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Title	Purposive Teaching Styles for Transdisciplinary AEC Education: A Diagnostic Learning Styles Questionnaire
Type	Article
URL	https://clock.uclan.ac.uk/12362/
DOI	
Date	2015
Citation	Khuzzan, Sharifah Mazlina Syed, Goulding, Jack Steven and Rahimian, Farzad Pour (2015) Purposive Teaching Styles for Transdisciplinary AEC Education: A Diagnostic Learning Styles Questionnaire. <i>International Journal of Architectural Research: ArchNet-IJAR</i> , 9 (2). pp. 98-112.
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PURPOSIVE TEACHING STYLES FOR TRANSDISCIPLINARY AEC EDUCATION: A DIAGNOSTIC LEARNING STYLES QUESTIONNAIRE

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Abstract

Acknowledging the progressive globalisation trend within the Architecture, Engineering, and Construction (AEC) industry, transdisciplinary education and training is now widely acknowledged as being one of the key factors for leveraging AEC organisational success. Conventional AEC education and training delivery approaches therefore need a paradigm shift in order to be able to address the emerging challenges of global practices. This study focuses on the use of Personalised Learning Environments (PLEs) to specifically address learners' needs and preferences (learning styles) within managed Virtual Learning Environments (VLEs). This research posits that learners can learn better (and be more readily engaged in managed learning environments) with a bespoke PLE, in which the deployment of teaching and learning material is directly augmented towards their individual needs. In this respect, there is an exigent need for the Higher Educational Institutions (HEIs) to envelop these new approaches into their organisational learning strategy. However, part of this process requires decision-makers to fully understand the core nuances and interdependencies of functions and processes within the organisation, along with critical success factors and barriers. This paper presents findings from the development of a holistic conceptual Diagnostic Learning Styles Questionnaire (DLSQ) Framework, which is comprised of six interrelated dependencies (i.e. Business Strategy, Pedagogy, Process, Resources, Systems Development, and Evaluation). The confluence of these dependencies directly influences pedagogical effectiveness. These findings contribute additional understanding to the intrinsic nature of pedagogy in leveraging transdisciplinary AEC training within organisations (to improve learner effectiveness). This framework can help organisations better augment and align their strategic priorities to learner-specific traits.

Keywords: *Transdisciplinary learning; Personal Learning Environments (PLE); Diagnostic Learning Styles Questionnaire (DLSQ); pedagogical effectiveness; organisational drivers*

INTRODUCTION

The Architecture-Engineering-Construction (AEC) industry contributes to a large portion of the employment rate and economic growth in many countries. For instance, in the European Union (EU), the AEC industry encompasses more than two million enterprises and provide in excess of 12M jobs; about ten per cent of the Gross Domestic Product (GDP), and more than 7 per cent of job opportunities of counties across Europe (NGRF, 2010). Such engagement and contribution to the development of 'wealth' make the innovation of design and construction projects even more important than ever before. As such, organisations and professional bodies within AEC need more inspired professionals and graduates who are able to lead and champion more innovative projects - the throughput of which can help procure more sustainable societies to enhance the wellbeing and prosperity of people. Acknowledging this, AEC professionals are

increasingly being asked to deliver products that require complex skill sets; and transdisciplinary education and training has been openly acknowledged as being one of the key factors that can be used to leverage AEC organisational success. This however requires a number of important factors to be considered, not least, the appreciation of skill set development, delivery content [and context], pedagogy, and transdisciplinary nature of stakeholders' needs.

From an instructional domain point of view (Kreber, 2004), noted a surfeit of approaches and abundance of teaching material for specific disciplines; but, noted that it was quite a challenging task when pedagogical aspects were included. This resonates with the concepts of delivering transdisciplinary teaching to people with different discipline knowledge and expectations (Fruchter, 2004). In other words, despite the availability of appropriate educational methodologies for individual disciplines within the AEC industry (and the corresponding broad range of skill sets required), it is often challenging to deliver these skills in a way that it is 'appreciated' by all learners, especially as they all tend to have different expectations and outcomes. The transdisciplinary Problem-, Project-, Product-, Process-, People-Based Learning™ (P5BL) approach (Fruchter & Lewis, 2003) has been proffered as an alternative technique to the traditional delivery of disciplinary education to AEC professionals. This universally validated method for transdisciplinary learning leverages learning from the lowest tiers of transdisciplinary teamwork understanding to the highest tiers. Where, Ibrahim *et al.* (2007) introduced four tiers of transdisciplinary teamwork understanding as follows:

- Island of knowledge: Learners acquire enough skills in their own discipline; however they have no idea about what is going on in the other disciplines;
- Awareness: They start to be aware about the goals and barriers within neighbouring disciplines;
- Appreciation: They form conceptual foundations to work with the other disciplines – and are now interested in their procedures and workings - and know what questions to ask when they meet experts with different backgrounds;
- Understanding: They have now built up the conceptual knowledge to approach, discuss, negotiate and work with the expert form other fields – and are prepared to deliver their own deliverables before being tasked by the others - and are aware of the experts who can solve their problems – and are able to use a common professional language, which is understood by all members.

