communities of learners engaged in employer and profession-focused activity-led education. Working definitions of the associated pedagogy, known as Activity Led Learning (ALL), are presented in Wilson-Medhurst *et al.* (2008) and Wilson-Medhurst and Glendinning (2009). Two key features of ALL are that the activity is the starting point for engagement in learning and that the tutor acts as facilitator. The learning process itself requires "a self directed ... process in which the individual learner, or team of learners, seek and apply knowledge, skilful practices, ... and resources (personal and physical) relevant to the activity [being undertaken]." (Wilson-Medhurst *et al*., 2008, p. 2)

This paper explores how the ALL concept of learning constitutes an innovation in response to the need for organisational adaptation. It then explores how this concept of learning frames the challenge of converting information into operational knowledge that guides individual and institutional styles and practices of teaching and learning.

Operational knowledge is defined here as a form of knowledge that is distinct from disciplinary knowledge, and is associated with the way a university goes about its day-to-day activities. It is held or embodied in a university's values, policies and practices (James, 2001). The Coventry EC case study presented below serves to illustrate how the above operational knowledge production challenge is being approached within a large multi-disciplinary Engineering and Computing faculty with over 4 000 students.

The challenge

In response to external pressures, "universities have become compelled to look for structures and processes better suited to frequent adaptation" (James, 2001, p. 43). As James also observes, teaching is the site of much of the change and adaptation due to three pressures in particular: the growth in higher education (HE) participation and the associated diversity of the student population, changes in student-teacher relationships and the impact of technology on the forms of learning and learning delivery that are possible (James, 2001).

In this UK case study context the activity-led concept of learning (ALL) is the innovation that of itself allows an adaptive response to the demands of the various faculty disciplines as well as the challenges outlined above. At the same time it provides a framework of operation that guides learning support, learning facilities and the roles of staff and students. It also lends itself to context-sensitive evaluation and measurement, as will be explored below.

James (2001) articulates five tentative principles for strengthening the adaptive capacity of universities:

- Recognise that the department/centre is the key learning unit.
- Consciously build feedback loops.
- Establish clear, agreed and measurable objectives.
- Encourage experimentation, tolerate error.
- Create nodes for knowledge diffusion.

These principles accord well with the findings of the fore-mentioned review of quality teaching in HE (OECD, 2009). However, the publication also acknowledges that achieving sustainable change in relation to learning and teaching is challenging, partly because measuring teaching quality is complex and difficult. This complexity is reflected in the following barriers or learning inhibitors to organisational adaptation within universities (James, 2001):

- Feedback on organisational performance in HE is often ambiguous.
- There are lengthy delays in the feedback loops.
- Causal links between actions and outcomes are unclear.
- Universities have individualistic cultures.
- Quality assurance has often been a top-down activity.

The measurement problem

As suggested above, lengthy delays in the feedback loops and problems establishing causal links between actions and outcomes all contribute to the measurement difficulties associated with assessing teaching quality. Higher

Education therefore looks for measurement opportunities with short-loop feedback properties that can serve as adequate proxies for longer-term outcomes (James, 2001). In the UK, the student satisfaction survey, known as the National Student Survey (NSS) (HEFCE, 2009) is just such a proxy for teaching quality. However the NSS, as with local variants such as the Coventry University student satisfaction survey based on the student satisfaction approach pioneered by the Centre for Research into Quality (CRQ, n.d.) do suffer from the limitations associated with the top-down quality assurance initiatives outlined above.

Surveys like the NSS may identify teaching quality deficits, and this often leads to the challenge of developing new operational knowledge to address the deficit. Such knowledge must be understood and owned by teachers and students. As Ramsden notes with reference to the Course Experience Questionnaire which predated the NSS, "evidence of how a course or department has responded to student evaluation data – the capacity of its teachers to learn from their mistakes – might be regarded as one of the most important indexes of its educational effectiveness" (Ramsden, 1991, p. 134). However one cannot assume that the operational knowledge is already "*in situ*" and it may need to be developed.

