ATTITUDES TOWARDS, AND UTILISATION OF, VIRTUAL LEARNING ENVIRONMENTS AMONG POSTGRADUATE UNIVERSITY TEACHING STAFF

Victoria Smy, Marie Cahillane, and Piers MacLean
Cranfield University
United Kingdom

Abstract

Skill retention within a virtual learning environment (VLE) is dependent upon the complexity inherent in skill use (Cahillane, MacLean, & Smy, 2015) and the frequency of skill use (Arthur, Bennett, Stanush, & McNally, 1998). A questionnaire was used to capture demographics and perceptions/attitudes concerning VLE usefulness, VLE ease of use and self-reported VLE use among postgraduate level teachers. Results indicate that self-reported teaching workloads were negatively associated with attitudinal positivity. Further results indicated that the attitudinal concept of *Perceived usefulness* explained a significant amount of unique variance in *VLE Use*. However, perceptions concerning the *Ease of VLE use* did not.

Introduction

The knowledge and skills of those generating and maintaining e-learning content is pivotal to successful e-learning provision (Rogers, 2003). Skill retention within a virtual learning environment (VLE) is a multi-faceted construct. Cahillane, MacLean, and Smy (2015) advocate a link between skill retention and skill complexity and highlight a set of predictive criteria for assessing skill complexity. Criteria include, but are not limited to: the number of steps required to perform the skill; the availability of feedback; the availability of support tools; the mental processing requirements; the variety of facts that must be recalled. Another pivotal factor in determining skill maintenance is skill use. Cognitive factors predictive of skill maintenance involve temporal aspects such as the amount of time that has passed since the skill was last used effectively (Cahillane et al., 2015), and the overall frequency of skill use (e.g., Arthur, Bennett, Stanush, & McNally, 1998). Another important determinant of skill use involves socio-cognitive, attitudinal factors.

Socio-cognitive factors known to influence the uptake, use, and frequency of engagement with VLEs include attitudes and perceptions concerning ease of use and the perceived utility of the VLE (Collis, Peters, & Pals, 2001; Mahdizadeh, Biemens, & Mulder, 2008; Samarwickrema & Stacey, 2007; Wang & Wang, 2009). Attitudinal positivity and frequency of use may further vary depending upon the differing features and functionalities afforded by the VLE (Mahdizadeh et al., 2008; Rogers, 2003) and the degree of choice or autonomy when designing and implementing e-learning provision for work purposes (e.g., Gagné & Deci, 2005; Locke & Latham, 1990, 2002; Patrick, Smy, Tombs, & Shelton, 2012).

Cranfield University's VLE(s) enables various features and functions for enabling and delivering e-learning content (See Cahillane, Smy & MacLean, 2016). The present paper reports on current findings in an ongoing investigation into VLE attitudes. Existing theoretical models outline both the perceived ease of use, and perceived utility of VLE platforms as having an impact on VLE use (e.g., Wang & Wang, 2009). We

hope to extend the conceptual space by exploring these attitudes, along with self-reported VLE use within a postgraduate teaching context. In addition, an exploration of the frequency in use of differing VLE functions is considered. The following section now outlines the methodological design.

Method

Research Context

All participants were recruited from Cranfield Defence and Security (CDS), one of the four research schools within Cranfield University. Cranfield University caters to postgraduate students only, with CDS acting as a satellite campus based upon a military site (The Defence Academy of the United Kingdom). CDS is unique in that it provides teaching provision closely aligned to the academic needs of the military. As such specialised defence, business, engineering, management leadership, and forensic courses are offered to a mixture of military, civil service and civilian students. Formal teaching provision is primarily focussed around the provision of part-time and full-time MSc courses. However, a number of short courses are also hosted, and PhD students can access core research skills modules in support of their development. Teaching partnerships are in place such that CDS staff may also teach on courses provided to other Governments which may require the delivery of teaching content to students abroad (e.g., Ethiopia) either in person, or via VLEs. Some of the teaching conducted at CDS is of a sensitive nature. As such, restrictions regarding the dissemination of commercially/defence sensitive content may act to constraint the use of VLE for some teaching staff.

