Variability in university students' use of technology: an 'approaches to learning' perspective

Variability in University Students' Use of Technology: An 'Approaches to Learning' Perspective

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This study reports the results of a cross-case study analysis of how students' approaches to learning are demonstrated in blended learning environments. It was initially propositioned that approaches to learning as key determinants of the quality of student learning outcomes are demonstrated specifically in how students utilise technology in blended learning contexts. Three case studies were conducted in a teaching-focused university and the findings of each case were examined across the case studies to determine their relatability. Prominent themes from the cases showed that a deep approach can be consistent with an intentionally selective use of facilities within the online environment. Similarly, a strategic approach can also be consistent with overall higher levels of online activity. Conclusions highlight that approaches to learning within a blended learning context are dependent on the level and the quality of the face-to-face as well as online instruction.

Introduction

One of the reasons given for the large-scale investment in technology-enhanced learning in higher education is that technology can improve teaching and learning while playing a central role in the development of student-centred learning (e.g. Selwyn, 2009). Most importantly, emphasis is also placed on how higher education students use technology for their learning, whether new modalities of learning emerge through the use of new

media, and how teaching, educational design and policy can accommodate such challenges (Palfrey & Gasser, 2008). The current study investigated students' use of technology by exploring how approaches to learning are demonstrated online within a blended learning environment. Earlier research in higher education explored variation in the way students and teachers experience teaching and learning, and identified relationships between the quality of what students learn, how they perceive the teaching and learning context, and the characteristics of the given student such as prior experiences (Ramsden & Entwistle, 1981; Trigwell, Prosser & Waterhouse, 1999). In terms of students' learning, two levels of processing were identified corresponding to the ways students tackle their academic tasks: a deep as well as a surface level of processing (Marton & Säljö, 1976). When teaching is relevant to students' interests (Fransson, 1977), the wider teaching environment is supportive (Ramsden, 1979) and students have an opportunity to manage their own learning (Ramsden & Entwistle, 1981), thereby a deep approach to learning is more likely to be demonstrated. Conversely, when student assessment favours reproduction of information and the workload is perceived as excessive, a surface approach is more likely to be observed, which can be thought of as a reliance on memorisation that operates in isolation from other ideas (Ramsden & Entwistle, 1981). Further work identified the strategic approach to *studying* (Entwistle & McCune, 2004) as derived from an intention to obtain the highest possible grades while focusing very closely on assessment requirements (Entwistle & Ramsden, 1983). Whereas the deep and surface approach characterises how students engage in learning – a composite of intention/motivation *and* strategy – the strategic approach typifies how students organise their study (Entwistle, 1991). Vanthournout, Donche, Gijbels and van Petegem (2014) argue that after considering empirical and conceptual arguments, only the deep and surface approaches are distinguished in student approaches to learning theory, while preceding literature discussed the existence of a combined deep/strategic approach to learning (Entwistle & McCune, 2004; Sun & Richardson, 2012). Research has also shown that variation exists in the ways that university teachers approach their own teaching (Lindblom-Ylänne, Trigwell, Nevgi, & Ashwin, 2006): teachers' approaches to teaching are associated with their conceptions of teaching and a distinction exists between a teacher- and a student-centred approach to teaching (Prosser & Trigwell, 1999).

Approaches to learning in blended learning environments

More recent studies have explored variation in the experiences of students in technology-mediated learning environments with a particular

conceptual focus on blended learning defined as a systematic combination of face-to-face and online interactions between students, teachers and learning resources (Bliuc, Goodyear & Ellis, 2007). Three clusters of studies are reviewed here as relevant to the current study: (i) inferential studies examining the relationship between usage of technology tools and student approaches to learning; (ii) phenomenographic studies thematising variation in the way students and teachers experience blended teaching and learning interactions; and finally (iii) frameworks that explore whether and how tracking student usage in online learning milieus can be beneficial to student learning.

