

Quality in blended learning: Exploring the relationships between on-line and face-to-face teaching and learning

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Abstract

This project draws on a large body of seminal research showing that the approaches students take to learning, and the subsequent quality of their learning, is closely related to their perceptions of their learning experience. Recent research has demonstrated these findings also hold for non-standard modes of delivery such as distance education using on-line strategies. However, there is currently little research about how predominately campus-based students' experiences of the on-line part of their course are associated with their experience of the course as a whole. The present study extends previous research into the domain of blended learning, by exploring the relations between student perceptions of the e-Learning environment, approaches to study, and student grades.

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1. Introduction

Teachers concerned about the quality of learning in universities are facing a number of challenges related to information and communication technologies (ICT). High on the list of these challenges is identifying appropriate ways of evaluating the extent of their contribution to quality learning experiences. There is no room to sidestep this issue as there are a number of drivers encouraging the integration of ICT into the student experience. These include the flexibility they bring to students with increasing work and familial commitments; the skills that they may help to develop such as modern communication and collaboration methods if they are used well, the immediate access they provide to an increasing amount of knowledge, both in the disciplinary and future professional areas of students; and the understanding they engender if they are to support learning appropriately.

These drivers are being increasingly recognised by universities, not only those teaching students at a distance, but by universities offering a predominantly campus-based education ([Higher Education Funding Council for England, 2004](#)). From a student perspective, this most commonly results in learning processes that are spread across face-to-face and on-line contexts. This type of learning, often referred to as blended learning, creates challenges for the evaluation process.

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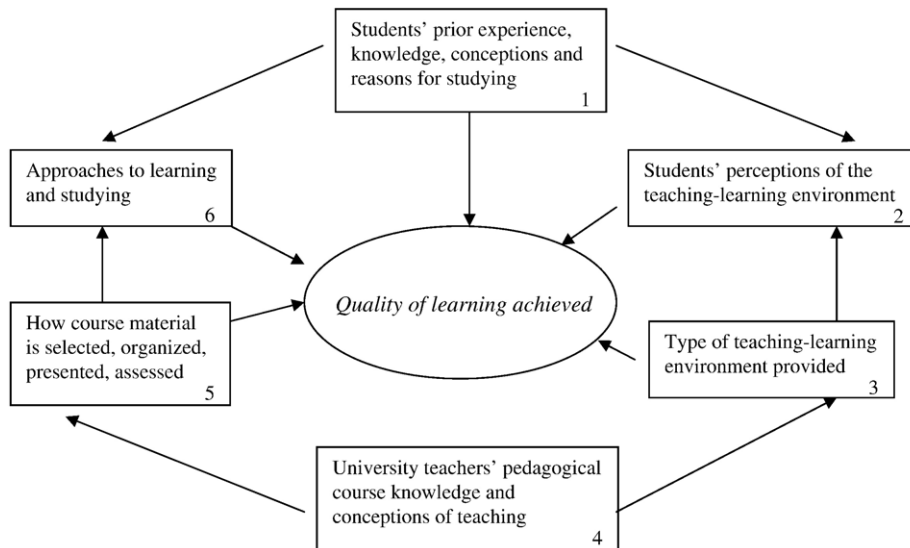


Fig. 1. Concepts related to the quality of learning at university (from Entwistle et al., 2002).

Evaluating the quality of blended learning experiences is no easy matter as technologies typically support only part of the learning processes that the students engage in. Consequently, evaluating the contribution of the technologies in blended learning experiences requires research methodologies sufficiently sensitive so that they can recognise and acknowledge the relational nature of the technologies to the quality of learning.

This study seeks to offer a useful way into the debate of how to evaluate the quality of learning arising from learning experiences that involve both face-to-face and on-line contexts. It does so by complementing well-known questionnaires used to evaluate the quality of learning in higher education (Biggs, Kember, & Leung, 2001), and the Course Experience Questionnaire (e.g. Ramsden, 1991; Richardson, 1994; Wilson, Lizzio, & Ramsden, 1997) with a questionnaire under development referred to in this study as “The e-Learning Experience Questionnaire”. The goal of this study is to begin to unravel the structure and meaning of student perceptions of e-Learning experiences as they relate to face-to-face experiences, in order to better understand how to help students make the most of the on-line context. To investigate what the key parts of the students’ e-Learning experience might be, the analyses of the e-Learning Experience Questionnaire are undertaken in relation to students’ responses to a well-established questionnaire, the Study Process Questionnaire-Revised (Biggs et al., 2001). The study’s goal, then, was to investigate how students’ perceptions of a major part of the subject – their experience of how e-Learning supported their face-to-face experience – related to qualitatively different aspects potential approaches to learning for the subject as a *whole*.

