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Decision support

## A utilisation focussed and viable systems approach for evaluating technology supported learning



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## ABSTRACT

The paper uses a higher education case study to illustrate a participative *theory of change* approach to evaluating technology supported learning. The approach is informed by the Viable Systems Model (VSM) and utilisation-focussed evaluation and, falls within the tradition of facilitated modelling approaches to operational research. We argue that this approach worked well in engaging primary evaluation users in a process of collaborative action research to improving an educational development initiative and that the approach helped generate information relevant to answering its primary users' questions, to inform their specific decisions and actions relevant to their quality enhancement responsibilities.

Through a case study, concerning the evaluation of an educational development initiative in a large UK university, we illustrate how the VSM and utilisation-focussed evaluation could be used to: (a) conceptualise the connection between strategies and their components at different levels of organisation; (b) to clarify the role and interests of stakeholders in these strategies; and (c) to scope evaluation to be relevant to informing the decisions and actions of these stakeholders. The paper contributes to illustrate how VSM principles can underpin a *theory of change* approach to engaging primary stakeholders in planning an intervention and its evaluation in the context of educational development work, in order to improve evaluation to be more relevant to their needs. The paper should be of interest to researchers exploring the use of systems theory in evaluation, in particular in the context of educational development work in higher education.

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## 1. Introduction

In this paper we use a case study to illustrate, a participative *theory of change* approach to evaluating technology supported learning (TSL). It is informed by the Viable Systems Model (VSM) and utilisation-focussed evaluation (U-FE) and, falls within the tradition of facilitated modelling approaches to operational research (OR). The purpose is to contribute to a body of published cases of soft OR applied to the evaluation of TSL, thus, explaining how theory is applied systematically in an intervention. This is to allow others to assess the relevance of the approach to their own contexts and, to gain some understanding of how to use the approach. This is presented not as a case of 'best practice' but as lessons learnt about implementing the evaluation approach used in a case study concerning an educational development initiative

in taught courses in the built environment disciplines of a large UK university.

A recent review of operational research and education (Johnes, 2014) suggested that despite the large provision of online courses, the OR in education literature, particularly vocational and e-learning education, still presents some gaps. He concluded that whilst some issues and problems such as efficiency, scheduling and resourcing in education have been well-covered using a variety of tools and techniques, this is an area in which operational researchers could make useful contributions (Johnes, 2014, p. 691). The aim of this paper is to contribute to addressing this gap.

The research context is that of educational development work in UK higher education (HE). The term *educational development* is used here to mean the "systematic and scholarly support for improving both educational process and practices and capabilities of educators" (Stefani, 2003, p. 10). We acknowledge that the term *academic development* is more popular in other parts of the world, but in the UK, this latter term is more commonly interpreted as subsuming educational development and covers a wider remit of developing academic staff in all areas of their practice.

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The paper is organised as follows: in the next section, we conduct a review of relevant literature to explain the rationale for the approach used in the case study. In Section 3, we provide some background to our case study, a complex educational development initiative in a large UK university. In Section 4, we describe the facilitated approach used with the university's stakeholders. In Section 5, we illustrate how the VSM principles were used to guide this facilitation and explain how this was found to be helpful. In Section 6, we discuss the results from the evaluation and reflect on the experience of implementing the approach. Section 7 provides our concluding remarks with some implications for future research.

## 2. Background literature

In this section, we explore the quality landscape in UK higher education, review research in TSL and consider the methodologies used in relation to what has been learnt. We draw from theory about intervention evaluation and systems thinking to assess its suitability for evaluating TSL to inform quality enhancement decisions and actions. In particular we consider program evaluation, utilisation-focussed evaluation, and facilitated modelling as approaches that bring to the fore the evaluation of the relationship between human activity and outcomes, the relevance of the evaluation to its intended users and the engagement of stakeholders. We discuss the interest in and relevance of using the concept of viable systems in modelling educational processes to guide the evaluation of TSL. We conclude this section with a summary of the arguments that justify the approach that will be illustrated in our case study.

### 2.1. Quality in UK higher education

It is a statutory requirement that the quality of HE provision in the UK be evaluated to provide accountability for government investment. This investment acknowledges the strategic importance of developing higher level skills needed in the UK labour market for it to remain competitive in a global market. The expectation is that institutions are adaptable and responsive to emerging skills needed by employers and to stakeholders' needs in the ways in which educational provision is met (UKCES, 2014). At the time of writing this paper the regulatory framework and process for oversight is in a period of significant change (Business, Innovation, & Skills Committee, 2016; DBIS, 2016).

A key challenge for the UK HE sector has been developing evaluation that informs improvement for a diverse group of stakeholders. Historically, there have been arguments that too much emphasis has been placed on driving improvement in UK HE through quality assurance (QA) activity at the expense of quality enhancement (QE) (Harvey, 2005; Harvey & Williams, 2010a, b). One of the main criticisms associated with QA activity in UK HE is its focus on a set of externally determined parameters that can be compared across institutions. This is framed by a *student as customer* perspective, with universities considered as businesses competing in a market (Houston, 2007, 2008a). This is a view being reinforced by current changes in the sector (DBIS, 2016). Hence, one source of data for this comparison is a national student satisfaction survey, often mirrored by internal surveys at different levels or organisation (course, department, faculty). These standardised surveys are often unpopular with staff (Bamber & Anderson, 2012), and student responses low (Nair, Adams, & Mertova, 2008). Whilst the purpose of these surveys is also purported to be to inform decisions about improving the student experience and student learning (Harvey, 2003), they focus on a narrow range of generic aspects of their experience, such as assessment and feedback and student support, and there is limited qualitative data

to help in the interpretation of the reasons for students' responses. It is therefore argued that this data is inappropriate for helping educators understand how their efforts support student learning in a specific context (Harvey, 2002; Houston, 2008a). In particular, this approach is questioned for its value in providing information usable at local level given the variability in local context (Ashby, Richardson, & Woodley, 2011; Harvey, 2003; Williams & Cappuccini-Ansfield, 2007) and between subject disciplines (Gibbs, 2010).

In the recent context of external quality review of UK HE institutions, academic quality is described as "*how well the learning opportunities made available to students enable them to achieve their award*" (QAA, 2012). The focus is on the transparency of policies and procedures, and the effectiveness of institutions' own approaches to monitoring, evaluation and improvement (QAA, 2015). The specific internal approaches that institutions use for this are not prescribed. However, this notion of academic quality implies making judgements about the relationships between processes and outcomes in the educational context. It has been argued that this, and the accountability to multiple stakeholders, means that quality criteria can be difficult to precisely specify and measure due to the increasing complexity this brings (Gibbs, 2010; Houston, 2007, 2008a).

An approach now widely relied on for quality enhancement in HE is for new academic staff to undertake professional development to become reflective practitioners actively engaged in experiential learning (Kolb, 1984; Schön, 1983) to inform improvement in their practice. This approach assumes change to be driven by individuals continually testing and improving their (often implicit) theories about the relationship between their activity and its effects in their local contexts. This has been argued to be too simplistic because it neglects to consider both the wider context of simultaneous change initiatives, and the more complex social and political influences on developing and sharing a concept of good practice (Trowler, Fanghanel, & Wareham, 2005). A more systematised and formalised approach to the inquiry through educational action research has been recommended for building capacity, improving rigour and developing transferable knowledge (Kember, 2002; Marks-Maran, 2015). Others have suggested that for organisational change to occur, this process needs to be undertaken and organised at the collective level (Biggs, 2001; Vince, 2002). Whilst some progress has been made with this aspiration (Bruce, Flynn, & Stagg-Peterson, 2011), collaborative research has also been found to be challenging in this context, particularly around issues such as establishing amongst collaborators a shared vocabulary, goal (Jacobs, 2016) and perception of importance and relevance of the research (Greenbank, 2007).

### 2.2. Technology supported learning and its evaluation

The use of technology in learning, teaching and assessment has become an important dimension of UK higher education strategy (HEFCE, 2009), and hence educational development work. The most recent (at the time of writing) of a periodic survey that monitors trends in this context (Walker et al., 2014) reported that *enhancing the quality of learning and teaching* is the primary longitudinal driver for using technology, but *lack of academic staff knowledge* was the second most important barrier to developments in this area (after *lack of time*). It has been argued that this lack of knowledge is due to existing evaluation and research not being based on appropriate assumptions of learning as complex socially constructed activity (Bennett & Oliver, 2011; Cox & Marshall, 2007; Oliver, 2011). Whilst the term *technology enhanced learning* is gaining favour over the term *e-learning* with its emphasis on added value to the learning process, there continues to be lack of clarity and debate about what exactly is meant by *enhancement* and how

this is evaluated to inform good practice (Cox & Marshall, 2007; Kirkwood & Price, 2014). In this paper, we have favoured the term *technology supported learning* as denoting an intention to facilitate the learning process in some way.

Research in this field has been criticised for its focus on specific practical problems such as the use of particular tools in specific contexts, with weak relationship to theory (Bennett & Oliver, 2011). Examples that illustrate this point are student surveys about:

- (a) Their experiences of the usability and accessibility of the technology used (Kim & Lee, 2008).
- (b) The generic benefits of using technology (e.g. time management, revisiting content) (Henderson et al., 2015).
- (c) Strategies for using technology to support learning (Wan, Compeau, & Haggerty, 2012).