One of the major issues of transdisciplinary education in AEC industry is how to tailor teaching materials to the environment in such a way that it suits various learner styles. This challenge has been debated in academic discourse by a myriad of seminal authors, supporting the notion that learning environments matched to learners' learning styles can not only help improve learner motivation, but also enhance the learning process (e.g., Buch & Bartley, 2002; Karagiannidis & Sampson, 2004; O'Brien, 1989; Oxford & Ehrman, 1992). Personalised Learning Environments (PLEs) are particularly well suited for this, as they are able to match cognitive abilities and preferences to learner traits (Goulding & Khuzzan, 2014). For instance, from an organisational context, using Architecture as an exemplar, these learner types are predominantly 'creative' and 'flexible' [as opposed to procedural-driven roles]. The challenge therefore, is to appreciate these nuances; and more importantly, incorporate these into a training environment that not only helps foster and improve learning performance *per se*, but also helps align this to organisational need (Goulding & Alshawi, 1999; Kumaraswamy, 1997; Naoum & Hackman, 1996). As such, the adaptation of "purposive" learning styles devices and methodologies is now considered vital for ensuring that learning delivery methods are consistent with the learning styles (Goulding & Khuzzan, 2014). In this respect, universities (as organisations) are looking to improve not only the learning experience and performance of learners *per se*, but also improve how teaching and learning is managed and delivered as part of their organisational strategy. This

paper presents the core issues and drivers that have the potential to reap significant benefits for organisations engaged in learning delivery – especially, the process of tailoring material to learners with different multidisciplinary needs from the AEC sector.

In pursuance of this, a conceptual Diagnostic Learning Styles Questionnaire (DLSQ) framework was developed to help organisations support organisational resources more effectively. The principal *raison d'être* for this framework was to help key decision-makers diagnose learners' learning styles in order to better align the learning process with learners' needs, whilst maximising the deployment of teaching and learning resources. The development of the conceptual DLSQ Framework was divided into two stages. The conceptual DLSQ Framework (Stage-I) involved the development of a Diagnostic Questionnaire (DQ) as the core of the conceptual DLSQ Framework, the work of which placed learners as the main unit of analysis using a quantitative approach for data collection and analysis (Khuzzan & Goulding, 2008). The conceptual DLSQ Framework (Stage-II) used the development of the DQ [from the conceptual DLSQ (Stage-I)] as a vehicle to embed the learners' learning requirements within a business setting.

This paper focuses explicitly on findings from Stage-II of this work – the development of the conceptual DLSQ Framework. From this, six interrelated dependencies (Business Strategy; Pedagogy; Process; Resources; Systems Development; Evaluation) are presented for discussion, as these are seen as the main organisational drivers to support Business/Systems Development theories (which are both needed to govern the DQ).

LITERATURE REVIEW

Learning dynamics and business performance

Knowledge has often been accepted as a shared collection of principles, facts, and rules; which, when appropriately marshalled, can be considered 'knowledge assets' [core competences, technology, processes, procedures etc.] in order to achieve competitive advantage. However, the process of achieving competitive advantage is much more than aligning knowledge assets to business issues, as more often than not, it requires the careful holistic engagement of organisational learning *per se* (Dodgson, 1993; Huber, 1991). This is an important factor in developing a learning organisation. The importance of aligning cognitive science with technological solutions is also increasingly providing new insight and understanding into learning, especially the ways learners develop skills. For example, PLE's are now able to reflect the needs, cognitive styles and specific needs of learners, using cutting-edge technological interfaces, e.g. adaptable VLE's (Pour Rahimian *et al.*, 2014). Moreover, from an organisational perspective, it is also important to be able to measure and assess learning styles, as skills are important for meeting organisational goals. This is particularly important, as the incorporation of learning styles can also help improve learning performance, work performance, and overall productivity (Kumaraswamy, 1997).

From a business perspective, organisations are increasingly looking to improve their overall competitiveness through strategic positioning using 'traditional' economic theories of competition (Porter, 1985). Strategic positioning also needs to consider direction of travel (Morgan, 1990), the routes of which tend to be aligned to well-defined decision patterns (Walsham & Waema, 1994). Acknowledging these issues, invariably, this means that organisations have to adapt through a process known as change (or change management). The real challenge however, is not the change process *per se*, but the need to organise and align corporate assets (organisational systems, procedures, resources and skills), to business opportunities (Porter, 1985). Given that organisational skills are a fundamental part of leveraging business strategy (Sleezer, 1993), it is therefore important to consider how these [skills] are developed and managed within an organisational setting.