Associations between approaches to learning, perceptions of online learning and patterns of technology usage

Studies at the earlier stages of the implementation of online learning investigated whether there is a relationship between approaches to learning and utilization of the new technologies in higher education. A study with philosophy students explored to what extent the use of a Learning Management System (LMS) contributed to the demonstration of a deep approach to learning: participants in online discussions had higher 'deep learning' scores and non-participants had higher 'surface approach' scores (Gibbs, 1999). Evidence was reported that 'strategic learners' demonstrated their approach by their choice of online activities (Gibbs, 1999; Light & Light, 1999). A more systematic investigation identified weak positive correlations between deep and strategic approaches and 'positive judgements about networked learning', while students with a surface approach were more likely to perceive negatively the 'value of networked learning' (Goodyear, Asensio, Jones, Hodgson & Steeples, 2003: 24). Analogous and weak to moderate correlations were found in a number of similar studies between deep and strategic approaches and positive perceptions of an LMS and/or surface approach alongside negative perceptions of the online environment (Buckley, Pitt, Norton, & Owens, 2010; Jelfs & Colbourn, 2002; Mimirinis & Bhattacharya, 2007). Subsequent investigations have evidenced associations between approaches to learning and perceptions of online discussions (Lee, 2013), and examined access to online resources in relation to student achievement (Knight, 2010), while an earlier study identified a link between a strategic approach and use of online discussions (Hoskins & van Hooff, 2005). All of the above studies, except Lee (2013), administered the Approaches and Study Skills Inventory for Students (ASSIST) questionnaire (Tait, Entwistle, & McCune, 1998) or the shorter version of Approaches to Studying Inventory (ASI) (Entwistle &

Ramsden, 1983). None of the above studies have been replicated in a blended or exclusively online learning environment.

Variation in students' experiences of learning with technology

Parallel to this stream of investigations exploring possible relationships between approaches to learning and perceptions of the online/blended environment, another set of studies has been based on the variation in the way students experience online learning in a range of settings adopting a phenomenographic approach (Marton & Booth, 1997). Studies have reported associations between conceptions of learning online though discussion, approaches to learning and academic achievement (Ellis, Goodyear, Calvo & Prosser, 2008; Ellis, Goodyear, Prosser & O'Hara, 2006). Ellis and Calvo (2006) have reported variation in the quality of approaches and how students perceived issues such as workload and what they thought they were learning through online discussions and performance, a theme that has been revisited more recently (Ellis, 2016). Two groups of students were identified: one group experienced discussions as a way of understanding the topic being studied, judged by positive scores on the deep approach to learning subscale (Ellis & Calvo, 2006). A second group had an experience orientated towards reproduction, judged by a positive score on the 'surface approaches and fragmented conception subscales' (Ellis & Calvo, 2006: 66). Ellis, Ginns and Piggot (2009) also investigated how e-learning technologies are used to support the face-to-face experience of final year business students. Through frequency analyses they identified correlations between the deep approaches, the e-learning variables, perceptions of the quality of e-learning, and achievement. Their analyses suggested that students who had negative perceptions of the quality of teaching, design, interactivity and workload tended to achieve relatively poorly online. Finally, Yang and Tsai (2010) proposed relationships between cohesive conceptions of learning through online assessment, deep approaches to learning via online assessment and greater progress in the early stages of online assessment. In summary, it can be argued that forty years after the introduction of the influential metaphor of deep/surface approaches to learning by Marton and Säljö (1976), phenomenographic studies have not yet produced an equally compelling metaphor to account for student learning in online or blended learning environments. However, to date they have underlined the importance of examining technology as an issue of integration and developed useful links between students' conceptions of technology-enhanced learning, their approaches to learning, and the quality of learning outcomes.

Educational mining, learning analytics and big data: who benefits?

As discussed, approaches to learning consist of motivation/intention *and* strategy, with the former exemplifying how students actually go about their learning and studying. The current study utilised mechanisms of data-gathering in the online domain to explore how this strategy is actualized while studying within an LMS. Increased levels and capacity of technology integration have afforded mechanisms of locating, collecting and analysing structured and unstructured data derived from student activities in online domains. Strategies of capturing student 'data' and its analysis and representation are accompanied by a multitude of claims and ambitions. These stem from different methodological and conceptual frameworks: 'educational mining' (Levy & Wilensky, 2010), 'big data' (Daniel, 2015), and 'learning analytics', the last being a sub-discipline of 'big data' (Park & Jo, 2016). The breadth, depth, scope and intensity of claims articulated by these sources vary. It has been argued that embedded analytics can inform strategic institutional decisions (Daniel, 2015), improve student retention and provide a new lens through which teachers 'can understand education' (Clow, 2013: 683). Data-gathering mechanisms may indicate levels of student engagement, record progress and serve as 'predictors' of achievement (Junco & Clem, 2015), although the latter has generated notes of caution in terms of the impact of contextual instructional influences (Gašević, Dawson, Rogers & Gasevic, 2016).