A qualitative study involving interviews with both teachers and students about their experiences of using a new virtual learning environment (VLE) provided some insight into the reasons for perceived benefits and strategies used across the institution as a whole (Heaton-Shrestha, May, & Burke, 2009). However, all of these evaluations seem to be aimed at discovering some generalisable outcomes of fairly generic uses of technology implemented at institutional level, rather than helping practitioners understand how their specific interventions with technology work.

There is an emerging interest in learning analytics using data held in learning management systems and VLEs to identify patterns of user behaviour and its correlation with demographic and/or assessment data (Picciano, 2012; Siemens, 2013). This can be used to indicate students at risk of dropping out or failure, to inform activity and resource allocation to be directed appropriately towards supporting students and improving retention and progression (De Freitas et al., 2015; Fritz, 2011; McFadyan & Dawson, 2012; Mogus, Djurdjevic, & Suvak, 2012). Again, those conducting this type of research acknowledge its limitation in terms of demonstrating the relationship between specific strategies used and learning (Verbert, Duval, Klerkx, Govaerts, & Santos, 2013) and providing meaningful data to inform practitioners in improving their own teaching strategies (Dringus, 2012).

Whilst there has been some discussion and conceptual contributions to HE research about the need for systems approaches in quality processes (Davis & Sumara, 2005; Houston, 2007, 2008a, 2008b; Radford, 2006) and more specifically in the context of TSL (Ellis & Goodyear, 2010), it has been argued that there is limited evidence to support the utility of these approaches and, that further research is needed (Houston, 2008a).

Examples of uses of systems thinking and practice in this field have been:-

- (a) To stimulate debate amongst stakeholders about priorities for change at institutional and sector level (Houston, Robertson, & Prebble, 2008; Houston & Paewal, 2013).
- (b) To explore (through survey data) use, experience and perceptions of usefulness of an implemented, institution-wide, e-learning system from both students' and teachers' perspectives (Alexander & Golja, 2007).
- (c) To participatively develop the evaluation criteria to be used in the evaluation of an institution-wide managed learning system (Hardman & Paucar-Caceres, 2011).

Systems thinking underpins the concept of *constructive alignment* (Biggs & Tang, 2011), a framework now commonly used to guide practitioners in designing teaching and assessment strategies to help learners achieve specific learning outcomes in context. The authors' advice to evaluate implemented strategies using evidence readily available that "*is relevant and sufficient for your purposes*"

(Biggs & Tang, 2011, p. 286) might be helpful in guiding individuals in their reflective practice, but is rather simplistic for the application to more complex, collaborative action research. It has also been criticised for treating teleology too simplistically in terms of the relevance of desired learning outcomes to the wider environment (Lee, 2014). A more recently proposed systems framework for evaluating computer-supported collaborative learning (Barros-Castro, Córdoba-Pachón, & Pinzón-Salcedo, 2014) also took as a starting point the definition of learning purposes from the teachers' perspective, neglecting to make explicit the rationale for how these were being shaped through connection with the wider environmental context. This research used a number of methods applied to a real case (e.g. surveys, analysis of VLE content and tracking data, minutes of meetings), but was also limited in qualitative data to provide rich insight into how the process was socially constructed. These limitations were acknowledged in the recommendations for future research to include a wider concept of beneficiary (rather than primarily students), to develop deeper understanding of stakeholder perspectives, and to consider influence of the process on the wider context.

### 2.3. Program evaluation

Program evaluation, also termed intervention evaluation, is intended to inform decisions about improvement action in specific situations of interest, with emphasis on developing understanding about process. Typically this involves iterative implementation and testing of 'theories' about patterns and relationships between components (e.g. people, activities, resources) and outcomes in these situations. Hence, terms in common use in early theory and practice were *theory-based* (Weiss, 1972, 1997) or *theory-driven* (Chen, 1990) evaluation.

Patton (2012) argues that these terms may imply testing of wider social science theory, and that the term *program theory* is more meaningful in describing the connections stakeholders make about what and how things work in their specific contexts. The latter is argued to require both a *theory of action* (implementation theory) and a *theory of change*, where the theory of change is considered to be concerned with assumptions about the central process(es) driving change and the theory of action is concerned with the specific strategies used to activate this change in a specific context (Funnell & Rogers, 2011). For example, in learning processes the theory of change might be informed by pedagogical theory such as experiential learning theory (Kolb, 1984). This makes the assumptions that we learn by engaging in some real world experience, and evaluate and reflect on our experience to make sense of what happened, which can inform our future decisions and actions. The theory of action would be concerned with more specific intervention strategies used by teachers to engage their target learners in real world experience anticipated to lead to some desired learning outcomes relevant to preparing them for some future situation they may face. A program theory may be informed by wider social science theory and its testing may contribute to this theory (Patton, 2012).

Acknowledging the variations in terms and their meaning and usage, this type of evaluation has been described broadly as "*any evaluation strategy or approach that explicitly integrates and uses stakeholder, social science, some combination of, or other types of theories in conceptualising, designing, conducting, interpreting, and applying an evaluation*" (Coryn, Noakes, Westine, & Scröter, 2011: 201).

From a realist perspective (e.g. Pawson, 2006; Pawson & Tilley, 1997) the aim of evaluation is to discover context, mechanism and outcome configurations that work in interventions through iterative implementation and evidence-based evaluation. There is

recognition of the need to understand complexity in terms of multiple factors in causation, non-linearity of change, and emergent outcomes (both intended and unintended) (Westthorp, 2012, 2013). As a consequence, there is an emerging preference for the term *contribution* rather than *attribution* when discussing relationships between processes and their outcomes, and contribution analysis which aims “to make credible causal claims about the contribution an intervention is making to observed results” (Mayne, 2012, p. 270). In this context, the theory of change is considered as a *postulated causal package* (Mayne, 2012).

The main criticism of this realist perspective is that it does not take into sufficient consideration the role of different stakeholders' subjective perspectives in both shaping and interpreting *mechanisms*. It has been argued that many of these types of evaluations focus on activity, outcomes and context configurations in such a way that they only access data that enables plausible inferences to be made about *what works* (or not). *How* interventions work may be hidden as the activity of those involved is influenced by their subjective beliefs, values, motivations, interpretations (Astbury & Leeuw, 2010; Weiss, 1997). Realist evaluation may seek stakeholder perspectives in guiding the focus of the evaluation and as sources of data, for example about their experiences, and use different methods to access this data. However, it is uncritical about who decides what counts as *intervention success*, how this could or should be achieved, and the influence this will have on stakeholder participation in both the intervention being evaluated and the evaluation activity, and hence what is learnt.

From constructivist and social constructionist perspectives evaluation attempts to take into considerations stakeholders' differences in motivations and perspectives on what counts as success and their role in achieving it at the outset. This is to acknowledge that these differences affect not only the outcome(s) of the activity or intervention being evaluated, but also its evaluation (Connell & Kubisch, 1998; Guba & Lincoln, 1989). Stakeholders are involved in negotiating the scope and criteria for the evaluation, and sometimes acceptable thresholds for these criteria, on the assumption that there is more likelihood that that the intervention will be successful if the stakeholders can agree on the meaning of success and the criteria by which it will be judged, *and* commit to achieving it. There is no assumption about consensus being reached, only that if there are issues causing conflict these are highlighted and can be an issue of relevance to explore in the evaluation.

For OR interventions these two positions have been differentiated as *expert* and *facilitated* modes with the following assumptions (Table 1):

**Table 1**  
Comparison of assumptions for expert and facilitated modes of OR (Franco & Montibeller, 2010, p. 491).

Expert mode assumptions	Facilitated mode assumptions
Problems are 'real' entities	Problem are socially constructed
Analysis should be objective	Subjectivity is unavoidable
Clients want 'satisficing' solutions	Clients want optimal solutions
Implementation of scientifically based analysis is straightforward	Participation increases commitment for implementation

The expert mode is aligned with the realist position that change can be driven by experts responsible for framing the problem correctly, deciding success criteria, and gathering and interpreting data about these criteria to recommend solutions. The facilitated mode is aligned more closely with the social constructionist position that change is dependent on the actions of those involved in the situation of interest, in turn influenced by their subjective perceptions of problems and solutions. In this mode, the consultant facilitates a participative process of modelling to guide inter-

vention and inquiry. Neither mode is advocated as 'best', only that the facilitated mode works better to inform strategic decisions in complex social situations. It is also acknowledged that using a facilitated mode in OR interventions does place constraints on the approach used (e.g. methods, models) and that further research is needed about the issues to inform the development of OR methodologies (Franco & Montibeller, 2010).