Therefore, in examining organisational knowledge and learning and moving towards a "learning organisation" (Senge, 1990), James (2001) suggests that "to develop universities into more effective learning organisations requires deeper insights into their present systems and structures for organisational learning, and into the kinds of steps and arrangements that support the creation and application of new organisational knowledge". James goes on to observe:

> Given the complexity of university operating environments and their missions, the knowledge guiding day-to-day practices is likely to be uncertain and "error" prone – using "error" here in a technical sense to refer to mismatches between expectations and outcomes. Under these circumstances, error prevention through rule-based management is unlikely and learning from error becomes the principal means for advancement; that is, the safest strategy for improvement is to nurture systems for learning from experimentation and feedback. Localised problem-solving will be optimised by conditions that foster and maintain experimentation, that are forgiving of risk-taking, and that maximise feedback. (James 2001, pp. 47-48)

Given the above challenges, what is suggested here is that quality enhancement of learning and teaching can be achieved through feedback mechanisms that are better aligned to the concept of learning within which the feedback loop operates. A key operating principle is that the evaluation of

quality teaching is used as a vehicle of discussion as the OECD (2009) publication recommends. This is consistent with the operating philosophy of ALL which places an emphasis on active (and open) engagement by all in the learning process. This dialogue around quality requires not only a top-down flow of centrally collected evaluation data (such as the NSS and Coventry University satisfaction survey data that in part inspired the ALL initiative) but also an effective counter flow of bottom-up feedback such as locally collected evaluation data. This paper focuses on the creation of this effective counter flow. Such bottom-up feedback should ultimately lead to more context-sensitive performance indicators for staff, students and managers for the purposes of enhancing the quality of teaching.

Introducing the case study context

The EC faculty at Coventry University faces a significant evaluation challenge. ALL is being developed and implemented through a continuous improvement change management process (Wilson-Medhurst *et al.*, 2008). Within this context there was an initial focus on evaluating "what works" (or not) at the modular level and identifying case studies of operation (see *e.g.* Booth and White, 2008; Davies, 2008; Davis and Davies, 2008; Lambert *et al.*, 2008). This was followed by a more systematic review of the first year students' experience of ALL at programme level in one department (Green and Wilson-Medhurst, 2009).

As these activities are scaled up to all undergraduate programmes across the faculty there is a need to consider not only how ALL will be developed but also how it can be measured and evaluated so as to promote discussion around quality teaching. Given the learning inhibitors and other challenges identified above, a bottom-up approach to quality enhancement was instituted within the framework of the overarching (top-down) concept of learning. This included setting up a Learning Teaching and Assessment (LTA) sub-group within EC at Coventry (Wilson-Medhurst, 2008) to provide a forum and a focus for deliberation around quality enhancement of teaching issues. This approach included engaging with the evidence emerging from ALL pilots within EC as well as similar activity elsewhere in the United Kingdom and overseas (Wilson-Medhurst *et al.*, 2008; Wilson-Medhurst and Glendinning, 2009).

Towards a developmental measurement tool

Over time it became clear that the LTA sub-group needed to develop a common evaluation language. This needed to be meaningful within each of the disciplinary contexts within which ALL was being implemented and thence meaningful for evaluation within those contexts.

As outlined above, there was an attempt to assess the quality of teaching of the first programme level implementation of the ALL pedagogical experience (Green and Wilson-Medhurst, 2009). This involved using a questionnaire based on the Coventry University student satisfaction survey mentioned above plus student and staff focus groups (*idem*). While this evaluation identified some useful feedback, it became clear that an instrument better tailored to the ALL approach would also be useful, in particular in relation to the kind of active learning behaviours and roles that the ALL pedagogy requires for effective learning to take place. Having an appropriate evaluation instrument for learning and teaching behaviours is particularly important when one considers that, as recent research suggests, once students are on their programme of study it is the quality of the learning and teaching experience that has the most influence on student satisfaction (or otherwise) rather than other aspects such as the physical environment (Douglas *et al.,* 2006).