While ethical, privacy and policy issues are acknowledged in similar studies, what is less explicitly recognized is the role of these data-gathering mechanisms in the construction of student subjectivities under new monitoring and surveillance regimes (Land & Bayne, 2004) and the emergent educational data discourses, thereby becoming bio-political strategies focused on the evaluation and management of learners' experiences (Williamson, 2016). A tokenistic approach to ethics would warrant assurances or safeguards whereby an otherwise well-intended organization or its surrogates (teachers, data managers, learning technologists, quality assurance agents, executives) 'protect' the student and work towards their benefit. In methodological terms, a frequent criticism featured in educational research is that the espoused theoretical framework of a study often overpowers the actual data. In the context of analytic/mining tools, this can be translated to a concern that the tools may produce reductionist and rather simplistic accounts of complex educational realities.

Methodology

The study sought to exploit the strengths of the case study approach as an empirical inquiry that investigates an educational phenomenon within its real-life context (Yin, 2003). It was expected that comparison across the cases would increase the relatability of the cases while acknowledging disciplinary differences. A semi-exploratory approach was adopted and the methodological design incorporated three data collection sources: a questionnaire measuring approaches to learning; web logs of LMS usage; and student interviews. Supplementary teaching observations of the first and last teaching session of each module were conducted by the author, largely with the aim of eliciting aspects of the lecturers' approach to teaching. Two types of statistical analyses were used. Factor analyses examined the structural relationships amongst the questionnaire items (construct validity) whilst Pearson correlation coefficients investigated the strength of the relationships between approaches to learning and use of the LMS.

Data generation

Data was generated from student responses to the revised ASSIST questionnaire consisting of five-point Likert items. Web log files recording LMS usage were also analysed after receiving students' consent. The scores on each scale and subscale were obtained by adding the scores of the relevant items. Table 1 presents the descriptive statistics for the revised, 48 item ASSIST inventory – excluding the 'Achieving' subscale of the strategic approach – (Entwistle & Tait, 1994), and provides an overview of students' approaches to learning and studying across the three cases of this study: Information Systems, Management, and Education. Internal consistency scales measured the homogeneity of the set of items of the inventory and indicated to what degree they all measured the same variable. A confirmatory factor analysis of the 12 subscale scores was computed using principal axis factoring and oblique rotation. Table 2 summarises the results of the factor analyses for the cases.

Table 1

Descriptive statistics for the 12 subscales of the revised ASSIST inventory

Subscales	Mean - Information Systems N=37	Mean - Management N=111	Mean - Education N=43
Seeking Meaning	16.11	15.21	16.05
Relating to Ideas	15.51	15.22	14.98
Use of Evidence	15.46	15.86	16.51
Interest in Ideas	15.57	14.55	14.09
Deep approach total	**62.65**	**60.83**	**61.63**
Organised Study	15.27	14.16	14.91
Time Management	14.59	14.69	14.61
Alertness to Assessment	17.14	16.23	16.93
Monitoring Effectiveness	16.46	16.97	17.65
Strategic approach total	**63.46**	**62.06**	**64.09**
Lack of Purpose	11.35	11.79	9.86
Unrelated Memorizing	12.78	12.58	10.95
Syllabus-boundness	13.95	14.32	14.12
Fear of Failure	14.11	15.57	15.28
Surface approach total	**52.19**	**54.26**	**50.21**

The possible score on all 12 subscales is from 4 to 20; possible score on total of each scale is from 16