In both PPE and U-FE the theory of change is not 'truth' about reality but a model that “*must be useful for those that have created it and comprehensive and engaging for others who will use it*” (Funnell & Rogers, 2011, p. 241), acting as “*an agile heuristic*” (Funnell & Rogers, 2011, p. 79) in guiding action in the direction of improvement. As such, the model will evolve as inquiry progresses. A good model has been described as “*one that contains sufficient knowledge and information to help the client group find a way forward*” (Franco & Montibeller, 2010, p. 494). It is modelling and model use that is argued to be what distinguishes facilitated modelling from other change facilitation processes and characterises it as OR practice (Franco & Montibeller, 2010). Models take various formats and can be used for different purposes and at different stages of intervention (communication, engaging stakeholders, planning, guiding management, monitoring and evaluation) and represent different content and detail for different purposes. In program evaluation, theory about process is often modelled into a visual representation referred to as a *logic model*. This is the conceptual model that aids communication about the activity being evaluated and frames debate and decisions about data generation, analysis, and interpretation. There is no prescribed format for this model, but users need to be critically reflective about the choice as it “*can [] affect the way we think about a program theory and can shape it*” (Funnell & Rogers, 2011, p. 32). These models are often criticised for representing change as a linear, unidirectional process. Fig. 1 provides a simplified representation of this linearity and unidirectionality in the relationships and connections.

Participative and facilitated approaches have also attracted some criticism (Mason & Barnes, 2007; Pawson & Tilley, 1997; Ulrich, 1987) for their assumption that all perspectives should be 'swept in', whether it is appropriate to involve all stakeholders, or even possible to identify all stakeholders, without first determining the scope of the evaluation or privileging someone's perspective on stakeholders. There are also questions raised about when negotiation of scope and criteria should cease, or who decides this. It has also been argued that they emphasise initial modelling over testing and critique of how the intervention works in practice (Blamey & Mackenzie, 2007). In situations of complexity and uncertainty, it also may not be possible to agree thresholds or targets for key indicators of success, as there will be no prior experience or base level data to inform this judgement (Patton, 2012). Hence, a systematic literature review of theory of change approaches to evaluation spanning 20 years concluded that more published cases of these type of evaluations are needed explaining “*how the approach is enacted, procedures and analytic frameworks, and the subsequent use of evaluation results*” (Coryn et al., 2011, p. 216).

#### 2.4. Systems thinking and program evaluation

It has been acknowledged for some time now that the theoretical fields of evaluation and systems have largely been developing separately despite sharing “*many experiences, concepts, goals, even attitudes*” (Imam, LaGoy, & Williams, 2007, p. 3) and “*drawing on some of the same philosophical, sociological, and scientific developments*” (Hummelbrunner, 2011, p. 399).

Three important concepts that have been argued to be important in categorising inquiry as systemic (Hummelbrunner, 2011; Imam et al., 2007):

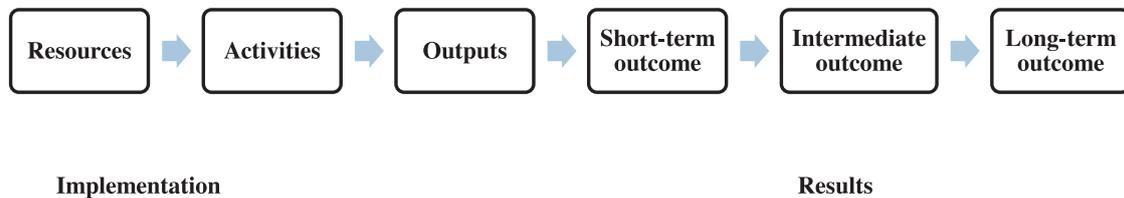


Fig. 1. Basic logic model.

- (a) Perspectives: the assumption that a situation of interest can be viewed from different perspectives.
- (b) Boundaries: the assumption that these perspectives will reflect value judgements about what/who to include in the scope of interest.
- (c) Entangled systems: the assumption that these perspectives will reflect value judgements about how boundaries are nested and connected.

It has been argued that *systemic* is often interpreted as consideration of “every component of that situation plus its context, plus its environment” but sometimes is useful to think that a systems-based approach to evaluation it is concerned with “what can reasonably left out of the enquiry” (Imam et al., 2007, p. 8). Therefore, boundary setting for any inquiry involves deciding what relevant knowledge is and who is relevant in generating it and having a stake in it. It involves consideration of issues such as the purpose, decision makers, actors, activities, measures of performance, and context for both the situation of interest and its evaluation, and consideration that these judgements are made from a particular viewpoint (Churchman, 1971; Midgley, 2000, 2007).

Both purposeful program evaluation (PPE) (Funnell & Rogers, 2011) and utilisation-focused evaluation (U-FE) (Patton, 1986, 2012) consider the purposeful nature of evaluation, starting from the assumption that evaluation is informing decisions and actions of its primary users. They therefore prioritise the need for evaluation findings to be credible and actionable, providing direction and reducing uncertainty for these users. The evaluator role is considered as facilitator working with these users in boundary setting for the inquiry. The primary users decide the evidence that will be credible in leading to plausible theory of change, and hence inform their action. It is their interpretations of a current situation and the need for change that becomes privileged in the theory building and testing process. This does not mean other stakeholders' perspectives are not important in informing this theory, but considering who these stakeholders are and their role in the evaluation is a decision made in the initial boundary setting process about appropriate design of the evaluation to answer its questions and achieve its purpose for its primary users (Patton, 1986, 2012). These authors also encourage the use of systems thinking in situations of complexity, to guide questions about “how things are connected” rather than “does a cause b” (Patton, 2012, p. 250), and to guide exploration of different perspectives in socially constructing these connections.

From a systems perspective, the role of a model is to facilitate the process of boundary critique, of how boundaries, relationships, teleology etc. of activity are perceived by different stakeholders. In social interventions, their role is to inform debate and decisions about improvement action, therefore very much aligned with the concept of facilitated modelling in OR. In program evaluation the importance of modelling is emphasised in “clarifying program boundaries” and helping participants visualise “where the program sits in, interacts with, influences, and is influenced by the wider context” (Funnell & Rogers, 2011, p. 150). Typical questions guiding boundary critique of the model concern: *relevance to whom?*; *for what purpose?*; and *how has this been determined?*

In the soft OR and problem structuring methods literature some authors have found that it can be a challenge to engage and develop practitioners in appropriate methods to use in managing complex situations (Ackermann, 2011; Midgley, 2007).

### 2.5. The Viable Systems Model (VSM) and the evaluation of technology supported learning

In the educational development literature, there has been some interest in using biological and ecological systems metaphors to explore the dynamic and dialectic complexity of change and adaptation processes in education (Ellis & Goodyear, 2010; Radford, 2006). This reflects a perspective that technology “enables [change] to happen but it also affects people's expectation about what is normal and possible” (Ellis & Goodyear, 2010, p. 2). These authors advocate that to be responsive to change, approaches need to develop users' self-awareness of how parts are interconnected and the role of communication in the effectiveness of their organisation. However, although the case studies they present do explore learning from the perspectives of both students and teachers using a range of data, they do not explain how systems concepts were systematically used in evaluation.

In the OR literature the Viable Systems Model (VSM) (Beer, 1972, 1979, 1985) has been frequently used as a lens to explore this type of adaptive organisational complexity in a variety of contexts such as: national innovation (Devine, 2005); public sector planning (Clemens, 2009); virtual enterprises (Assimakopoulos & Dimitriou, 2006); environmental sustainability (Espinosa, Harnden, & Walker, 2008); purchasing (Azadeh, Darivandi, & Fathi, 2012); disaster response (Preece, Shaw, & Hayashi, 2013, 2015); eco-community development (Espinosa & Walker, 2013); service management (Badinelli et al., 2012), policing (Brocklesby, 2012) and planning information systems in a UK Police Authority (Kinloch, Francis, Francis, & Taylor, 2009).

These examples discuss and illustrate the usefulness of the model in organising thinking about human activity in terms of the roles and relationships and the communication channels between them and how these are working in an organised way to manage change (Espinosa & Walker, 2013; Preece et al., 2013). However, cybernetic concepts and the language used in the VSM have also been found to be difficult for non-experts to grasp (Espinosa & Walker, 2013; Espinosa, Reficco, Martinez, & Gyzmán, 2015; Preece et al., 2013) and hence under-used by practitioners (Stephens & Haslett, 2011). Although case studies have been found to help it has been argued that there are few available that provide this guidance “particularly in relation to some of the more detailed nuances of practice” (Ackermann, 2012, p. 652).

There have been some applications of VSM in the education sector. For example, it has been used to try and understand why educational sector reform programs in Latin America experienced disappointing results and to inform a new approach to change (Espinosa & Jackson, 2002). It has also been found useful in the conceptualisation of a HE curriculum development process to ensure continued relevance of courses in their wider environment (Gregory & Miller, 2014). However, this latter was not illustrated through the case of an actual intervention and its evaluation. In

the more specific context of TSL, the VSM has been used as a framework to critique the functionality of prototype e-learning environments and software for their abilities to support the social interactions assumed to be required for social learning processes (Britain & Liber, 2004). However, we could not find any published cases illustrating its application in the evaluation of implemented TSL strategies, nor its use with a theory of change approach to engaging stakeholders in evaluation. This paper aims to fill those gaps.

### 2.6. Summary of background literature

In this section we have attempted to connect the literature from a number of relevant fields to justify that the approach illustrated in the following case study represents an appropriate contribution about the application of OR theory in practice.