Education and training within AEC

It is globally acknowledged that a well-trained and educated workforce can provide greater productivity and flexibility, especially in fluctuating markets where agility is needed (Clare & Johnston, 1993; Hopp & OYEN, 2004; Tishman *et al.*, 2012). Education and training can procure beneficial consequences with the adoption and adaptation of new technologies (Chapman & Tan, 1992). In this respect, education and training can be seen as a management tool and instrument for addressing knowledge and skills deficiencies in order to adapt learners' qualifications to job requirements (Van der Krogt & Warmerdam, 1997). Therefore, if successfully managed, knowledge and skills gained by learners (i.e. employees) can link to increases in productivity, business performance, and overall efficiency. Acknowledging this, education and training should be integrated with the long-term needs of the organisation (Cato & Gordon, 2009); as it can formally act as a conduit for linking organisational strategies and goals (Sleezer, 1993).

For example, within an organisational setting, learning is seen as a purposive quest to retain and improve competitiveness, productivity, and innovativeness – particularly useful in uncertain technological and market circumstances (Dodgson, 1993). Providing education and training for learners is therefore viewed as one of the most important aspects to be considered (Nel, 2011). On this theme, research has attempted to correlate the success of individual organisations with their education and training policies - as this is intrinsically linked to organisational success (Keep and Mayhew (1988). Moreover, education and training is an important factor that can be seen to help facilitate an organisation's expansion; whilst also developing its potential to enhance overall profitability (Cosh *et al.*, 1998).

In summary therefore, knowledge and skills gained by learners (i.e. employees) have a proven link with productivity gains and business performance improvement - the supposition of which argues that education and training should be integrated with the long-term needs of the organisation (Kumaraswamy, 1997). Given this, tailored forms of education and training (Connor & Shaw, 2008) offers significant promise. At a more detailed granular level, this requires 'personalisation' [of learning styles], to better align education and training material to learners' needs. There is therefore, a need to understand the diverse range of learning styles available and the instruments of learning styles used.

Learning Styles

There is now a significant paradigm shift from 'conventional' pedagogic approaches and methods of delivering training, towards more advanced approaches in order to address individual and occupational styles and needs (Zhang, 2008). Spanier (2001) acknowledged the importance of being more learner-centred, noting that learning experiences should no longer be confined to the physical limitations of classrooms - embracing hybrid courses and digital technologies to support student-centred pedagogy. However, whilst some have questioned the usefulness of learning styles (Delahaye & Thompson, 1991), it is also important to acknowledge that this discourse is still unfolding. More fundamentally, it is generally accepted that there is an intrinsic need to understand how learners learn, and how learning styles' theories support the learning process. Where for example, Lindsay (1999) argued that if learners' learning styles were taken into consideration [in the design of learning environments], then learning performance and satisfaction would be significantly improved. Given this, the application of learning styles theories continues to offer benefits as a mechanism for determining the value of cognitive and learning styles in education and training practice (Evans & Sadler-Smith, 2006). Learning styles instruments and PLE's are also a fundamental part of this debate.

Personalised Learning Environments

Learning styles and the way individual learning capabilities and characteristics can be nurtured by purposive learning systems and PLEs have started to become the focal point of many

scholars (Karagiannidis & Sampson, 2002; Sampson *et al.*, 2010; Stash *et al.*, 2004; Wolf, 2002). In essence, the development of teaching and learning processes in accordance with individual learning styles and preferences has been advocated as a successful approach (Watson & Hardaker, 2005). The purposive learning concept indicates a paradigm shift in educational theory from the 'conventional' approach, to one which engages PLE's (Pahl, 2003; Sampson *et al.*, 2010). The goal of a PLE is to provide digital (and remotely distributable) educational content to suit learners' individual needs and preferences; which ideally, should also embrace learning styles (Goulding & Khuzzan, 2014).