Table 2

Factor Analyses of the responses to ASSIST questionnaire across the three cases

	Factors – Information Systems			**Factors - Management**		**Factors - Education**		
	I	*II*	*III*	*I*	*II*	*I*	*II*	*III*
% of variance	***33.9***	***15.6***	***12.7***	***39.6***	***16.6***	***35***	***20***	***11.2***
Deep approach								
Seeking Meaning	**.701**			**.762**		**.791**		
Relating to Ideas	**.795**			**.775**		**.564**		
Use of Evidence	**.697**			**.815**		**.791**		
Interest in Ideas	**.880**			**.610**		**.415**		-.339
Strategic approach								
Organised Study			**.952**	**.711**		**.329**		-.648
Time Management			**.789**	**.594**				-.825
Alertness to Assessment	.487		**.338**	**.684**		**.621**	.341	
Monitoring Effectiveness	.525	-.351	**.541**	**.678**		**.589**		-.319
Surface approach								
Lack of Purpose		**.870**			**.696**		**.721**	
Unrelated Memorising		**.885**			**.665**		**.773**	-.502
Syllabus-boundness		**.687**			**.628**		**.673**	
Fear of Failure		**.680**			**.423**		**.504**	

All loadings smaller than .30 in absolute magnitude have been omitted. Loadings replicating subscales of approaches are in bold. Method: principal axis factoring and oblique rotation (delta set at zero). N=37 for Information Systems, N=111 for Management, N=43 for Education.

Three distinct approaches emerged in the first case study. The factor analysis of the second and third case produced a combined deep/strategic approach and a surface approach. The combined deep/strategic approach presented strong loadings on all the relevant subscales of the deep approach scale as well as all the subscales of the strategic approach scale. In the third case study, the first factor accounted for 35% of the variance and presented strong loadings on all the relevant subscales of the deep approach scale as well as some moderately strong loadings on three of the subscales of the strategic scale. The second factor (20% of the variance) produced strong loadings on all the subscales related to surface approach and a loading marginally above .30 in absolute magnitude on the 'Alertness to Assessment' subscale of the strategic approach scale. Finally, the third factor, which accounted for 11.2% of the variance, showed strong negative

loadings on two of the strategic approach subscales (namely 'Organised Study' and 'Time Management') and three relatively weaker loadings on other subscales, one at each of the main approaches. The two strong loadings on the strategic approach scale did not relate interpretively to the other loadings, hence this third weaker factor was not considered in the next analysis steps.

First case study: a final year module in Information Systems

The first case study selected was a module in Methods and Tools for the Engineering of Information Systems and was offered as a final year option to a number of undergraduate Computing Science students. The module assessment was comprised of a summative and a formative component. The summative component included an unseen examination (60%) and coursework (40% group report and an individual log book). The formative element involved an individual bi-weekly logbook, participation in LMS-based tasks and evidence of individual contribution in online group activities, which contributed 5% to a student's mark for this module. The discussion board was used heavily for activity-based learning in a blended teaching mode. A two-hour weekly lecture was well attended and additional 90-minute seminars led by the teacher and a teaching assistant emphasised the online aspects of the delivery.

Data generation and analysis

Teaching observations indicated a student-centred approach to teaching with a strong emphasis on students' success in the module assessment. Some elements of a content-focused approach to teaching appeared, for example by providing a lot of facts not always directly relevant to module content. On the other hand, the lecturer initiated discussions about the module topics and outlined the opportunities available through online discussion threads. He intentionally bridged experiences between different activities and provided tools for scaffolding conceptual change. He also extensively used metaphors and abstractions, which challenged students' conceptions of the core module ideas. The online discussion activities produced 18 separate threads: 12 study groups, and one thread for coursework, general enquiries, lectures, unit activities, unit discussions and seminars respectively. Logs were analysed separately since the tracking functions of the system produced one log for each student, containing information such as frequency and duration of access, functions of the

system used and participation in online assessments set by the lecturer. In total 31 cases were further processed after the first round of analysis of the ASSIST questionnaire and based on students' consent to cross-examining questionnaire data with their use of LMS.