Participants

Twenty-nine teaching staff at CDS volunteered to take part in the research. Of those beginning the survey, 27 answered a reasonable amount of relevant questions and were included in the final sample. Three participants did not disclose their age. Of the participants who did, reported ages ranged between 30 and 67 years (Mean 48.7, SD 9.66). Twenty-one of the sample were male, six females. Teaching disciplines were varied, including (but not limited to) Management, Engineering, Behavioural science, Computing, and Forensics. Participants' teaching experience ranged from one to 34 years (Mean 14.04, SD 10.11). The amount of work time reported to be devoted to teaching provision (included design, delivery, assessment and supervision) ranged from 20% to 90% (Mean 57.04, SD 20.53). Of those responding, all but one used virtual learning environments in their teaching provision. All VLE users (n = 26) reported using the CDS virtual Moodle platform, with seven participants also reporting some use of the Blackboard virtual platform. VLE users had, on average, 6.91 years' VLE experience (SD = 3.99). Participants were recruited via an introductory email and were assured that the information they provided would be treated confidentially.

Materials and Design

An e-survey was designed using Qualtrics software. The survey consisted of a number of blocks of questions, preceded by project recruitment details, research aims, and ethical consent statements. The first block of questions captured participant demographics, as well as their teaching and VLE experience, the details of which are reflected in the previous section.

The second block of questions assessed VLE use and attitudes towards VLEs in general. Participants were required to capture their responses using a five-point Likert scales

ranging from "strongly disagree" through to "strongly agree" with the midpoint of the Likert scale representing "neither agree or disagree." As such, the Likert scale enabled responses to be scored in such a way that higher scores represented greater attitudinal positivity (with the exception of one reverse-scored item). Three separate attitudinal scales were administered. The first, a three-item scale was developed to assess participants' perceptions of their personal needs and responsibilities in regards to using VLEs within their teaching provision. We labelled this scale ***VLE Use*** ($\alpha = .57$; whilst Cronbach's alphas of .70 or above are typically recommended, lower coefficients can be deemed acceptable for scales consisting of a small number of items: e.g., Anastasi, 1990; Sijtsma, 2009). Items include, "I use the VLE frequently," "VLE use is optional in my teaching role" (reverse scored), and "VLE use is essential for my teaching role." A second scale assessed participants ***Perceived ease of VLE use*** (Davis et al., 1989, cited by Wang & Wang, 2009). This incorporated five items: an example is, "I find it easy to get the VLE to do what I want it to do corresponding to the ways I teach" ($\alpha = .92$). The third scale assessed ***Perceived usefulness*** of engaging with VLEs for teaching purposes (Davis et al., 1989, cited by Wang & Wang, 2009). Eight items were used: an example is, "Using the VLE gives me greater control over my work" ($\alpha = .86$).

A third, exploratory block of open questions was included to investigate how frequently teaching staff used Cranfield VLEs in order to fulfil different teaching functions. Functions were identified and developed using the inputs of four members of CDS teaching staff in a focus group setting. Whilst an exhaustive description of focus group methodology is not included in the present paper, interested readers are referred to the ICICTE16 paper, "A Case Study of the Barriers and Enablers Affecting Teaching Staff E-Learning Provision" (Cahillane et al., 2016). Sixteen VLE functions, covering typical pedagogical practices, administration, assessment, policy, and teaching management practices were identified. Whilst the list developed is not expected to exhaust every teaching possibility afforded by VLEs within educational contexts, we believe the list reflects the bulk of teaching-oriented VLE activity undertaken by teaching staff within the present research context. The full list of VLE functions is as follows:

- Conducting course administration
- Delivering introductory course materials
- Promoting student self-directed learning
- Promoting participation and interaction in learning discussions
- Archiving/curating course materials
- Developing practice and revision opportunities for students
- Assessing student engagement with course content
- Conducting formative assessment
- Conducting summative assessment
- Providing feedback to students
- Co-ordinating learning activities for part-time/distance students
- Generating course evaluation and feedback from learners
- Delivering blended learning
- Tailoring content to student ability and understanding
- Meeting student and institutional expectations
- Fulfilling contractual requirements for course management purposes

The frequency with which participants conducted each teaching function, where applicable, was measured using a further five-point Likert scale ("never," "rarely," "sometimes," "often," & "always," scored 1-5 respectively).