The development of technology has now increased the demand for innovative approaches to deliver education and training. This has also been partly driven by a desire to design cost-effective and high quality e-Learning environments to meet the needs of learners. For example, Pour Rahimian *et al.* (2014) noted the use of ICT as a means for improving education in the field of pedagogic research, e.g. automation of educational procedures, leveraging e-learning by creating digitally distributable learning materials, increased emphasis on instructional learning, supported by clearer and more tangible e-Learning objectives and standards. Given this, the correlation between pedagogy and technology seems to be a significant aspect of this discourse. Where, Arciszewski (2009) asserted that emerging international trends and increased global distribution of knowledge through the World-Wide-Web, social media etc., was revolutionising higher education – as this underpinned knowledge-based economies. That being said, a “one-sized hat fits all” approach does not actually procure significant advantages. In fact, static or inflexible systems can actually often hinder the process. It is therefore advocated that individual learning styles and cognitive needs of the target students are fully embraced (Goulding & Khuzzan, 2014; Riding & Sadler-Smith, 1997).

Architecture and Urban Research Education: An Overview and Critique

The future of AEC education in general, and Architecture and Urban Design specifically, has been at the forefront of debate, particularly since the recent economic recession. Numerous studies have been conducted on the effectiveness of 'conventional' design studios within the architectural and urban design education. Similarly, the importance of instructors providing a strategy that is relevant to the style of each learner in design studio process has been asserted (Demirbas & Demirkan, 2007). However, the majority of these studies have not advocated a traditional style of teaching architecture; but more through alternative methodologies (Demirbaş, 2001). For instance, Salama (2008) in a study titled “Integrating Knowledge in Design Education” argued that a responsive architectural design pedagogy that gave credit to socio-cultural, and environmental needs could enable future architects to create more liveable environments. Similar studies also investigated the implementation of purposive learning styles to leverage greater learner performance.

With regards to the major shortcoming of the current educational systems within the AEC discipline - especially requirements such as: hands-on real-world experience, skills for supporting effective communication with stakeholders, collaboration with different project partners, and effective business management skills; the efficiency of the traditional design studios approach is questionable. This is more pronounced when taking into account the individual and discipline based learning needs and styles of each learner (which can not readily be addressed by the current form of studio deliver). These kinds of issues support the need for a PLE approach, as these issues can readily accommodate learners' individual and occupational needs and unique learning styles. Therefore, the learning process within architectural design studios is a fertile ground for adopting new approaches, as this is where AEC professionals have an opportunity to be encouraged, supported and inspired in order to enhance their overall creativity. Demirbaş (2001) noted the importance of learning style preferences in AEC education. For example, AEC as a profession is often delivered through myriad of discreet approaches within each phase of the

design studio process. As such, the facilitator of this delivery must by default be innovative (and flexible) enough to incorporate different types of pedagogic styles during each phase in order to accommodate different intellectual capacities and educational backgrounds. In this respect, the AEC sector is somewhat underrepresented regarding the formal adoption of learning styles *per se*, into AEC educational settings. The development of the conceptual DLSQ Framework was therefore considered to be timely in this respect. The next section discusses the development of this framework.

RESEARCH METHODOLOGY

The focus of this research was to help key decision-makers diagnose learners' learning styles in order to better align the learning process with learners' needs, which would then help organisations better leverage organisational resources to strategic direction. This paper reports on the findings of the development of the conceptual DLSQ Framework. The development of the conceptual DLSQ Framework adopted an explicit mixed methods approach (Holt & Goulding, 2014), as a procedural framework to guide this work, i.e. having the research philosophy guiding the inner research approach and research technique. A Positivist philosophical stance was adopted, rather than a Social Constructivist philosophical approach, as it was appreciated that there was a need to include both deductive and inductive approaches. A precursor to this required education and training-related theories to be evaluated. One single embedded case study was adopted (as the context), using a UK Higher Education (HE) establishment as the vehicle of investigation – hereafter known as University ABC. The single embedded case study was considered suitable [representative] as it typified a typical HE institution implementing technology enhanced learning.

The aim of this research was to develop a conceptual DLSQ Framework for use within a HE/training environment setting; in order to help organisations augment and align their strategic priorities and resources through viable business processes that maximises pedagogical delivery in order to improve learner effectiveness. This research did not aim to influence/change attitudes of the participants (which it is argued could be influenced through say action research); nor did it aim to study the behavioural patterns/psychology of participants (which could for example be better achieved through ethnographic research). The focus was on investigating contemporary phenomenon in a particular setting (an organisation) - which required obtaining data from multiple sources in order to understand the complex and real life social phenomena involved - hence, the need for a case study approach.

The complexity and diversity of the research made triangulation an essential element of this work, particularly to increase the validity and reliability of the research results based upon case study findings. In this respect, the case study in question developed the conceptual DLSQ Framework using a two-stage approach; whereby the conceptual DLSQ Framework (Stage I) concerned the development of the DQ (not reported in this paper), whilst the conceptual DLSQ Framework (Stage II) considered the development of the core interrelated dependencies (components) required to embed the core DQ within a business setting. The conceptual DLSQ (Stage II) process used the developed DQ [from the conceptual DLSQ (Stage I)] as the main vehicle for embedding this within an organisational context. In this respect, the organisational setting was defined as a HE education and training provider. Therefore, it was acknowledged that the conceptual DLSQ Framework had to embrace the core organisational drivers needed within an organisational setting if it was going to be successful.