In developing such a tailored instrument, a suitable pilot approach was identified as soon as the LTA sub-group focused on the overarching objective of the ALL concept of learning, which is to promote student engagement. To this end it was important to identify what was meant by engaged learning and a report identifying indicators of engaged learning (Jones *et al.*, 1995) provided useful insights (see Appendix I). These indicators of engaged learning formed the basis for discussions around the derivation of an evaluation instrument for ALL. The LTA sub-group containing representatives from all departments discussed and agreed that EC would pilot a questionnaire based on these indicators of engaged learning. This piloting was to be conducted within a focus group setting.

Consistent with the ALL concept of learning, the objective at this stage was to design an evaluation instrument that could be used consensually by students and staff to:

- Encourage student reflection on their learning (Rowley, 2003).
- Allow students the opportunity to give teaching staff feedback on their learning experience to date and therefore give staff a "window" on that experience and the opportunity to respond.

This step constituted an attempt to "shorten" the feedback loop and to optimise localised problem-solving to allow learning from experimentation and feedback.

The survey questions that formed the evaluation instrument focused on ALL learning and teaching behaviours, attitudes and approaches: these constituted the "objects" of satisfaction (Aldemir and Gülcan, 2004). Students were asked to rate the extent to which they were satisfied with various aspects of their learning and teaching experience on their course, and then to rate

how important they were to their experience as a student. Thus, for example, where the Coventry University satisfaction survey prompted "Teaching staff treat you with appropriate respect" and "Class size appropriate to the activity", the ALL survey instead prompted "I can question my tutors" and "I work in small groups with persons from different backgrounds and experiences". The ALL survey questions are better aligned (Biggs, 1999) to the ALL concept of learning. Table 1 gives further examples of the different style of questions in the two types of survey.

Table 1. **Comparison of survey question "types"**

Typical "standard" survey questions	ALL-aligned survey questions
Availability of staff for informal discussion.	I can question my tutors.
	I can debate concepts and ideas with my tutors.
How you are being taught.	I work in small groups with persons from different backgrounds and experiences.
Class size appropriate to the activity.	
Knowing what is expected of you as a student.	I try out new things.
	I teach others in informal contexts.
Range of topics covered in your syllabus.	The activities on my course relate to real world problems.
The course is intellectually stimulating.	My studies use and develop my different capabilities and strengths.

The above ALL-aligned survey questions are intended to provide a common evaluation language in order to promote tutor-student and student-student communication around activity-led learning. These survey questions need to be "fit for developmental purpose" and to be used in conjunction with other feedback mechanisms to facilitate dialogue, as is consistent with the ALL concept of learning. This does not preclude the use of aligned top-down indicators to help benchmark change over time.

An outline of the method and findings of the pilot

The questionnaire was piloted with two volunteer groups of first- and second-year undergraduate students drawn from different programmes of study; 17 students participated in all. The focus group sessions were facilitated by student advocates from the faculty's student experience enhancement unit (SEE-U). The questions relating to indicators of engaged learning were on the whole well understood by students, and provoked discussion around matters that were clearly important to them. The discussions revealed that activity-led learning was being implemented differently and to different degrees in different modules, programmes and departments. Different degrees of satisfaction were reported as a function of

these experiences. Key factors for satisfaction related to the teacher/facilitator role, learning activity design, as well as assessment design and alignment.

The aim of this pilot was to check students' understanding of questions and whether these questions were important to them. Having identified their relevance and where question refinements could usefully be made, the next step will be to put the refined questionnaire to a larger number of student groups in the 2009/10 academic session. The results of this survey will help evaluate first year undergraduate, first six-week ALL pilot implementations across the EC faculty. This in turn will inform the development of the ALL approach and identify new operational knowledge that will help staff and students to effectively utilise ALL within their disciplinary contexts. Ultimately this will nurture the development of context-sensitive performance indicators that are predicated on activity-led (rather than, say, didactic) models of teaching and learning. These indicators should enable staff, students and managers to enhance the quality of teaching and learning.