Drawing from the quality in HE and educational development literature, we argued that lack of knowledge amongst practitioners of how to effectively use technology to support learning is still an important issue affecting quality enhancement processes. There has been some discussion about the reason for this being the lack of appropriate methodology that recognises the complexity of human interaction that results in learning and the role of technology in this process. Another issue highlighted has been the lack of a formalised, systematic and collective approach to action research in the sector to develop good practice and drive organisational (and sector) change. There has been some interest in applying complex adaptive systems concepts to understanding learning processes in HE, but limited reporting of the evaluation of real cases that make use of these concepts, and particularly so in the context of TSL.

From the evaluation and OR literature, we concluded that a facilitated theory of change approach is based on appropriate assumptions of understanding processes as socially constructed. Such an approach seeks to understand process and inform decisions and actions in the specific situation being evaluated, taking into consideration multiple stakeholder perspectives in both the theory articulation and testing. It can also contribute to the development of wider theory about good practice. However, these assumptions also bring challenges in terms of which stakeholders to involve and how to involve them, who decides this, and how to model the complexity of change and engage stakeholders in this process. More case study research has been called for to develop understanding of the implementation of these types of approaches.

The position we have adopted in this paper is that utilisation-focused evaluation and systems thinking have concepts that offer potential with respect to addressing some of these challenges. U-FE starts from a clear premise that it is a priority to involve the primary users of the evaluation in the facilitated approach, since it is their decisions and actions that the evaluation will inform. Systems thinking encourages the focus of evaluation on human activity, and therefore in the context of TSL helps the evaluation to shift from a techno-centric perspective to one that considers the role of technology in supporting learning and teaching. As we explained in detail in Section 5, VSM has been found useful to organise thinking about communication and information flow in organisations for learning and adaptation, and therefore it particularly resonates as appropriate for the purpose of evaluating educational processes. Whilst there has been some interest in its application in this context, most of the work so far has been conceptual, and we could also find no published examples of them being applied to evaluating the learning and teaching strategies of 'chalk face' practitioners. Their usefulness has been demonstrated in other contexts, but one of the challenges has been found to be that of engaging non-expert practitioners in these concepts.

The question therefore framing the case study presented in Section 2 is 'how U-FE and the VSM could usefully underpin a facil-

itated theories of change approach to evaluating practitioners' learning and teaching strategies?' We therefore go on to illustrate and discuss this in the application of a real case, drawing particular attention to how this helps generate information relevant to helping practitioners' understand how a specific learning and teaching strategy is working, and the role of technology in it, to inform their decisions and actions for improvement.

### 3. Background to the case study

The case study concerns an educational development initiative in taught courses in the built environment disciplines of a large UK University. The educational aim was to provide students with a more authentic learning experience relevant to developing knowledge and skills they would require in their future professional practices such as architecture, town planning, landscaping, and mechanical and civil engineering. The first author was involved in this evaluation as facilitator.

The intervention and its evaluation were considered complex for a number of reasons. The core teaching team involved academic staff from four different academic departments, with one team member designated project leader. They were also supported by a practitioner from the construction industry appointed as visiting lecturer and acting as critical friend, particularly in respect of the employability dimensions of the project. All the students were either on one-year taught postgraduate masters programmes or the final year of four-year undergraduate professional degree programmes.

The wider theory underpinning this initiative was experiential learning theory (Kolb, 1984; Schön, 1983). To simulate experience students would likely face in their future employed practice, they were required to work collaboratively in multidisciplinary teams on design projects (built structures and landscape) for a real urban development site. Although an initial visit to the development site formed part of the support provided for this task, some of the access to the 'real world' dimensions of the project was needed through electronic resources that could be accessed at any time, by any course member, through the virtual learning environment (VLE). Students were free to independently return to the real physical site as many times as they wished after this initial site visit, but there was no resource available to support repeat visits and due to students' conflicts in availability it was likely impractical for them to return in their groups. An important focus on the evaluation was the effectiveness of these electronic resources in reminding them of the physical attributes of the development site, as well as providing insight into the complexity of the political and social context of its development. In addition to static files and documents such as maps, photographs and planning reports, some bespoke resources had been developed. These included interactive maps with links to site photographs and videos of different stakeholder interviews representing the perspectives of different stakeholder groups (residents, developers, local businesses and local government).

The project team made a successful application for central university resources to help them in the initial stages of developing and embedding this new learning activity and the electronic resources to support it. There was therefore an accountability dimension to the evaluation. The institutional requirement for evaluation was framed by a wider context of quality enhancement at institutional and sector level, and historically the institution had experienced some difficulties in engaging stakeholders in evaluation and generating findings usable by multiple stakeholders (Hart, Diercks-O'Brien, & Powell, 2009).

The case study therefore formed part of an action research project being undertaken by the first author (working within a team of educational developers) to improve the process of engaging academic practitioners in developing and sharing good teach-

ing practice. A further purpose of the evaluation was therefore developmental (Patton, 1994), in terms of helping organisational members 'learn how to learn' (Argyris & Schön, 1996). For accountability purposes, the institutional interest was that the teaching team develop a better understanding of how the initiative contributed to improved outcomes for students and wider institutional change, and that this learning was shared with practitioners outside the initiative. The evaluation therefore needed to serve the interests of multiple clients. It needed to generate information relevant to informing the future decisions and actions of the teaching team, lead to learning relevant to other practitioners that could be shared more widely, and contribute to improving evaluation capacity within the institution.

#### 4. Modelling the theory of change: facilitating the intervention with stakeholders

The model format chosen to engage the teaching team in planning the evaluation was similar to what has been called a *tabulated pipeline* model (Funnell & Rogers, 2011). A weakness of this type of model is argued to be that it can be too simplistic in representing relationships between components as linear and 1:1 (see Section 2.3), but an advantage can be that they are quite intuitive and easy for non-experts to interpret, which is an important consideration for facilitated approaches. In this case, it is argued that the benefits of a simple approach to visualisation were a primary consideration as it was being used to engage academic staff unfamiliar with this type of evaluation. The premise of the facilitator was that the systems concepts applied as discussed in this paper would help mitigate against these limitations.

The initial draft logic model was prepared by the facilitator based on their interpretation of funding application documents. It is not uncommon practice in program evaluation to make initial drafts from existing documentation (Funnell & Rogers, 2011). This interpretation was discussed with the project leader, who advised on the other teaching team members that would be considered primary users of the evaluation. These were the leaders of other units who had students that would be participating in the new learning activity. Individual meetings were held with each of these unit leaders to discuss their interpretation of the intervention and the priority issues for evaluation, with the draft logic model guiding discussion about the: (i) rationale for change (including internal and external drivers), (ii) desired and anticipated outcomes providing direction, and the (iii) planned activities, and (iv) resources and contextual factors that they perceived to be important in effecting this change.

Points (i)–(iv) also reflect the broad sequencing of planning the discussion, although issues may emerge relevant to any element of the model at any stage in the discussion. The meetings also provided opportunity to discuss with the teaching team the purpose and scope of evaluation and the role of the facilitator. The meeting with each team member provided opportunity for any differences in perspective to be articulated. Following these meetings, the draft logic model was updated, highlighting particular issues that still lacked clarity or consistency. This latest draft was then used in a team meeting to clarify and agree the issues of relevance to prioritise for the evaluation and the approach for generating data.

Table 2 shows the logic model for the case study that was developed through this participative process. In order to aid usability a decision was taken for the model to be represented in a single 'view' maximum size A3 poster format. It has therefore been slightly simplified for reproduction in the more restricted format of this paper.

Attempt was made to address some of the criticisms of traditional linear models by including elements to describe its coupling

with its wider environment (Hummelbrunner, 2011; Julian, Jones, & Deyo, 1995). This was in terms of the outcomes and factors outside the team's direct control that might be influence direction and success (Funnell & Rogers, 2011). These are expressed as a *rationale for change* (left column) reflecting intelligence about the need for change from both the internal and external environment and *longer term aspirations and intended impact* (right column).

The *desired outcomes* describe the expected change achievable by the end of a defined period of specified intervention activity and within more direct control of the team responsible for the initiative. In this case, the desired educational outcome after implementing with the first cohort of students was to have improved their ability to design for sustainability in their future practice environments. The teaching team assumed this required raising students' awareness of sustainable development issues and design skills, including the more social dimensions of these, in a range of built environment disciplines i.e. not just within the context of their own academic discipline (element 17).

The need for intervention to achieve this was being driven by external changes in legislation relating to sustainability (element 1), and feedback from professional contacts and employers about social professional skills required and often lacking in graduates, particularly from engineering disciplines (elements 2 and 3). Some wider and longer term aspirations associated with the longer term relevancy and sustainability of the new learning activity were that even more disciplines would become involved (element 19). In terms of wider impact they anticipated developing and sharing some knowledge of good practice that could influence changes in academic practice at the departmental and institutional level (elements 21 and 22). Applying systems thinking to the development of the model also encourages consideration of the outcomes desired or anticipated for different stakeholders rather than a narrow focus on outputs of activity, such as qualified graduates or research publications, or outcomes for just one stakeholder group. These elements guiding direction may be adjusted with each iteration as the strategy is informed by the inquiry.