Table 3

Significant correlations between approaches to learning and use of LMS

			Total hits	Module Content	Quizzes	Discussion Articles
Strategic approach	**Strategic approach scale**	Pearson correlation	.364*		.430*	
		Sig. (2-tailed)	.044		.025	
	Organised Study	Pearson correlation	.310			.329
		Sig. (2-tailed)	.090			.070
	Time Management	Pearson correlation			.536**	
		Sig. (2-tailed)			.002	
	Monitoring Effectiveness	Pearson correlation	.316			
		Sig. (2-tailed)	.083			
Surface approach	**Unrelated Memorising**	Pearson correlation		.408*		
		Sig. (2-tailed)		.023		
	Syllabus-boundness	Pearson correlation				
		Sig. (2-tailed)				
	Fear of Failure	Pearson correlation			.300	
		Sig. (2-tailed)			.101	

* *Correlation is significant at the 0.05 level (two-tailed)*

** *Correlation is significant at the 0.01 level (two-tailed) r values under .300 have been omitted, N=31*

Correlations were computed between the overall scores on the three scales of the questionnaire and the usage of LMS functions. The scores of the subscales were also computed and some secondary correlations emerged. There were two significant correlations at 0.05 level between use of the LMS and the scores on the strategic approach scale: .430 with hits on Quizzes and .364 regarding the total number of students' hits. There were no significant correlations between LMS usage and the main deep approach scale or with any of the deep approach subscales. The module leader

asserted that utilising the LMS helped his students' to achieve desirable learning outcomes, which were specified as a thorough understanding of the role of Information Systems development methodologies. Nevertheless, the analysis of the correlation between approaches to learning and students use of the LMS, suggest a strategic, instrumental use of the technology. The correlations observed between the overall scores for the strategic approach and use of online assessment as well as the scores for the 'Time Management' scale and online assessment, present evidence of such use of the LMS. Notably, scores for the surface approach correlated with use of the LMS or some of its functions. Deep and surface approaches to learning normally co-exist in a learning environment and this was clearly the case in the context of this study. Two discerning approaches were identified drawing on the results of the correlation analysis. The scores on the 'Alertness to Assessment' sub-scale were the highest among the four strategic subscales, suggesting that a first approach was demonstrated by students prioritising assessment and opting for strategies such as regular classroom attendance and participation in online group work. A second approach focused on passively responding to module requirements inclusive of the online instruction and participation requirements. The correlation between scores on the surface scale and its subscales ('Unrelated Memorising', 'Syllabus-boundness', 'Fear of Failure'), and use of the LMS, support this assertion. Students with a predisposition to a deep approach to learning may have experienced the online component of the module as a poor learning experience. It is also possible that lack of intervention on their lecturer's part was also seen as poor teaching, affecting their perception of the quality of online teaching. Given the high volume of online activity, it is hard to expect that the facilitator would be able to promptly monitor every post on the discussion thread or how many students are participating in online assessment; yet again this indicates possible dangers that may arise out of an excessive use of technology. The importance the lecturer placed on assessment and his regular cues on how to achieve a good mark for the module, resulted in a student-focused approach to teaching with a strong emphasis on assessment and what was required of students to succeed.

Second case study: a final year module in Management

The second case study was a module in Management and was offered to final year students of the university's Business School. A two-hour weekly lecture was supplemented by a 90-minute seminar. In the seminars, the lecturers made regular references to the materials and activities within the LMS, mainly in terms of the multimedia content, which included pre-recorded lectures or so-called 'rich pictures.' The latter was an important element of the module leaders' pedagogy, generally aiming to encapsulate problematic life situations by incorporating both 'hard' factual and 'soft' subjective information. Lectures were designed to provide an introduction to the main tools of strategic analysis and focussed on the key issues affecting contemporary businesses. Seminars were intended to serve as a setting for smaller groups to discuss module requirements and to enable discussion of concrete cases. The module was assessed by examination and course work. The final two-hour examination (40% of the final mark) was based on a case study, which was made available on the LMS a few weeks before the exams. Another key area of intervention was assigning group work online and designing formative assessments as students progressed towards submitting their coursework.