The knowledge production process

The EC faculty case study illustrates the process by which context-sensitive evaluation elements can be identified to allow meaningful feedback for the purpose of creating new operational knowledge. This knowledge can then be applied and tested for on-going refinement and learning.

This process reflects James' five tentative principles (outlined above) for strengthening the adaptive capacity of universities, *i.e.* recognise that the department/centre is the key learning unit; consciously build feedback loops; establish clear, agreed and measurable objectives; encourage experimentation, tolerate error; create nodes for knowledge diffusion (James, 2001).

In the case under discussion the EC faculty is the key learning unit, where, as the OECD report recommends the evaluation of quality teaching is used as a vehicle of discussion, here within the guiding vision and principles of activity-led learning. One central element of this process is a consciously built feedback loop using aligned teaching quality indicators that are themselves constructed and refined through an action research (McNiff and Whitehead, 2006) process. Top-down data flow can generate the impetus for change but the response to generate new operational knowledge requires a bottom-up drive and strategy. This approach also acknowledges that sustainable change is one in which both staff and students are engaged to generate the new operational knowledge.

The knowledge production process articulated in this paper includes the following key features. It should:

- Have a clear statement of the vision and values that underpin the initiative.
- Provide a clear articulation of the concept of learning in terms of expected behaviours, attitudes and approaches (links to the underpinning vision and values).
- Allow time for the co-operative selection (*i.e.* involve staff and students locally) of teaching quality indicators that are meaningful within the context of learning. This can include aligned top-down indicators to help benchmark change over time.
- Use the aligned teaching quality instrument in conjunction with other appropriate sources of feedback to evaluate the "experiments".
- Use the teaching quality instrument itself developmentally; and ensure that the feedback is owned and utilised by key stakeholders but in particular teaching practitioners who are engaged with its development.
- Utilise (and have access to) supportive management and team-working structures including a staff forum for discussing the outputs that feed into other decision-making structures and discussion fora.
- Give a key role to lead facilitators (not simply "champions") at faculty, departmental and course level.

In short, to generate new knowledge aligned to the concept of learning the knowledge needs to be built in concert. In EC at Coventry this was initially achieved through ALL pilots which were co-ordinated through an LTA advisory group, and as a result of this an emergent Community of Practice (Wenger, 1998) of ALL researcher practitioners formed (Wilson-Medhurst, 2008). This work was carried out in tandem with developing student-facing systems and processes that are fit for purpose. This parallel initiative gave rise to the EC faculty's Student Experience Enhancement Unit (SEE-U) and student advocacy as described in Glendinning *et al.* (2008) and Wilson-Medhurst and Glendinning (2009). Student advocates acting as research "assistants" played an important role in the research process to test questions with volunteer students. The ALL innovation extends to planning and designing learning spaces that are fit for purpose. Some initial exploration of these aspects of the work at EC, plus others in relation to the change management approach being adopted, is explored in Wilson-Medhurst and Glendinning (2009).

Linking to the EC faculty vision

This adaptive knowledge production process has a consciously built feedback loop that ultimately links back to the vision that underpins the activity-led learning innovation. The evaluation questions help to close the

feedback loop not only locally at the course and departmental level but also at the strategic or vision level. Table 2 illustrates how the ALL-aligned survey questions link back to the vision that underpins this initiative.

Table 2. **The EC vision and examples of related evaluation questions**

Vision: to develop communities of learners engaged in employer- and profession-focused activity-led education	Example of type of question that relate to the EC vision
Communities of learners.	*e.g.* I feel part of a learning community where I learn from others.
Employer- and profession-focused.	*e.g.* The activities on my course relate to real-world problems.
Activity-led education.	*e.g.* I am presented with a range of activities that allow me to develop my capabilities in a variety of ways.