2. Prior research

2.1. The student learning framework

Systematic and extensive research into quality student learning in higher education has occurred since the 1970s (Biggs, 2003; Entwistle & Ramsden, 1983; Laurillard, 2002; Marton & Säljö, 1976a,b; Prosser & Trigwell, 1999; Ramsden, 2002). Outcomes from this research have helped to identify key concepts related to quality learning in higher education.

Fig. 1 visually represents the concepts arising out of this research as they relate to the quality of learning achieved by students. This study focuses on concepts 2 (students’ perceptions of the teaching–learning environment) and 6 (Approaches to learning and studying) in Fig. 1, and how they relate to the quality of learning achieved. For this reason, prior research in these areas is discussed below.

The quality of student approaches to learning has been found to be closely associated with the quality of their learning outcomes. Early studies found that the way students approached reading and analysing texts was closely related to the level of outcome (Marton & Säljö, 1976a,b). Students who read the texts for the intentional content tended

to have a better understanding of the argument the author was putting forward, while students who read to learn the texts themselves, a type of recall of the texts, tended to have a lesser understanding of what the author was trying to say. More recent studies into approaches have identified variation in how students use technologies in learning (Ellis, 2004; Ellis & Calvo, 2004). In one of these studies, students were provided with on-line discussions as a way of reviewing and discussing key issues related to the e-commerce topics they were studying (Ellis & Calvo, 2004). Results showed qualitative variation in how the students approached the use of the bulletin boards used for discussions. Some students read other students postings to get a feeling for the range of issues being discussed, and then used these postings to broaden their own perspectives on the issues before writing their own posting. In contrast, other students were reluctant to make postings, either afraid of appearing ignorant, or only posting their thoughts when they were required to do so. In such cases, it was often at the last minute with little reflection or relation to their colleagues' postings.

Variation in student perceptions of their learning context has been found to be closely associated to the quality of their learning outcomes. Seminal research (Entwistle & Ramsden, 1983; Ramsden, 1991, 2002) has found that student perceptions of key aspects of the learning context, such as assessment, workload, independence, the quality of the teaching and the clarity of the goals and standards are closely related to the quality of learning the students experience. Broadly speaking, students who perceive the workload as high, assessment tasks orientated towards reproduction, a lack of clarity surrounding the goals and standards of the course, little independence and poor teaching, tend to experience a lower quality of learning than student with positive perceptions of these aspects. These relationships have been identified in systematic research (Prosser & Trigwell, 1999; Ramsden, 2002).

2.2. *Teaching evaluation in a blended learning context*

In the past 10 years, largely driven by the increasing pervasiveness of the Internet in society, universities around the world have perceived a growing need to incorporate information and communication technologies (ICTs) into their offerings (Bell, Bush, Nicholson, O'Brien, & Tran, 1999; Katz, 1999). The issue of how to evaluate e-Learning as part of a face-to-face learning experience of university students is a significant educational challenge for those responsible for the quality of student university learning. Jochems, van Merriënboer, and Koper (2004), in discussing the notion of "integrated e-Learning", argue there is a need for "a variety of coherent measures at the pedagogical, organizational and technical levels for the successful implementation of e-Learning in combination with more conventional methods" (p.5). The issue of coherence in evaluating the success of blended learning is especially germane, as the overall goal of a blended learning experience is to provide a mix of both on-line and face-to-face experiences which support each other in achieving desired learning outcomes.