Other elements of the logic model relate to implementation mechanisms and contextual factors assumed to be important in influencing the outcomes e.g. teaching staff activity providing guidance and motivation (element 12) and the development and use of the electronic resources (elements 5–8, 11, 14). In the context of evaluating TSL, modelling the learning in this way encourages the evaluation to focus on the role of technology and its effectiveness in supporting the learning process, with issues such as functionality and usability forming only part of this evaluation. Success is articulated in terms of intended educational benefits for learners. The terms *enablers* and *resources* are used in the model to reflect it is a description of what is anticipated to positively influence the outcomes. Whether this model is shared by different stakeholders is an issue for the evaluation to explore.

This form of representation is not intended to make assumptions about linear, unidirectional logic of action and its effect on outcomes or a 1:1:1 relationship between components. It is intended to be interpreted as representing a more complex relationship between components. For example, the availability of a particular resource may influence the ability to undertake one or more of the activities, and each outcome may be considered effected by more than one of the activities. In planning this evaluation, the elements in the logic model guided discussion with the primary evaluation users about data, sources of data, methods, timing etc. that could provide insight into how the strategy is working (or not) to improve future iterations.

In this case study the logic model was initially developed to guide evaluation at the end of the first year of implementing this teaching and learning initiative. It was also used to frame the teaching team's critical reflection on the meaning of data gener-

**Table 2**

Logic model for case study.

Rationale for change	Resources/enabling factors	Process	Desired project outcomes	Longer-term aspirations and intended impact
<b>1) Increasing legislation on sustainability, which needs to be addressed in the curriculum</b>	<b>4) Teaching team collaborate to design multi-disciplinary learning experience for students that is relevant to practice in built environment disciplines</b> – assessed group design project – introductory programme including site visit	<b>11) Teaching team integrate electronic resources into sustainability units in participating departments</b> – prior to interaction programme integration approach unique to each department	<b>16) Students engaged with learning activity</b> –enabled them to contribute –perceived meaningful to future practice	<b>19) Other departments also adopt resources and become involved in multi-disciplinary approach</b>
<b>2) Students often do not engage with social issues in their learning in engineering disciplines</b> –social issues not currently addressed in teaching	<b>5) Teaching team collaborate to develop learning resources in VLE comprising a case study of an authentic development site</b> –images and maps –perceptions of different stakeholders in development site	<b>12) Teaching team motivate students and facilitate learning activity</b> –engagement with introductory multi-disciplinary programme, multi-disciplinary team project work and VLE learning resources.	<b>17) Students achieve intended educational outcomes</b> –awareness of sustainable development issues – ability to think more holistically about a design problem – skills in designing for sustainability –knowledge and awareness of different perspectives (inc. stakeholders) and contributions different disciplines – awareness of issues of multi-disciplinary team-working	<b>20) Graduates in construction design disciplines have improved range of employability skills</b>
<b>3) Employers find graduates ill-equipped for multi-disciplinary team work</b>	<b>6) Support required from educational technologists for development of the VLE resources</b> –videos, image database, and their embedding in VLE	<b>13) Students undertake discipline specific learning activity, multi-disciplinary introductory programme and collaborative group work</b> –student groups prepare a poster and presentation – contribution of poster & presentation to assessment & overall degree mark may be different for each department		<b>21) Innovative approaches to teaching and learning adopted elsewhere in departmental curricula</b>
	<b>7) Electronic resources need to be accessible and usable by students</b>	<b>14) Students use VLE resources to support their learning</b> –presentation engaging –helps group project work	<b>18) Good practice and transferable knowledge is developed in participating departments about:</b> –use of e-learning resources –team approach to teaching –new and more active approaches to learning and teaching – introduction of sustainability concepts into the curriculum – multi-disciplinary approaches to sustainable development.	<b>22) A collaborative learning community is fostered across construction design disciplines in the University</b>
	<b>8) Copyright needed for reproduction and inclusion of appropriate material</b>	<b>15) Teaching team share their experience and learning from the project more widely</b>		
	<b>9) Access to development site is required</b>			
	<b>10) Additional resources required</b> –space for multi-disciplinary activity -finance for site visit & visiting speakers			

ated (see Section 6) about its progress and the implications for revisions to the strategy and its evaluation in the second iteration.

## 5. Application of the viable systems model in the case study

As a model we are reminded that the VSM is “neither true nor false: it is more or less useful” (Beer, 1985, p. 2) offering “a [...] set of abstractions as a working tool” (Beer, 1985, p. xi). Implicit in this statement is that in any situation the model has a user with a purpose behind its use. It is not the intention to repeat a detailed generic description of the model in this paper. For this, readers can refer to one of Beer’s original sources (Beer, 1985 for accessible explanation), or other efforts at summarising and simplifying the model (e.g. Espejo & Gill, 1997; Preece et al., 2013). The aim

is to explain how these concepts were found particularly useful to the facilitator in this case study to enable others to assess whether they would be useful to them.

### 5.1. Clarifying the evaluation purpose

Beer defines ‘viability’ as being able to maintain a separate existence in a supportive environment, without meaning independence or lack of connection. This implies meaningful ‘identity’ in context. When we apply this concept to the social world, this viability is referencing organised human activity and conceptualisation of how collectives of lower level viable organisations produce (not serve) the organisations in which they are embedded. To illustrate

the relationship between these various levels in an organisation, Beer states that for a viable system to be viable, its organisational structure must be recursive. This viability has been interpreted as being dependent on a process of experiential learning in context (Badinelli et al., 2012), where the VSM provides a model for the information flow required for learning and adaptation of an organisation in its wider environment.

This concept of *viability* resonates as particularly relevant for the context of higher education, where the emphasis is on developing independent learners capable of taking responsibility for their own learning, with academic staff facilitating this being expected to take responsibility for continually improving their own practice in this role, and where higher education needs to continually adapt to the knowledge and skills needs of business and society within a framework determined by an elected government. With respect to the specific issue of evaluating technology supported learning (TSL), the technology is not a viable entity in its own right. Its value is determined in context by specific users with intent. The concept helps to shift focus to the organised human activity of interest – that of learning. Evaluation of the technology involves questioning its role and effectiveness in supporting this learning activity.

### 5.2. Clarifying scope of the evaluation

In systems approaches determining what is relevant (and not) is part of the *boundary setting* process, alongside consideration of whose perspective is relevant. In U-FE it is the evaluation users that determine the scope of interest relevant to their purposes. As argued in Section 2, it is this relevance that is often lacking in the evaluation of learning and teaching in HE. For the facilitator involved in U-FE they need an appropriate tool to help evaluation users critically reflect on these boundary decisions. In this case study the logic model is this tool.

When using the VSM, Beer (1985) recommends modelling the viable *system in focus* and the viable organisations at least one level higher and lower, i.e. considering the relationship with the immediate wider environment that it produces and the core component operations that produce it. From a facilitator's perspective the concept of recursive relationships with components and a wider environment encourages dialogue with participants to articulate and critique a logic model that will focus inquiry at an appropriate level of granularity, that of a change strategy that is to a large extent within their control, even if the outcomes and wider impact of that activity cannot be predicted. This is so that it guides information to be generated that is meaningful to their own decision making and action, and helps fulfil their accountability obligations to higher level organisation(s). For the purposes of this evaluation the viable *sub-systems* were conceptualised as the groups of learners working collaboratively to create their sustainable designs for an urban development site. For learning processes this helps to position learners, their learning activity, and the outcomes for them, at the centre of the evaluation. The immediate higher level viable organisations were conceptualised as the multiple course units in which the group learning activity was to be embedded, these in turn being embedded in the various programmes for which the students were enrolled at the university, and an even wider environment of relevant professional practice. In the logic model in Table 2 these core subsystems are reflected by element 13b (students doing some learning), and connection with units based in different departments reflected in element 18. This recursion pattern is represented in Fig. 2.

The concepts of *variety* and *variety management* can also help the facilitator in critique of the content of the logic model for its focus on key issues relevant to helping its users understand how the situations they manage are working. To do this it can be

helpful for facilitators to think about the logic model as needing to represent users' perspectives of the key sources of variety and their variety management strategies in use for the *system in focus*. The term *variety* is described as “a measure of complexity because it counts the number of possible states of a system” (Beer, 1985, p. 21). Whilst we cannot precisely count these states, in specific social situations it is possible to make comparative analysis of them at different points in time. Managers have low variety compared to an organisation they manage, and since they cannot possibly know everything that happens, they need to decide what is most relevant to know about its state, and over time use this information to make informed judgements about how it is working. Similarly, operational units have lower variety than the wider environment with which they interact. Relationship management between components in organisations, and organisations and their wider environment relies on the lower variety components reducing the variety with which they are faced or increasing their own variety to be able to manage the situations they face. Variety management strategies are not to be confused with the data generated about how they are working in practice. Managers will use strategies to influence the variety generated by the operational process, and strategies for generating and communicating *relevant* information about how these variety management strategies are working in practice.

Beer (1985) stresses the importance of understanding the difference between these as both are required for what he describes as *homeostatic regulation*. The concept of homeostasis in the context of social relationships has been described as referring to “relationships that keep stable over a time period while agreeing on certain purposes and game rules that fit both” (Espinosa in Espinosa & Jackson, 2002, p. 1334). It helps to explain how organisations tend naturally towards a *compromise purpose* for its multiple stakeholders, hence why the VSM is a model justifiable for framing inquiry into how organisations are socially constructed. It is also a model to guide critique of how these relationships are designed for balance such that “no entity will be swamped [...] by the proliferation of another's variety” (Beer, 1985, p. 29).