Data generation and analysis

Observations of the face-to-face teaching sessions offered some evidence of a teacher-focused approach to teaching. The tutor provided a lot of facts to students not always directly relevant to module topics. He initiated discussions about the topics but these were limited in terms of scope or the time available for students to conclude them. Assessment appeared to be seen as a response to external requirements and the examples used were appropriate yet not always aligned with the focus of the teaching strategies. In total 84 cases were further processed after the first round of analysis of the ASSIST questionnaire, based on students' consent to the cross-examination of questionnaire data with logs recording their use of the LMS. Almost two thirds of the total sessions of all students logged on the system for the 'Content Folder' and individual files including the video recorded lectures. The 'Assignment' and the 'Web Links' areas attracted 12% and 10% of students' access respectively. It is important to note the significance for students to access the module learning materials, the assignments and items such as the introduction to 'rich pictures', identified as a key component of the lecturer's pedagogy.

There were two significant correlations at 0.01 level between use of LMS and the scores on the 'Time Management' subscale of the strategic approach: use of 'Content Folders' (.285) and use of the 'Files' section (.319). Weak to moderate correlations at 0.05 level were observed between the scores on the strategic approach and 'Web Links' views (.253), 'Content Folder' views (.257) and 'Files' section views (.274). The scores of the 'Alertness to Assessment' subscale (strategic scale) correlated with the number of 'Web Link' views (.238), while 'Monitoring Effectiveness' correlated with views of the 'Content Folder' (.224) as well as views of individual 'Files' (.215). Only one of the subscales of the deep approach ('Use of Evidence') correlated with the scores measuring access of the 'Web Links' (.231), 'Content Folder' (.231) and individual 'Files' sections (.230) respectively.

Table 4

Significant correlations: approaches to learning and use of LMS

		Sessions	Web links views	Content folders views	Files views
Use of Evidence (Deep approach)	Pearson correlation		.231(*)	.231(*)	.230(*)
	Sig. (2-tailed)		0.036	0.035	0.035
Strategic approach scale	Pearson correlation		.253(*)	.257(*)	.274(*)
	Sig. (2-tailed)		0.021	0.018	0.012
Time Management	Pearson correlation	.228(*)	.233(*)	.285(**)	.319(**)
	Sig. (2-tailed)	0.037	0.034	0.009	0.003
Alertness to Assessment	Pearson correlation		.238(*)		
	Sig. (2-tailed)		0.030		
Monitoring Effectiveness	Pearson correlation			.224(*)	.215(*)
	Sig. (2-tailed)			0.041	0.050

* *Correlation is significant at the 0.05 level (two-tailed)*

** *Correlation is significant at the 0.01 level (two-tailed)*

r values under .200 have been omitted, N=84

The teacher asserted that utilising the LMS enriched students' learning and helped them to achieve the module's learning outcomes. Nevertheless, the enthusiasm and the experience of the lecturer were not transformed into

concrete teaching strategies in the face-to-face or online arena. For example, none of the rich pictures' interventions were appropriately adjusted within the LMS. Hence the materials remained static, non-interactive and pedagogically inefficient and this was reflected in the results of the data analysis. The correlations between students' approaches to learning and their use of the LMS suggest a strategic use of the technology without necessarily achieving the module's intended learning outcomes. The observed correlations between the overall scores on the strategic approach and access to content available through the LMS, as well as the scores on the 'Time Management' scale and frequency of content access, offer some evidence for this claim. This is supplemented by the correlation between the 'Use of Evidence' subscale of the deep approach scale and 'Views of the Links' module section, where additional resources were made available; it was also linked with students' strategies for expanding their knowledge of the subject matter, identifying additional resources for their coursework, or responding to weekly module requirements.

Third case study: a final year module in Education

The third case study selected was a module examining issues in Information and Communications Technology (ICT) in Education. It was offered as a final year module to undergraduate students training to become primary education teachers. The module was the third in a series of modules for ICT drawing on the skills, knowledge and understanding gained across two previous modules and during school placements. The module was taught through a series of weekly 90-minute sessions including seminars, group and individual workshops; during the term, students were given the opportunity to reflect on their own practice and how teaching of ICT had developed over the three years of the course. The first part of the module assessment required the presentation of a journal article. Students were expected to design a presentation on an aspect of ICT research in education. The second part of the assessment was an essay and an abstract reviewing the literature in a chosen area of ICT.