Procedure

Upon receiving an invitation to participate, volunteers clicked a hyperlink redirecting them to the Qualtrics webpage where the e-survey could be found. Participants first read about the research aims and the ethical handling of their data. Once informed consent had been obtained, participants proceeded to work through the questions at their own pace, according to the relevant skip logic. On average, participation took 10mins 35s, (SD 6mins, 57s).

Results

For the sake of simplicity, results are presented in two sections. The first section presents the results pertaining VLE attitudes. The second section examines the frequency with which various VLE functions are carried out.

VLE attitudes

The item scores of each of the three attitudinal scales were summed to produce on overall score. Table 1 presents descriptive results and intercorrelations reflecting VLE attitudes. Also presented is demographical information reflecting teaching workload, teaching experience, and VLE experience, all of which may impact upon attitudes towards the use of technology within teaching provision. As might be expected, a significant association was evident between teaching experience and VLE experience (r = .47, p < .05). Both teaching and VLE experience were not significantly associated with attitudes towards the VLE. Interestingly, reported teaching workload was found to be negatively associated with all attitudinal scales (*Perceived Usefulness*, r = -.46, p < .05; Perceived *ease of use,* r = -.50, p < .01; *VLE Use*, r = -.41, p < .05). Surprisingly, VLE experience was not significantly associated with the attitudes towards VLE environments measured within the present study.

All attitudinal scales were significantly and positively correlated. Of note is the high correlation between *Perceived usefulness* and *Perceived ease of use* (r = .86, p < .01). Whilst a correlation between these variables was expected, the magnitude of the correlation is indicative of a considerable degree of conceptual overlap between the two measures and statistical multicollinearity (Pallant, 2007). Hierarchical multiple regression was used to assess the ability of *Perceived usefulness* and *Perceived ease of use* to predict *VLE Use w*hilst controlling for the effects of reported teaching workload. Results indicated a significant, unique contribution of *Perceived usefulness* but not *Perceived ease of use* (*part r*s = .37, -.07, *p*s .02, .64 respectively).

Table 1

Descriptives and Intercorrelations

Variable	Mean	SD	1	2	3	4	5
1. Teaching experience (years)	14.04	10.11	-				
2. Teaching workload (%)	57.04	20.53	.26	-			
3. VLE experience (years)	6.91	3.99	.47*	.12	-		
4. Perceived usefulness	23.44	7.60	-.28	-.46*	-.09	-	
5. Perceived ease of use	14.23	5.57	-.11	-.50**	.16	.86**	-
6. VLE use	11.81	2.91	-.14	-.41*	.09	.69**	.52*

* = p < .05, ** = p < .01

VLE functions

Table 2 presents the mean frequency of use of various differing teaching functions that could feasibly be carried out via a virtual learning platform, ordered according to the most frequently used VLE functions. Whilst the average reported use of all functions fell around the midpoint of the frequency scale, individual scores ranged from 2.17 - 4.25 (out of 5).

Paired-sample *t*-tests were used to compare the frequency of use of each individual function against the overall mean reported use of all functions. *Bonferroni* corrections were applied. Results indicated that two functions were conducted more frequently than average. These were *Conducting summative assessment* and *Meeting student and institutional expectations* (*t*s(23) = 6.35, 3.51, *p*s < .01, < .05 respectively). On the opposite end of the scale, *Assessing student engagement with course content* and *Generating course evaluation and feedback from learners* were reportedly used at a significantly lower frequency (*t*s(23) = -3.72, -4.34, *p*s < .05 respectively).