Using the example of the case study to illustrate, the collaborative work involving students from different disciplines aimed to help students increase their variety in relation to the wider environment and situations they will face in the future. However, their prior knowledge, experiences and motivations would influence their interpretation and behaviour in this collaborative work and could be viewed as a source of variety for the *system in focus*. There was a need to achieve some balance between the benefits the different disciplines bring to the learning process, but not to generate so much variety that it would be too difficult for teaching staff to engage students in the new activity within the limited period for this, or for students to be overwhelmed by the new experience. Some criteria therefore had to be placed on the students involved in terms of their prior knowledge and experience – hence limiting the activity to certain disciplines and levels of study. This latter is an example of a management strategy to reduce variety. The lecture course helped teachers to convey information about sustainability and issues relevant to practice and to the specific site used for the design projects. It also provided opportunity to supplement written assessment briefs with information about what was required for the group project and how it would be assessed, and advice on how to go about completing the task and access and use resources available to support the task. This can be considered as the teaching team increasing their own variety through communication aimed at helping students interpret what was required, in turn reducing variety in terms of the different possibilities for what the students would do and produce.

The VLE and electronic resources placed in the VLE could also be considered as being used to manage variety in a number of

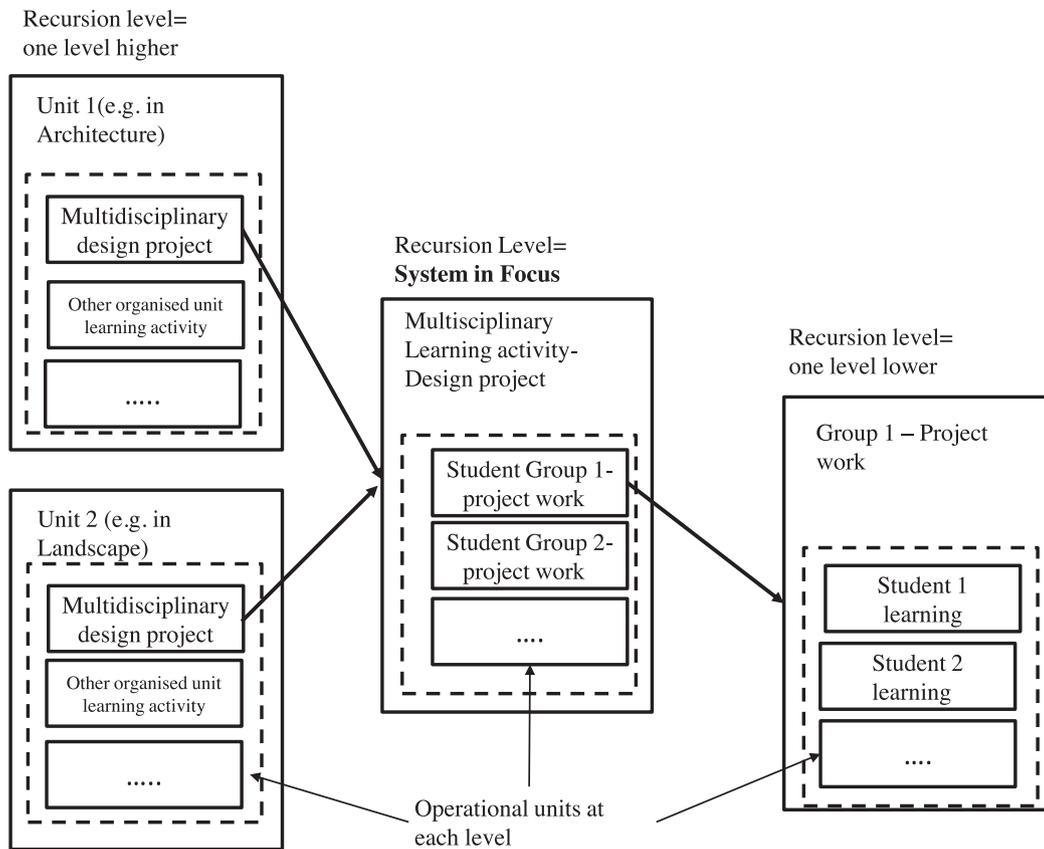


Fig. 2. Conceptualised recursion pattern for case study.

ways. An example is in supporting communication between staff and students so a consistent message can be conveyed to all even if all are not able to attend scheduled briefings and classes. The VLE also allows students access to important resources at any time. One of the particular features of technology is its ability to increase the speed of transmission, and volume of data, within a specified period of time. In this particular instance the intention was to reduce the need for students to undertake time consuming literature and resource searching and repeat site visits to find the information that would help their design work. The initial physical visit to the development site could also be considered a strategy to increase students' variety in terms of their ability to make sense of these resources.

The examples used here also illustrate the importance of communication, information flow and interpretation in organisation of the process. There is no guarantee communications will be conveyed by all teaching staff in the same way, nor will resources be accessed, read, interpreted, or used by all students in the same way. This is why information about the effectiveness of these strategies is needed, and points to the need for interpretive methods and qualitative data in the evaluation. Thresholds or targets are not articulated in the model. Quantitative measures may be appropriate data, but the purpose of the model is to guide direction. Hence, patterns and trends in relevant quantitative data over time is likely to be more suitable for this purpose than thresholds or targets. The logic model guides generation of information about state at a particular point in time, in this case after the first iteration of the initiative. This provides a static snapshot of a dynamic process. Theories of change and the tools that help to articulate them have therefore been described as fulfilling an important role in helping managers to visualise the dynamic processes they manage and frame evaluation. They provide them with a sense of *provisional stability* to help make decisions about change needed

to move from one state to another (Saunders, Charlier, & Bonamy, 2005). This visualisation of desired state in relation to current state may change based on business intelligence and changes in the relationship with the wider environment.

In this case study, discussion with individual unit leaders in different departments helped to highlight in advance some particular concerns they had with the variety and variety management strategies that they felt needed to be given particular attention in the evaluation. For example, there were not equal numbers of students from each subject discipline. This meant that when the cohort was divided into multidisciplinary groups to undertake the design project the number of students from different disciplines in each group was not balanced. Some disciplines dominated more than others in the groups. Also the weighting of the design project in the overall unit assessment mark differed between some of the units in which the activity was embedded. There was a high degree of uncertainty about how this would influence the group dynamics and student related outcomes (elements 16 and 17 of logic model).

### 5.3. Clarifying roles, relationships and meta-questions for the evaluation

The VSM describes specific functions and their connectivity to support relationship management in organisations through communication and information flow in the way described in Section 5.2.

Fig. 3 shows our interpretation of the model when applied to the learning activity used in this case study.

Each of the connectors on Fig. 3 represents complex interactions between organisational functions involved in the variety management process described in Section 5.2. This is a much simplified representation of the complexity of multiple and dialectic interactions envisaged to influence the process.

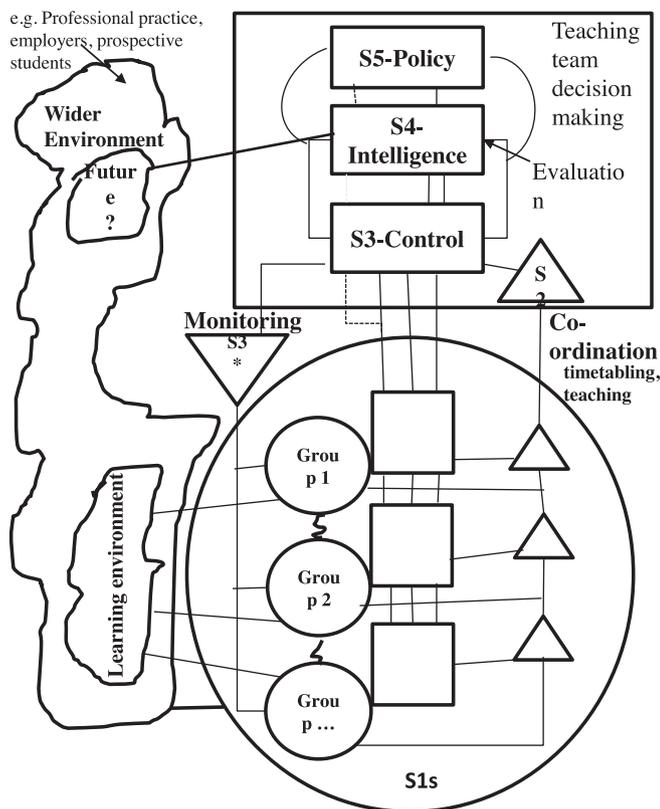


Fig. 3. Simplified interpretation of viable systems model applied to case study 'system in focus'.

A useful summary of the 5 core functions in VSM structure is:

System 1s – Operational activity. Does the core work (with resources allocated and within framework communicated by system 3). Interfaces directly with the environment.

System 2s – Co-ordination and service of system 1s (with resources allocated and within framework communicated by system 3).

System 3 – Management control and resource allocation to systems 1 and 2 (with resources allocated and within framework communicated by system 5). Provides information on how this is working to system 4. May learn about this through formal audit processes (3\*) or through direct information/communication channels with system 1s and 2s.