Data generation and analysis

In total 42 cases of consenting students were further processed after the first round of analysis of the ASSIST questionnaire. More than half of stu-

dents' online activity was dedicated to accessing module content, with a significant proportion directed to activities on the discussion boards (30%) and formative assessments (7%). Correlations were computed between the overall scores on the three scales of the questionnaire, their associated subscales and the use of LMS.

Table 5

Significant correlations: approaches to learning and use of LMS

		Sessions	**Web link views**	**Content folder views**	**File views**
Deep approach	Pearson correlation				.356(*)
	Sig.(2-tailed)				0.02
Relating to Ideas	Pearson correlation				.314(*)
	Sig.(2-tailed)				0.04
Interest in Ideas	Pearson correlation				.364(*)
	Sig.(2-tailed)				0.016

** Correlation is significant at the 0.05 level (two-tailed)*
r values under .300 have been omitted, N=42.

There were three significant correlations at 0.05 level between use of LMS and the scores on the deep approach scale and two associated sub-scales: engaging with module content appeared to moderately correlate with the scores on the deep approach scale and the 'Relating to Ideas' and 'Interest in Ideas' subscales. There were no significant correlations between LMS usage and the main strategic or surface approach scale. The lecturer was a very experienced online tutor and used the LMS simply as a content management system; her approach proved efficient while encouraging deep approaches to learning. The results of the correlation analysis detailed above demonstrate that, to some extent, the utilisation of the LMS was in consonance with a deep approach to learning.

Cross-case study analysis

Drawing on case-specific data, prominent themes were extracted from each case study and are presented in Table 6. No consistent patterns have been identified between approaches to learning and studying, and use of the institutional LMS as part of these three final year undergraduate modules. The variability of the results indicates that approaches to learning as part of a blended learning experience are dependent on the level as well as the quality of the face-to-face and online instruction. A strategic approach to studying moderately correlated with use of the LMS in the Management module but this was not replicated in the third case study where engaging with module content was found to correlate with a deep approach to learning. Scores on the scales should be analysed cautiously while also acknowledging that the ASSIST questionnaire was validated in large samples and across different institutional and cultural contexts.

The sample sizes of the case studies need to be taken into account in the interpretation of these figures. Relatively divergent scores were observed on the strategic and the surface approach scales, reflecting the conditions and differentials of the learning environment in the three case studies. The highest score on the surface scale appeared in the Management module. The figure tallies with some of the problems reported in the follow-up interviews (not reported in this paper) such as lack of organisation, perceptions of heavy workload and disengagement with the learning process. It may be that the size of the module cohort affected students' perceptions of the quality of face-to-face or online learning. The departmental size and culture might also have affected the student experience in this Management module. The score of the 'Use of Evidence' subscale reflects to some extent the nature of inquiry in the Education module where a considerable amount of emphasis was placed on finding appropriate resources for teaching. Students in the Education module returned the highest scores on the 'Monitoring Effectiveness' subscale too; monitoring their progress was a prerequisite for graduation and emerged as a key dimension of a deep strategic approach, in this context linked with professional practice, higher levels of motivation and the prospect of a safe transition to employment in the education sector. Within that context, a deep approach to teaching induced use of specific LMS facilities by students who adopted the same approach as a response to the requirements of their final year study.

Table 6

Themes and findings across the three cases

Theme	Information Systems	Management	Education
Deep approach and use of the LMS		⇒ 'Use of Evidence' correlates with access of external resources and Syllabus Content	⇒ 'Seeking Meaning' subscale moderately correlates with access to module content ⇒ 'Relating to Ideas' subscale moderately correlates with view of external links
Strategic approach and use of the LMS	⇒ Strategic approach moderately correlates with frequency of LMS access and access of online assessments ⇒ 'Organised Study' moderately correlates with frequency of access using discussion threads ⇒ 'Time Management' strongly correlates with use of Online assessments ⇒ 'Monitoring Effectiveness' correlates with frequency of LMS use	⇒ Strategic scale correlates with access of external resources and Syllabus Content ⇒ 'Time Management' strongly correlates with number of online sessions, external resources and Syllabus Content ⇒ 'Alertness to Assessment' correlates with access of External Resources ⇒ 'Monitoring Effectiveness' correlates with access of Syllabus-Content	
Surface approach and use of the LMS	⇒ 'Unrelated Memorising' correlates with access of content		
Special findings			
	⇒ a student-centred approach to teaching alerting to the assessment requirements	⇒ a teacher-centred approach to teaching with opportunities for student-centred strategies ⇒ students reported lack of consistency in the provision of online learning at programme level	⇒ a student-centred approach in close alignment with professional practice