The Conceptual Diagnostic Learning Styles Questionnaire Framework

The conceptual DLSQ Framework has the DQ at its 'heart', and is supported by six core interrelated dependencies/components (which represent the environment/context for successful delivery/operationalisation). The conceptual DLSQ Framework went through a two-stage

development in order to develop the DQ (Stage-I), and subsequently the surrounding environment (Stage-II).

Development of the Conceptual Diagnostic Learning Styles Questionnaire Framework (Stage-I)

The principal aim of the DQ was to help identify learners' learning style preference. In this respect, a questionnaire was developed by amalgamating learning styles from three 'core' existing models of learning styles - derived from literature, which categorised learners based on the way they perceived, processed, and organised information received (Khuzzan & Goulding, 2008). The findings from this development stage are reported in (Goulding & Khuzzan, 2014).

Development of the Conceptual Diagnostic Learning Styles Questionnaire Framework (Stage-II)

Stage-II of the development of the conceptual DLSQ Framework identified the interrelationships between the core dependencies of the DQ in context to the learning organisational setting, i.e. University ABC. This section describes the development process of the conceptual DLSQ Framework, where the core interrelated dependencies/components were formulated using a case study approach. In pursuance of this, it was acknowledged that this needed to address learner's styles and needs, especially to overcome gaps in current instruments of learning styles (Khuzzan & Goulding, 2008). However, in order for the conceptual DLSQ Framework (Stage I) to be successful in personalising learning to the needs of learners, it also needed to support organisational needs, and by default, be embedded within a business environment. This led to the development of the conceptual DLSQ Framework (Stage II). The conceptual DLSQ Framework needed to embrace both the pedagogical and core-interrelated dependencies. Six core dependencies were identified through the development process; business strategy (BS), process, resources, pedagogy, systems development, and evaluation.

These six dependencies within the conceptual DLSQ Framework were considered dependent on each other (either directly or indirectly). For example, the importance of strategic direction requires resources, which requires processes etc. This is where the implementation of the DQ was seen as an important initiative to match opportunity with core capability – given the importance of education and training (Gratton et al., 1999). Pedagogical principles are considered backbone theories that govern good practice, and which form the primary rubrics where teaching and learning coalesce (Ward et al., 2002). Similarly, new strategies often cause changes in the business process, where objectives need to be appropriate to the planned outcomes of the organisation (Avison & Shah, 1997).

Development of the Conceptual Diagnostic Learning Styles Questionnaire Framework (Stage-II) - Case Study Findings

The conceptual DLSQ Framework (Stage II) was carried out using semi-structured interviews with three domain experts in order to capture how new systems (or the extension of an existing system) could be developed and implemented within one setting (University ABC). A draft conceptual DLSQ Framework was prepared from extant literature findings to define the context delimiters and rubrics. This was piloted and validated prior to distribution. The challenge here was to ascertain the main operational issues regarding the interrelated dependencies. The semi-structured interviews were conducted with three domain experts. Findings from these interviews helped to shape and define the internal structure of the framework (Figure 1). From Figure 1, it can be seen that the DQ is supported by six core dependencies, representing: business strategy, pedagogy, process, resources, systems development, and evaluation. These core dependencies rely on the DQ as the central conduit through which interaction is managed. Each of these core dependencies has three separate sub-dependencies. These directly govern the operation and management of the parent dependency. In this respect, the relationship between the sub-

dependencies and core dependencies is represented by a solid two-way arrow line, which signifies a direct transfer of information/data for subsequent analysis within the core dependencies. The core dependencies are also linked to the central DQ through a dashed two-way arrow line, the depiction of which signifies an indirect information/data flow between not only the main DQ, and also the six core dependencies. For example, whilst the 'Systems Development' dependency shows a link between the DQ and 'Evaluation', and 'Resources', it does not show a formal link to 'Business Strategy', 'Pedagogy', or 'Process'. However, there is an indirect link to each of these core dependencies through the DQ. In this respect, the DQ acts as a conduit through which information/data is transferred (on a direct needs-required basis). For instance, the 'Business Strategy' dependency identifies clear critical success factors, which governs and drives the way the 'Systems Development' dependency operates. This approach is followed for each of the other dependencies.