Table 2

Use of Differing VLE Teaching Functions

Functions	**Mean**	**SD**	***t***
Conducting summative assessment	4.25	1.07	6.35**
Meeting student & institutional expectations	3.97	1.52	3.51*
Tailoring content to student ability & understanding	3.57	1.27	2.80
Fulfilling contractual requirements for course management purposes	3.32	1.62	1.13
Promoting student self-directed learning	3.26	1.29	1.71
Delivering introductory course materials	3.08	1.38	.83
Archiving/curating course materials	2.92	1.59	.11
ALL FUNCTIONS	2.88	.68	n/a
Co-ordinating learning activities for part-time/distance students	2.88	1.48	-.03
Conducting course administration	2.44	1.34	-.66
Developing practice & revision opportunities for students	2.42	1.10	-.24
Delivering blended learning	2.35	1.40	-2.72
Promoting participation & interaction in learning discussions	2.29	1.12	-2.77
Conducting formative assessment	2.38	1.38	-2.37
Assessing student engagement with course content	2.17	1.27	-3.72**
Generating course evaluation & feedback from learners	2.17	1.31	-4.34**

* = $p < .05$, ** = $p < .01$ (*βonferroni* corrections applied), *df* = 23 in all instances

Discussion

The present research found that higher reported teaching workloads were associated with greater negativity in attitudes towards VLEs. High teaching workloads may be evidenced through greater variation in teaching content, a larger number of students (and therefore a greater assessment burden), and a greater need to standardise teaching processes (or a reduced ability to utilise some desirable VLE features such as tailoring content to student understanding). Whilst nothing can be concluded as to the criteria teachers used when estimating their teaching workload, it is apparent that within the

CDS research context, more teaching resulted in greater perceptions that VLEs were cumbersome to engage with and not of additional benefit to teaching quality.

Surprisingly, and contrary to expectations, the level of experience in using VLEs was unrelated to VLE utility attitudes. As such, a greater level of familiarity with VLEs did not result in perceptions that the VLE was useful or easy to use. Amongst VLE utility attitudes, *Perceived usefulness* explained a significant, unique amount of variance in *VLE Use*. *Perceived ease of VLE use* was positively associated with both *Perceived usefulness* and *VLE Use*. Such findings converge with theoretical models of VLE use (e.g., Davis et al., 1989, cited by Wang & Wang, 2009). However, overlap in the statistical measurement of *Perceived ease of use* and *Perceived usefulness* was indicated, and regression analysis indicated that *Perceived ease of use* did not account for unique variance in *VLE Use, but Perceived usefulness* did.

An exploration of various VLE functions indicated that the VLE was used most frequently to *conduct summative assessment*, and to *meet perceived student and institutional expectations*. Other functions, specifically *assessing student engagement with content*, and *generating evaluation and feedback from learners* were reported to be used less frequently. Whilst no further examination of VLE function use is reported in the present paper, it may be the case that various demographic distinctions such as teaching role (e.g., module contributor/lead, course director) may impact upon the frequency of use of the differing VLE functions explored. For instance, it seems likely that those functions mentioning course content or course evaluation would be of greater relevance to course directors as opposed to module contributors. Additionally, given the impact of teaching workload upon perceptions of VLE utility, the level of self-reported teaching workload may also differentially impact upon the VLE teaching practices that are used more frequently. For instance, those with light teaching workloads may only require two or three functions to carry out their teaching, whereas those with high workloads may need to use a wider range of functions on a frequent basis.

What is clear from the present results is that the use of information technologies for instructional/teaching purposes is a complex, multi-directional issue (Wang & Wang, 2009). Whilst technical knowledge (Rogers, 2003), task complexity and skill fade can impact upon the cognitive skills required to optimise VLE use (Cahillane et al., 2015: Rogers, 2003), attitudinal factors (Collis et al., 2001; Mahdizadeh et al., 2008; Samarwickrema & Stacey, 2007; Wang & Wang, 2009) and the nature of teaching workloads play a pivotal role in motivating teachers to interact with technology, and therefore need to be factored into models of VLE use.