Exploring the relationship between a teacher's approach to teaching and how it impacts on student approaches to learning was not the prime focus of the current inquiry. It is rather that the above assertion emerged as an unintended outcome of this study where approaches to teaching were treated as an observed contextual factor. How the three lecturers went about their teaching was categorised either as a student- or teacher-centred approach, a categorisation that reduced much of the complexity of their teaching strategies to two broad, opposing constructs. While it is acknowledged that this distinction oversimplified the intricacies of the teaching activities, it was a useful analytical tool that allowed insight into the influence of a crucial factor – the teacher's approach to teaching. The most striking example of a face-to-face approach to teaching affecting the student approaches in the online context was evident in the first case study. A student-centred approach to teaching encouraged use of the technology aiming to achieve the 5% assessment weighting that was allocated to online participation. The lecturer's orientation towards assessment was demonstrated by frequent references to success, suggestions of efficient study methods and an abundance of assessment-related cues. Such cues were persistently present in plenary sessions, and the opening and closing teaching activities. While his online presence was less prominent, his face-to-face teaching strategies had a direct impact on the strategic use that students made of the online environment, as evidenced by the number of emerging correlations between the strategic approach and use of the LMS. Although the picture was less clear in the following case study, the teacher's approach to teaching re-appears as a powerful factor in the third case. The confidence of the lecturer in bridging the online and face-to-face aspects of her teaching was evident in the correlations between a deep approach and students' use of elements of the LMS in a way that enhanced construction of disciplinary knowledge and professional practice.

Discussion

Technology-enhanced learning is influenced by a wide range of factors such as the university's IT infrastructure, learning support services and the extent to which teaching teams manage to meaningfully integrate online activities into the curriculum. Teachers' motivation for using technologies is linked to perceived benefits in terms of resource saving, as clearly evident in the second case with the pre-recorded lecturers, or teaching enhancement and design (Goodyear, Banks, Hodgson, & McConnell, 2004), as more

clearly demonstrated in the third case. It is recognised that students will adopt different approaches to learning according to their personal preferences and the context in which they are learning, and that the two are inter-dependent (Laurillard, 1997). Therefore, it is crucial that further research systematically explores the constituents of such approaches in technology-rich environments in higher education beyond deterministic assumptions about the role of technology.

In light of the cross-case study assertions, it can be claimed that these offer support from an approaches to learning perspective to the argument that the benefits of integrating technologies in predominantly classroom-based settings stem from the quality of the teaching rather than the use of technology. In a broad sense this is consistent with the meta-analysis of 1,055 studies that arrived at the same conclusion (Tamin, Bernard, Borokhovski, Abrami & Schmid, 2011). Previous studies have also attested to no discernible relationship between the use of a technology's features in a blended environment and the achievement of learning outcomes (e.g. Kember, McNaught, Chong, Lam & Cheng, 2010). The more technology is integrated into university teaching milieus, the more challenging it may become to ascertain which parts of the university environment correlate to the students' perception when answering items on questionnaires such as ASSIST. Nevertheless, the variability of the results across the three cases underlines the relational nature of approaches to learning in settings where face-to-face teaching is supported by online facilitation and learning materials, and students' usage of technological media is an important parameter in evaluating their learning experiences. This was evident in the scores on the questionnaire scales across the three cases and, more importantly for the scope of this study, the correlations that were revealed between approaches to learning and use of technology. It is reiterated that evaluating the quality of blended learning is a challenging pursuit as technologies often underpin only specific parts of the learning process that students participate in. The teaching and learning environment of each individual case study was conducive to nurturing different approaches to learning. The study showed that, to a substantial extent, it also nurtured varied approaches to using technology as part of students' responses to the demands of the given academic tasks. Further research may elucidate the balance between consistency and variability in student approaches to learning when technological media are systematically woven in the fabric of university learning.

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