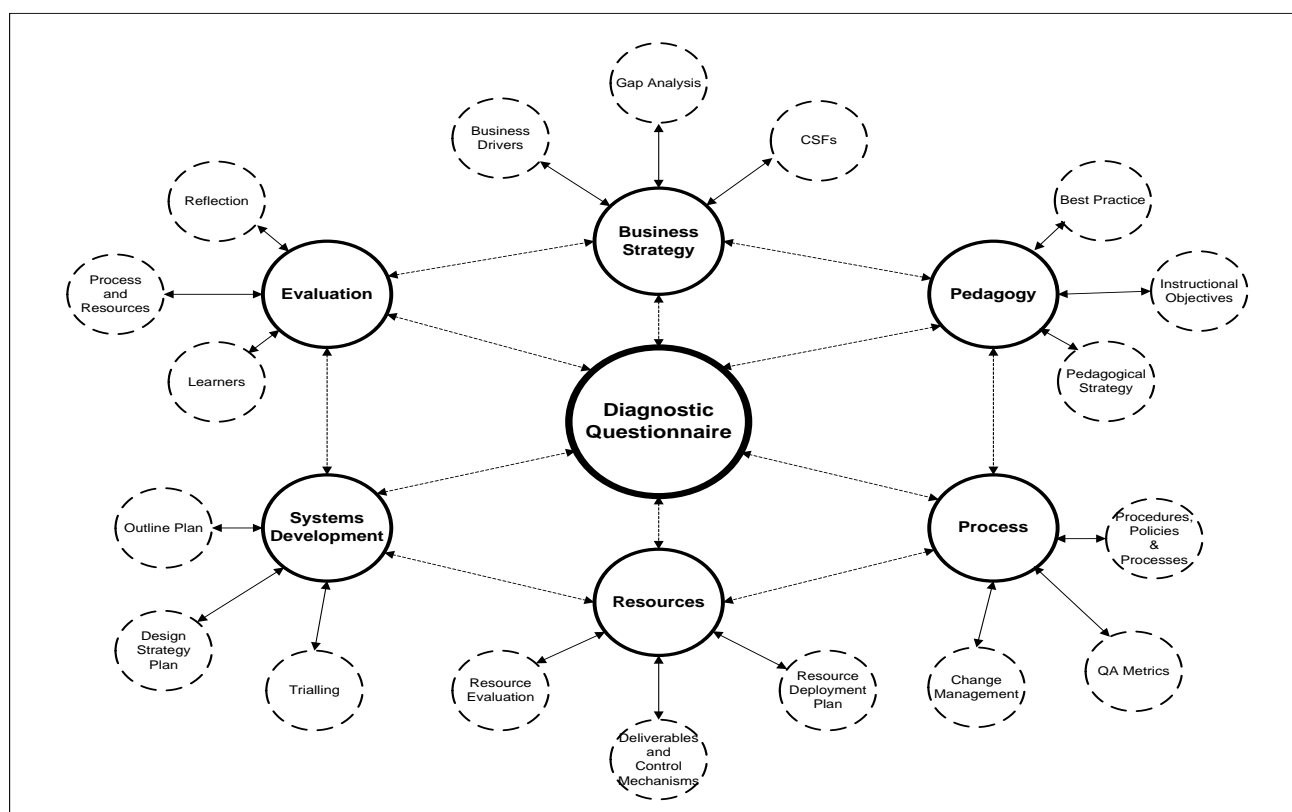


Figure 1. The Conceptual Diagnostic Learning Styles Questionnaire Framework (Khuzzan, 2009)

From an operational perspective, users can enter this conceptual DLSQ Framework at any stage, as there are no discreet direct entry or exit points. However, organisations that have not been engaged in the conceptual DLSQ Framework before, would normally commence the dependency 'Business Strategy' first, as this would help the development team within the organisation evaluate its current business strategy and drivers in order to determine whether there was a clear business case for the DQ. If this was accepted, then the critical success factors would be identified, and the *raison d'être* for all decisions would be stored in a Legacy Archive for further reflection. On this theme, the Legacy Archive acts as a central repository of information. It also enables process and phase successes and failures to be formally documented (for subsequent referral and reflection). This follows the principles of Organisational Learning. If however the organisation decided not to progress with the DQ, then the 'Business Strategy'

dependency would be terminated, and no further action would be needed. Should the organisation accept the need for the DQ, then the critical success factors from this would help form the rubrics for the DQ (and subsequent dependencies).