Limitations

There are a number of methodological considerations that should be acknowledged. Firstly, the small sample size may affect the strength of conclusions that could be drawn. The 29 respondents documented presently represent a small percentage of the overall number of teaching staff at CDS who received an invitation to take part in the research. Secondly, the three-item scale developed to assess participants' perceptions of their personal needs and responsibilities in regards to using VLEs within their teaching provision (*VLE use*) had suboptimal internal consistency. Whilst a small sample size may have contributed to this result, further refinement and validation of a measure of teaching staffs' personal (i.e., not mandated) investment in VLE use would be desirable. Thirdly, with the exception of one reverse-scored item, no control measures were built

into the questionnaire in order to mitigate the impact of common method variance that can be introduced through use of self-report measures and common response formats (i.e., Likert scales). Future development of the questioning methodology will seek to intersperse scale items, develop more reverse-scored items, and visibly remove previous responses in order to reduce the likelihood of response sets. A further methodological improvement would be to reduce the reliance on self-reported data by using observable measures such as actual VLE engagement. Another limitation is the use of cross-sectional data. Whilst there are theoretical justifications for predicting that some attitudinal variables are antecedents of VLE use (based on the weight of the evidence within the VLE literature base), a longitudinal design and data collection plan would be required to infer cause and effect.

A final consideration regarding the present results is the nature of CDS as a research context. In addition to the contextual nuances outlined within the Method section, restrictions regarding the dissemination of commercially and/or defence sensitive teaching content may act to constraint the use of VLE for some teaching staff within the present research context. Indeed, some Masters level courses are not available to civilian students, a factor not captured in the present research design. Further contextual concerns emerge from preliminary inspection of the comments left by questionnaire respondents. Whilst a full qualitative exploration of teacher's comments regarding current VLE provision is beyond the scope of the present paper, some reoccurring themes merit mention. These include the practical and applied nature of lots of CDS teaching disciplines. Terms such as "inflexible," "demonstration," and "hands-on work" indicate that some respondents did not feel like some teaching content could be best delivered via a VLE.

Future Research

Whilst the results reported presently reflect an interim snapshot of VLE attitudinal positivity within CDS, future research phases are planned. Such activity will involve collecting data within Cranfield University's other research Schools (School of Energy, Environmental Technology and Agrifood; School of Aerospace, Transport and Manufacturing; School of Management). This will enable comparison of the CDS environment against the VLE teaching practices of those on a more typical campus, whilst maintaining a focus on postgraduate education.

A further fruitful avenue for research development involves assessing the criteria (actual metrics and perceived components along with their relative weightings) considered when reporting teaching workload. Of high priority given the present impact of teaching workload on attitudinal factors, is to investigate whether self-reported workload coincides with contractual obligations. Where discrepancies arise, an examination of the factors at play in skewing workload estimations could highlight contextual factors that affect attitudes towards VLE utility.

It is envisioned that the long-term output of the research avenues outlined may have multiple applications. Firstly, the research may identify areas of underuse/disuse within Cranfield's VLE provision which could inform policy as to future functionality provision. Secondly, results could be used to determine whether VLE training or support may be of benefit. Here, frequently used functions that are perceived to add value to teaching provision should be prioritised.

Conclusions

VLE use is a multi-faceted construct dependent on knowledge, skills, and attitudes. Cahillane et al. (2015) suggest that skill fade is dependent upon the inherent complexity of enacting a teaching task within a VLE, coupled with consideration of when the knowledge and skills underpinning task performance were last used effectively. The present research builds upon this by highlighting some attitudinal factors that affect the use of technical skills used to achieve differing teaching functions. Future efforts should aim to merge these two research streams to establish a model of the socio-cognitive factors affecting the development and maintenance of VLE teaching skills. Such a model might have implications for assessing VLE teaching capability at an organisational level.

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Author Details
Victoria Smy
v.smy@cranfield.ac.uk
Marie Cahillane
m.cahillane@cranfield.ac.uk
Piers MacLean
p.j.maclean@cranfield.ac.uk



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Smy, Victoria; Cahillane, Marie; MacLean, P.

2016-07
ICICTE
http://www.icicte.org/Papers_ICICTE2016/5.1%20027_Smy%20final%20edit.pdf
Smy V, Cahillane M, MacLean P (2016) Attitudes towards, and utilisation of, virtual learning environments among postgraduate university teaching staff. 16th International Conference on Information, Communication Technologies (ICICTE 2016) Rhodes 07-09/07/2016

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