The types of question above enable students to provide aligned feedback that can be acted upon by relevant stakeholders and teaching practitioners in particular. Such questions, as appropriate proxies for ALL teaching quality, can also be used to track changes over time, for benchmarking purposes for example. More meaningfully, perhaps, these questions provide both staff and students with the opportunity for self evaluation or self tracking against aligned performance or developmental indicators.

Concluding remarks

A student satisfaction survey cannot be a sufficient proxy for teaching quality if questions asked do not fully relate to the teaching and learning behaviours, attitudes and approaches expected and required of both staff and students. Indeed it may promote learning and teaching practices that are not fully aligned to the concept of learning. This can potentially limit or undermine the development of context-sensitive operational knowledge around learning and teaching practices. It is therefore important to identify and develop evaluation instruments that are better informed by the concept of learning in which they must operate.

This paper presented a case study that demonstrates the processes through which such an evaluation instrument can be developed. This includes ensuring the elements or objects of evaluation are suitably aligned to the concept of learning. The instrument itself, if used developmentally in conjunction with other feedback, can promote sustainable improvements in teaching quality framed within this concept of learning. Another objective is to generate performance or developmental indicators which are better recognised and valued by those who need to respond to them at the operational level, and that are consistent with the overarching vision and values that underpin the innovation.

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APPENDIX I

Table 3. **Indicators of engaged learning**

Variable	Indicator of engaged learning	Indicator definition
Vision of learning	Responsibility for learning	Learner involved in setting goals, choosing tasks, developing assessments and standards for the tasks; has big picture of learning and next steps in mind.
	Strategic	Learner actively develops repertoire of thinking/learning strategies.
	Energised by learning	Learner is not dependent on reward from others; has a passion for learning.
	Collaboration	Learner develops new ideas and understanding in conversations and work with others.
Tasks	Authentic	Pertains to real world, may be addressed to personal interest.
	Challenging	Difficult enough to be interesting, but not totally frustrating, usually sustained.
	Multidisciplinary	Involves integrating disciplines to solve problems and address issues.
Assessment	Performance-based	Involving a performance or demonstration, usually for a real audience and useful purpose.
	Generative	Assessments have meaning for learner; maybe produce information, product, service.
	Seamless and on-going	Assessment is part of instruction and *vice versa*; students learn during assessment.
	Equitable	Assessment is culture fair.
Instructional model	Interactive	Teacher or technology programme responsive to students' needs, requests (*e.g.* menu driven).
	Generative	Instruction oriented to constructing meaning; providing meaningful activities/experiences.
Learning context	Collaborative	Instruction conceptualises students as part of learning community; activities are collaborative.
	Knowledge-building	Learning experiences set up to bring multiple perspectives to solve problems such that each perspective contributes to shared understanding for all; goes beyond brainstorming.
	Empathetic	Learning environment and experiences set up for valuing diversity, multiple perspectives, strengths.
Grouping	Heterogeneous	Small groups with persons from different ability levels and backgrounds.
	Equitable	Small groups organised so that over time all students have challenging learning tasks/experiences.
	Flexible	Different groups organised for different instructional purposes so each person is a member of different groups; works with different people.

Table 3. **Indicators of engaged learning** *(cont.)*

Variable	Indicator of engaged learning	Indicator definition
Teacher roles	Facilitator	Engages in negotiation, stimulates and monitors discussion and project work but does not control.
	Guide	Helps students to construct their own meaning by modelling, mediating, explaining when needed, redirecting focus, providing options.
	Co-learner; co-investigator	Teacher considers self as learner; willing to take risks to explore areas outside their expertise; collaborates with other teachers and practicing professionals.
Student roles	Explorer	Students have opportunities to explore new ideas/tools; push the envelope in ideas and research.
	Cognitive apprentice	Learning is situated in relationship with mentor who coaches students to develop ideas and skills that simulate the role of practicing professionals (*i.e.* engage in real research).
	Teacher	Students encouraged to teach others in formal and informal contexts.
	Producer	Students develop products of real use to themselves and others.

Source: Jones, B.F. *et al.* (1995).

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