It is acknowledged that the precise use of the conceptual DLSQ Framework would differ from one organisation to another (as organisations tend to have different structures, strategies, drivers and mission statements). Given this, and from an organisational maturity perspective, organisations that have used the conceptual DLSQ Framework before would be more readily able to enter this Framework at any stage/iteration – typically through the Legacy Archive from one of the core dependencies (as they would have gone through the process of aligning requirements to deliverables identified in each of the six core dependencies). Another example might be to enter through the ‘Systems Development’ dependency, where users would need to discern what was needed regarding the implementation stage; and more importantly, where they were in the holistic cycle of procuring the DQ. In summary, the conceptual DLSQ Framework can be seen as a conceptual approach for gauging and assessing organisational maturity in terms of “where they are”, “where they need to be”, and “what needs to be done”.

VALIDATION OF THE CONCEPTUAL DIAGNOSTIC LEARNING STYLE QUESTIONNAIRE FRAMEWORK

The conceptual DLSQ Framework was validated independently with three domain experts, outside of the case study boundary. This approach was adopted in order to: maximise reliability and validity, and increase relevance viz generalisability and repeatability. The three domain experts used were deemed ‘representative’, covering both HE academic institutions, and a ‘typical’ external training provider. This expertise was considered vital for validation – the details of which can be seen as follows:

- Domain expert 1— an expert within the area of technology and systems development, with direct responsibility for the management, implementation and maintenance of a university’s VLE.
- Domain expert 2 — a Technology Innovation Manager at one of UK’s distance learning universities, with extensive experience in the innovation of teaching and learning technology for delivering the University’s VLE.
- Domain expert 3 — an Associate at one of UK’s leading independent training provider’s, with significant experience of strategic policies, procedures and investment decision-making.

Given the above, a qualitative validation approach was conducted to address: a) the construct validity of the conceptual DLSQ Framework, b) the usability and functionality of the conceptual DLSQ Framework, c) the validity of the processes within the core organisational drivers embracing the DQ (not reported in this paper); and, d) suggestions for improving the conceptual DLSQ Framework. The results and findings from the validation process were analysed and linked back to seminal literature for comparison and reflection.

The following section discusses the qualitative validation analysis of the conceptual DQ, i.e. the validation approach adopted for the conceptual DLSQ Framework.

The Qualitative Analysis: Validation Approach

This stage of research employed a qualitative approach for testing the reliability of Stage II of the conceptual DLSQ Framework using semi-structured interviews with three domain experts (elucidated above). The analysis encompassed analysing the feedback from three domain experts concerning the:

- Holistic view of the conceptual DLSQ Framework;

- Interrelationship of the integral dependencies identified (links and dependencies); and;
- Use and functionality of the conceptual DLSQ Framework within the context of an organisational setting.

Table 1 presents a summary of the feedback and comments made by the domain experts, obtained during the validation process of the conceptual DLSQ Framework.

Table 1: Summary of Findings: Validation Approach

Conceptual DLSQ Framework	Feedback and Comments	
	Positive	Negative
<u>Holistic Overview</u>	<ul style="list-style-type: none"> • Good that Pedagogy and Systems Development are combined together • The conceptual DLSQ Framework was considered to be representative • The interrelated dependencies/ components identified were considered to be imperative for the successful development and implementation of the conceptual DLSQ Framework within organisations 	<ul style="list-style-type: none"> • Evaluation should be a general core issue to be addressed within all the other five interrelated dependencies/ components; now it looks as if it is only an evaluation process for systems development • Communication should be included as one of the core interrelated dependencies/ components to enhance the conceptual DLSQ Framework implementation within an organisational setting • Technology should be included as one of the interrelated dependencies/components • BS should be replaced with Teaching and Learning Strategy • Risk Management should be included as one of the core interrelated dependencies/ components.

FINDINGS AND DISCUSSION

Results from the analysis of the validation indicated that the developed conceptual DLSQ Framework was accepted for use within a HE/ training organisational setting, with some additional recommendations made to enhance its relevance (Table 1). The domain experts agreed that the identified six core organisational drivers (Figure 1) were sufficient for enhancing the implementation of the conceptual DLSQ Framework within an organisational setting. However, comments were made to further improve this – in line with the organisational drivers and their dependencies (Table 2). From Table 2, it can be seen that majority of the findings presented in this study aligns to previous works cited elsewhere.