System 3\* – Audit. Monitors performance of operational activity and provides information about this to system 3

System 4 – Intelligence. Analyses internal and external trends and evaluates implications for the future. Communicates these to systems 3 and 5 to inform decision making.

System 5 – Policy and ethos. Sets and communicates overall values and direction that determine identity. Decides on resource allocation between systems 3 and 4 and monitors the balance between them. Accountable to organisation at next highest level of recursion for resources allocated to it.

One of the challenges highlighted with participative evaluation is the decision about which participants to include. The approach taken in this case study was to acknowledge this and focus on the primary users of the evaluation as advocated by U-FE (Patton, 1986, 2012). In this case, whilst there was a designated project leader for the intervention it was a collaborative venture by academic staff from a number of participating departments. Participants were identified using a snowball technique, starting with the designated project leader. However, the facilitator can also be

guided in this discussion by conceptualising where the various stakeholders may fit in undertaking these VSM functions, their role in decision making, and hence their potential interest in the evaluation.

In this case study, the system 1s are modelled as the collaborative learning activity undertaken by the students. System 2 co-ordinating functions help the students work in a co-ordinated way. Examples included providing access to the VLE and the learning resources available to support their work, and timetabling classes and site visits so that they could be attended by all students. As the model focuses on functions and roles or individuals undertaking these, unit leaders were involved in teaching, unit design, organisation and leadership functions, and thereby undertaking functions positioned from systems 2–5. The evaluation facilitator's role in this case study was envisaged as positioned at system 4 (working collaboratively with the unit leaders in generating and analysing intelligence) and to some extent to system 3 (working with the unit leaders to monitor performance).

A further benefit for guiding evaluation is that this model can be translated into generic evaluation questions of interest to each function that can be more easily understood by those not familiar with the model (Fitch, 2007). For example, those questions relevant to systems 3–5 are:

- How are implementation plans and the resource allocation for systems 1 and 2 being translated in practice? In the context of this case study, this concerns the core learning activity and support of this within its immediate environment. What is happening? How is this being experienced by those involved?
- How effective and efficient is the operational framework for achieving the intended purpose? In this context, how the learning activity and available support and resource is influencing the students' achievement of intended learning outcomes.
- Is the organisational framework still relevant and sustainable in the wider environment? In this context, is it still relevant to the needs of for example prospective students, employers, society, and meeting the expectations of the institution/sector about good practice, quality? What are the threats to this?

For the facilitators describing the logic model to users as a tool for guiding evaluation and critical reflection, these provide some overarching questions to critique the articulation of the model in terms of the relevancy of the elements and their inferred relationships guiding evaluation to answer these questions. Following data generation, these questions can also be used in conjunction with the logic model to help frame the interpretation of data.

## 6. Discussion of results

Due to word constraints and purpose of this paper it is not the intention to provide a full account of contextual evaluation findings about this case study. The aim is to illustrate the relevance of the information generated by the approach to the evaluation users.

The first iteration of this learning activity involved 67 students, 59 of which completed evaluation questionnaires, used to gain some measure of the representativeness of perspectives across the cohort. Two focus group discussions each involving 8 students were used to generate qualitative data to give more in depth insight into their perspectives. One of these groups was a team that worked together on the design project. The members of the second group had not worked together but still consisted of students from different academic disciplines. The focus groups were organised in this way as it was felt this may influence how students might talk about their positive and negative experiences.

Illustrative quotes only are used in the following sections, but are representative of the data set. Data about the access and use of the electronic resources was also available from the VLE tracking records. Perspectives from the teaching team about their own experiences and their interpretation of the meaning of this data was obtained in group discussions at team meetings.

### 6.1. Operational issues

Significant sources of variety for the learning activity were the differences in disciplines, prior knowledge and skills of the students. The focus group data and open comments on the questionnaires about positive aspects of students' experience suggested that the opportunity to work with students from other disciplines was valued for the reasons intended by the teaching team, in terms of exposing them to different perspectives and ideas. [*“working in a group, because ideas are highlighted that I wouldn't have thought of myself”*]. Nearly all questionnaire respondents also agreed they had felt able, or more able than other group members, to contribute to the collaborative design project.

However, the students did report finding the project work challenging, and some of the reasons they gave for this were related to *variety* issues identified by the teaching team prior to the evaluation. One of these was the difference in prior knowledge and experience between the undergraduate and postgraduate students. The other issue was the difference in weighting assigned to the collaborative design project in the overall unit assessment for the different units in which it was embedded. This was a lower weighting in the postgraduate units. This affected the group dynamics in ways that many students perceived as negative, for example leading to noticeable differences in how much time and effort individuals from different disciplines invested in the project work and the roles adopted. From a postgraduate student's perspective *“I had to spend a lot of time managing the group because there was a large difference in understanding and knowledge in the whole group”*, but from an undergraduate students' perspective *“the [postgraduate] students in our group sometimes objected to what we believe was a reasonable group contribution, leaving other members to take on more”*. An observation from a member of the teaching team was that the postgraduates were *“a lot more confident and a lot more experienced. That leads them to take on a leading role. So there's this contradiction between their role in the group and the amount of time that they feel it deserves. And that leaves everyone else feeling a bit vulnerable.”*

In terms of the variety management strategies adopted by the teaching team, the aggregated students' questionnaire responses were fairly neutral about the clarity of the communication of the design project brief. The negative feedback in both the questionnaire and focus groups related to what students perceived to be poor communication by the teaching team about the aims and objectives of the learning activity and assessment requirement [*“given poor information as to what was expected [...], leading to us not being able to present our work in the format that was required, leading to us not receiving any useful feedback”*]. Some students felt there was a lack of consistent message about the degree of freedom and constraints on the creativity of their urban designs, leaving them confused about the requirements for the design [*“I think in a way they wanted us to be realistic but also have more creativity at the same time”* and *“but then at the last minute he says that you can broaden your creativity and do whatever you want”*]. Another issue was lack of clarity about the roles expected of the different disciplines [*“most people were not clear which students were supposed to do what, i.e. responsibilities for each course”*].

The focus groups also gave some insight into the criteria implicitly guiding their work [*“they always say ‘oh well, we aren't going to mark you on your computer skills’, but you do get marked*

*on your computer skills, you do get marked on how good it looks”*]. The teaching team agreed with this in their critical reflection [*“we did sort of switch canoes part-way through the race”*] but they also felt that the undergraduate students were to some extent over-reliant on staff guidance, an expectation they felt was probably encouraged by previous interactions in earlier stages of the course [*“I think they have spent three and a half years being somewhat spoon-fed.”*].

An important issue was identified regarding the co-ordination of the activity. Staff reported that the site visit and lectures were quite poorly attended, but some of the students were reporting that these clashed with other timetabled sessions. On the questionnaire only 30% of respondents agreed that these had helped them prepare for participating in the collaborative project work. Three interaction days were scheduled for groups to meet over a three week period, but outside this time students also reported difficulty finding time to meet. The overall time frame was reported too short by some students, with some comments reflecting that insufficient consideration was given to the group forming stage of group work [*“At least to know each other beforehand, rather than wasting the day getting to properly know each other.”*]. Other comments related to the scheduling in relation to other assessment commitments, which was not consistent for all the disciplines [*“time frame for the project was a bit too short, coupled with the fact that we had other modules to cope with”* and *“we have dissertations to hand in next week!”*]. The teaching team perceived this to be more an issue of lack of organisational skills on the students' part.

Nearly all of the students in the questionnaire responded to state they had accessed the resources and not experienced any problems in doing so, and the VLE data supported the reports of access. However, the teaching team were disappointed that the electronic resources had not been used to the extent that they had anticipated

### 6.2. Effectiveness and efficiency issues

The aggregated questionnaire responses reflected overall only marginally positive agreement that the electronic resources actually helped students in the completion of their collaborative design projects. The qualitative data provided an insight into the issues experienced by students, which was fundamentally one of 'information overload' [*“there was too much information”, “we didn't really know what to do with it”, “overwhelming”*]. Framing this in terms of VSM concepts, they were not able to absorb this variety in the time available. There were also indications that this was linked with lack of clarity about assessment criteria. They found it difficult to assess the relevance or usefulness of the resources for the task they were being asked to undertake [*“I think there was too much information about planning laws and things like that. I'm not exactly sure if we had to go through all that information and apply it to the design”*].

On the questionnaires students were asked to rate on a 5-point Likert scale the extent to which they felt the learning activity had helped them in a number of developmental areas, such as understanding sustainable development issues, working within multidisciplinary teams, and using tools and techniques commonly used in a professional context. Again there was some variation in responses, with an aggregate response only marginally positive, with the highest scoring outcome being the raising of awareness of sustainable design issues perceived as traditionally falling outside their discipline. This was also talked about in the focus groups, as were some of the transferrable skills that they felt they had developed further such as communication skills, teamwork and using software. Despite their frustrations with the group work, students' comments also illustrated that they recognised this was

central to the intended learning [*“taught me to listen more and respect other discipline views”* and *“I guess that’s what we are meant to be learning”*].

In terms of students’ achievement of the assessment task, the teaching team were pleased with the quality of the students’ urban development designs given the time constraints, and a practitioner member of the judging panel thought these demonstrated good understanding of issues being faced by practitioners. However, the main areas of weakness were considered to be the groups’ rationales for their designs and the ‘fit’ of the designs with the real urban development site. In some teams not all members participated equally in the formal presentation of the design to the judging panel. Given the theory of change adopted and the information obtained about the issues with the implementation, then a plausible interpretation was that this may be influenced by the limited engagement with the development site, lack of site visit and limited use of the electronic resources that could have informed these designs, and the challenge of the group dynamics.

### 6.3. Relevancy and sustainability issues

In terms of the teaching team’s collaborative approach to managing this multidisciplinary learning activity, strategic planning meetings were held three times each year, with evaluation planning being an agenda topic in the earlier meetings, and discussion of evaluation data and its implications for change for the following year being discussed in the final meeting of the year. In the teaching team’s own critical reflection, they reported that working collaboratively in this way, bringing together a number of unit leaders whose units were embedded in programmes in different departments, did mean that it took longer to make decisions. This was one of the issues that they felt had affected some of the communication and organisational problems experienced by students, for example timetabling and booking of rooms being quite late compared to other units and therefore limiting the options.

Despite some of the operational problems and negative perceptions of students, over 70% of questionnaire respondents stated they thought the learning experience relevant to the situations they would face in their future practice. Comments in the focus group discussions also reflected this relevancy to be one of the positive dimensions of the learning [*“you can sit and look at your notes and revise for an exam, do an exam, and forget about it after a month. But with this you’ll remember it when you go into a job”*]. The visiting professor also reported that the employers she was in contact with were showing interest in employing graduates from the course because of the changes made. At the time of conducting the evaluation, actual employment data was not available for the students involved, but this is an example of data routinely gathered in institutions and a trend that could be monitored over time.

Whilst the variety generated by the different disciplines involved in the group work had been a challenge, the teaching team decided that simply adjusting the weighting of the assessment to be the same in the overall unit mark for all the disciplines was not straightforward, due to different credit ratings and learning outcomes of the units in which the assessment was embedded. Instead, they decided to manage students’ expectations of the activity by improving the clarity of the assessment brief for the design project. In particular, this would outline expectations about the different roles and contributions of the disciplines and emphasise the centrality of the experience to the learning, thus requiring some explicit critical reflection on this learning. With regard to the electronic resources, the teaching team decided that they needed to provide clearer signals throughout the learning activity about when and in what way specific resources might be helpful. They also needed to reorganise the material within the VLE so that students could more easily find specific resources when signalled

to do so. These are examples of the variety management strategies being informed and adjusted by the evaluation.

The main threat to the continued sustainability of the initiative was its resourcing. The central university funding helped to resource some of the additional activity, including the eventual temporary appointment of a dedicated co-ordinator with delegated operational decision making responsibility (equivalent to system 3 of VSM). This post was considered by the team as essential if the communication and organisational problems initially experienced were to be avoided in the future.

In terms of additional issues in the evaluation that were investigated to provide accountability for the learning and teaching resources allocated, this related to the team sharing their experiences more widely and contributing to the development of good practice. Activity undertaken had included participation at internal and external conferences, and writing of papers. Indicators of progress included publication of papers and awards for innovative teaching. There were also some requests from other unit leaders to become involved in the collaboration. Whilst this latter was welcomed as an early indicator of progress with the longer term aspirations and wider impact, the team needed to consider whether it was still realistic to further add to the complexity, given the implications for scheduling classes (room sizes and availability, timetable slots) and the sizes and dynamics of the student groups.

### 6.4. Reflections on the approach

In order to inform further improvement we recognise the need to critically reflect on its implementation in a process of *second order* inquiry. The focus of first order inquiry is the situation of interest, with the focus of the second order inquiry being the first order inquiry (Midgley, 2000). This critical reflection is also framed by its own theory of change, modelled on the same principles. This evaluation case study represents a snapshot of this research at a particular point in time.

The rationale for this approach was to improve engagement of collaborators in evaluation, within an overarching collaborative action research approach to quality enhancement in educational development work in HE. The premise was that this would be achieved by using a participative approach that would generate data relevant to helping inform participants’ decisions and actions as well meet their accountability obligations. In this context, this required an evaluation design that would help them understand how the implemented educational development initiative was working, including the contribution made by electronic resources intended to support students’ learning. Further purposes were to inform improvement on the approach and capacity for collaborative action research within the institution. The facilitator used concepts derived from soft OR, and specifically utilisation-focused evaluation (U-FE) and the Viable Systems Model (VSM), to critically reflect on the meaning of ‘relevancy’ to guide their facilitation.

With respect to the first of these aims the teaching team did appear to be engaged and all contributed fully and cooperatively in both individual and team meetings about the evaluation. Reflecting on the facilitation of the process, it was felt that this was helped considerably by developing an initial draft logic model prior to these meetings to frame the discussions, using information already articulated in documents produced by the teaching team. This may be because it demonstrated that the facilitator had already taken the time to attempt to understand the activity to be evaluated as expressed from the teaching team’s perspective, and helped to gain trust that the evaluation would remain focused on information relevant to their needs. It was also found that the process of collective action research could quickly and easily be communicated, by explaining that the purpose of the model was to frame the generation, analysis and interpretation of data, and help them

answer the meta-questions derived from the VSM about operational activity, effectiveness, efficiency, impact and continued relevance, that would ultimately help them make decisions about how to improve this new learning activity. In discussions about data collection methods and instruments, whilst the facilitator used their expertise to make suggestions and put together draft instruments, the collectively agreed logic model provided the teaching team with a framework for evaluating these suggestions. After completion of two iterations of planning, implementation and evaluation, the designated project leader confirmed that it had resulted in “a huge amount of very useful detail. We’ll certainly be using it to improve the project next year”. The teaching team also talked positively in team meetings about how this resulted in some credible and convincing conclusions, which would be valuable in helping them to make a case for further funding, and to persuade other departments to collaborate (if subsequently decided feasible). They also stated that they felt the independent facilitation of the evaluation would help others to view the findings as balanced.

One of challenges of this more formalised and systematised approach to evaluation is the resource required to undertake it. Whilst some research on academic staff opinions of the evaluation of learning and teaching has indicated an openness to ‘regular and structured processes of evaluation’ and ‘a more creative approach’, this was with the caveat that “this should not involve significant time and effort” (Bamber & Anderson, 2012, p. 11). Other research has suggested that the “triad of partners (team leads, teacher researchers and university researchers)” (Bruce et al., 2011, p. 450) enables some of these challenges to be overcome because this workload could be shared, with the role of the team lead has also been highlighted as crucial in communicating between other team members and the researchers (Bruce et al., 2011). In this case study this triad was represented by the teaching team leader, the other unit leaders, and the facilitator of the evaluation. The experience of facilitation in this case study would seem to agree with these findings. The team leader was instrumental in preparing the other team members for the evaluation and in integrating the facilitator into the collaboration.

## 7. Conclusions and further research

In this paper, we have argued that improvement in the evaluation methodology for TSL was required to more appropriately recognise the complexity of human interaction that results in learning. It has also been argued that in order to develop transferrable knowledge about good practice in technology-enhanced learning, evaluation needs to lead to a better understanding about the relationship between learning and teaching strategies employed and their outcomes (i.e. process and the connection between strategies operating at different levels within an organisation – processes in context).

Through our case study, concerning the evaluation of an educational development initiative in a large UK university, we have illustrated how the VSM and utilisation-focussed evaluation could be used to: (a) conceptualise the connection between strategies and their components at different levels of organisation; (b) clarify the role and interests of stakeholders in these strategies; and (c) scope evaluation to be relevant to informing the decisions and actions of these stakeholders.

Specifically, concepts derived from the VSM have helped to: (a) draw out stakeholders’ articulation of a theory of change which in turn has given some clarity about the level of granularity (*system in focus*); (b) represent their perceptions of its coupling arrangement with the wider environment and higher level of recursion; (c) focus on important variety generators and strategies for managing variety that will influence what the system does and; (d) reflect their perceptions of who the other stakeholders are and their in-

terest. Importantly for technology supported learning, it articulates how this supports an educational process.

The contribution of this paper is therefore to illustrate how VSM principles can underpin a ‘theory of change’ approach to engaging primary stakeholders in planning an intervention and its evaluation in the context of educational development work, in order to improve evaluation to be more relevant to their needs. The role of the evaluator is as facilitator, using the theoretical constructs of the VSM to frame their discussions with stakeholders, to help them articulate their contextual ‘theory of change’.

That said, we are aware that the proposed approach and the conclusions resulting from its application to the case are limited and that its wider transferability would need to be tested across multiple cases. Although elements of the framework proposed can be used to evaluate similar educational developments, some adjustments and refinements are necessary and areas of further research should be directed. For instance, this might be to explore how the approach would work for effectively connecting different levels of strategies for learning and teaching enhancement within an organisation. In particular, in terms of developing, sharing and adoption more widely of learning related to key institutional and sectoral priority areas for enhancement (e.g. TSL, inquiry-based learning, internationalisation of the curriculum). Additional work is also needed to evaluate the process and progress with capacity building through both facilitated evaluations and targeted academic development (e.g. through the formal professional development program).

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