Table 2: Summary of Discussion and Findings/ new organisational driver/ dependencies

Organisational Drivers	Comments By Experts	Recommendations By Experts	Cross-Reference With Literature Review	Remarks
Evaluation	Was seen as if only intended for the evaluation of systems development <i>per se</i> .	This dependency should be undertaken within each interrelated dependency.	This conformed to findings from literature, whereby (Ritchie <i>et al.</i> , 1998) noted that the process of evaluation was complex, because it involved different people in the organisation, each of whom would be evaluating the system from different perspectives and for different purposes – which meant that the evaluation not only looks into the systems development <i>per se</i> , it also looks into how the system effected the whole organisation, with regards to process, resources, etc. (Avison & Fitzgerald, 1995; Avison & Shah, 1997; Bruegge & Dutoit, 1999).	In the context of this research, although the evaluation was illustrated if it represented the evaluation of the systems development, it is acknowledged that evaluation should be conducted within the processes of each 'core' interrelated dependency, i.e. they are implicit.
Communication	Communication although was agreed to be one of the factors needed to enhance the implementation of the conceptual DLSQ Framework; it was acknowledged not to be included within the core interrelated dependencies within the conceptual DLSQ Framework as an implicit (and important) part of the whole development process.	Remain unchanged	Communication as an essential element of the project lifecycle (Bruegge & Dutoit, 1999) especially as the relevance of communication in complex systems development projects is of primary importance – conforms with findings Many projects fail due to inadequate management of communication (Alshawi, 2007; Pour Rahimian <i>et al.</i> , 2008; Pour Rahimian <i>et al.</i> , 2011).	Remain unchanged
Technology	Promoted as a factor which needed to be included in the conceptual DLSQ Framework; and this is currently included under the core dependency 'resources'.	To include as separate issue/ as an organisational driver		
Risk Management [#]	Recommended to be included	Recommend to include the element risk management as part of the conceptual DLSQ Framework	Conforms with Lyytinen and Robey (1999) as systems development is often a high-risk undertaking.	This is an exceptionally valid point, and was captured through the conceptual DLSQ Framework in such areas as business strategy, process, resources, and systems development.
Business Strategy	The domain experts felt that all of the detailed attributes established were more or less similar to what they were used to, and had implemented within their organisation (except for some different terminology)	Remain unchanged	Conforms with (Arif <i>et al.</i> , 2012; Broadbent & Weill, 1997; Goulding <i>et al.</i> , 2014; Khuzzan & Goulding, 2008; Rockart <i>et al.</i> , 1996; Walsham & Waema, 1994).	Remain unchanged
Systems Development	1) Emphasised the importance of 'people' in systems development; as people and technology should go hand-in-hand. 2) The domain experts highlighted that the monitoring process should be shown as an ongoing process from design through operationalisation. 3) Evaluation can have a great impact towards the success of systems development, as it allows organisations to find out the status of their systems development in order to rectify this. Therefore, the inclusion of the Legacy Archive within each of the core areas was seen as a positive step forward in addressing these needs.	<ul style="list-style-type: none"> Remain unchanged Should show monitoring as on-going process Remain unchanged. 	<ul style="list-style-type: none"> Conforms with (Mager, 1962) Conforms with (Avison & Shah, 1997; Goulding & Rahimian, 2012; Ritchie <i>et al.</i>, 1998). Conforms with (Cooper, 1990; Goulding, 2000; Sheath <i>et al.</i>, 1996). 	<ul style="list-style-type: none"> People considered as under the core organisational driver 'resources' Reflected in evaluation Remain unchanged
Pedagogy	The domain experts also felt that all of the detailed attributes established similar to what they were used to, and had implemented within their organisation.	Remain unchanged	Instructional objectives were considered important as they lead to what is really needed to be delivered to learners, and to how it can be done. Conforms with (Mager, 1962; Melis & Monthienvichienchai, 2004).	Remain unchanged

CONCLUSION

Due to the emerging transdisciplinary global projects, AEC projects are becoming progressively more complex. This is placing unprecedented demands on organisations to perform – very often with a moving landscape of deliverables. Acknowledging this, organisations are now having to engage new business processes and technological solutions to meet these challenges. This often requires employing high-level skill sets to deliver the solutions needed. It is therefore particularly important that the causal drivers and influences associated with creativity and transdisciplinary decision-making in global AEC teams are fully understood and supported. Cognisant of these observations, this paper advocated the use of purposive learning styles to consider, assess, and diagnose learner traits and styles (to meet transdisciplinary needs). A DLSQ Framework which includes a diagnostic learning styles questionnaire was presented as a possible way forward. This can help align e-Learning styles to different learning models. The proposed framework offers promising opportunities for embracing a broader background of cognitive aspects of learners. This work presents new insight and understanding in the field of social science and behavioural science theory, particularly the causal links and dependencies surrounding: learner styles, behaviourism, learner effectiveness, and motivational theory. More specifically, it also attempts to uncover new meaning on the nature of the learning process and how this links to pedagogy (through the understanding of learning styles) - especially how individual characteristics can be supported by learning systems. However, work of this nature is not without its cautionary caveats. In this case, research limitations include the inherent challenges of absorbing 'perfect' learner traits into an all-encompassing generic solution. Perhaps a panacea solution may never be fully available, especially as new concepts on theory generation are still unfolding.

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