This study takes the concept of approaches to learning as it relates to blended learning, and examines how the students experience learning in both their face-to-face and on-line contexts. Coherence in the learning experience is conceived to be brought about through an alignment of the learning processes across the blended contexts towards the same learning outcomes. This evaluation framework builds upon an established, student-focused approach to teaching evaluation (e.g. Barrie, Ginns, & Prosser, 2005; Crawford, Gordon, Nicholas, & Prosser, 1998; Lizzio, Wilson, & Simons, 2002; Trigwell & Prosser, 1991), extending that approach to incorporate salient characteristics of blended learning contexts. Thus, the framework addresses the quality of the "part" of blended learning through the development of reliable and valid scales, and links these aspects of quality of the "part" to the "whole" of the student experience by investigating the relations of these scales with students' approaches to learning across the entire course, as well as the overall grade for the course.

3. **Research site**

The research site chosen for this study consists of two years of a five year undergraduate degree in a Faculty of Veterinary Science at a large Australian metropolitan university. Students in years three and four of the bachelor degree complete courses in basic animal science, professional practice, para-clinical studies and clinical management of animal disease. In this study, students were studying aspects of what it takes to be a professional veterinarian and the issues involved in pig health and production.

In 2003, the faculty introduced a blended approach to learning across key courses in years three and four. This meant that students were integrating learning experiences across face-to-face and on-line contexts towards the achievement of their learning outcomes. The orientating rationale for the on-line resources is typically an authentic scenario detailing

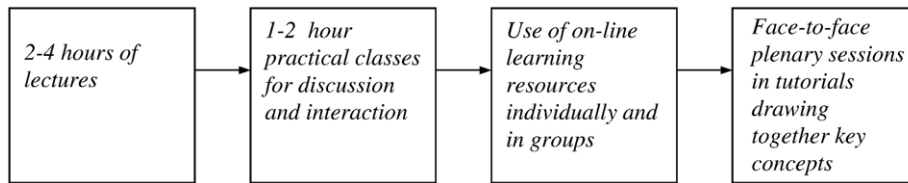


Fig. 2. Blended learning sequence involving on-line learning resources.

the issues of a veterinary problem. The other on-line resources are usually to help the students to deal with the problem in the scenario. The types of e-Learning resources used are:

1. The scenarios giving authentic situations in which the students can orientate their discussions, conceptualization and understanding of the course matter
2. Guidelines of how to complete their related oral and written assignments and other assessment items
3. Formative assessment exercises such as multiple choice quizzes
4. Financial exercises involving the completion and analysis of financial spreadsheets enabled by arithmetic macros on course websites
5. Indicative commentary from personnel about the scenario problem in the industry via audio/video clips
6. Annotated images of the animals showing symptoms or clinical signs for discussion
7. Laboratory test results of the animals for the purpose of analysis
8. Relevant library reference materials for background information on the theories and illnesses involved.

These types of resources are used to complement the face-to-face experiences of the students. The on-line resources are part of a blended learning activity that was structured in the learning sequence shown in Fig. 2.

In general, students were exposed to background knowledge of the case in lectures. They had a practical class which allowed them to relate the ideas of the lecturers to hands on veterinary activities. After these stages, the students worked on the case studies individually and in small groups and then reflected on relationships between the background knowledge from the lectures and the specific issues and activities raised on-line in their tutorials.

More specifically, the third year course, Professional Practice of Veterinarians, used the authentic scenarios from veterinary practice to raise financial and legislative issues in the minds of the students. For example, key financial issues were raised in lectures and students demonstrated their understanding through revisiting the issues in a scenario and its activities on their course websites. Similarly, in the fourth year course, Pig Health and Production, the background to common problems of pig medicine and production were raised in the lectures, and students revisited those issues in a scenario and its activities on their website.

Since the principles underpinning the faculty's approach to blended learning was consistent across years 3 and 4, and the methodology of learning underpinning the design and intention behind the on-line scenarios and activities across years three and four was the same – that is, the use of authentic data and scenarios to engage in a professional decision-making process leading to appropriate diagnoses – the decision was taken to pool the students responses to the questionnaires. This study focuses on the quality of the blended learning experiences of the students across both years.

4. Method

4.1. Participants

Participants were 127 Veterinary Science students from years three and four of a five year undergraduate degree, in a metropolitan university in Australia. Sixty-one students came from the third year course, and sixty-six students were from the fourth year course. The average age of students was 23.03 years (standard deviation=3.05), and the majority (80.3%) of students were female. Both groups of students were approached during a break in a lecture and invited to take part in a research project on their experiences of on-line learning. Students who consented to take part in the study filled out two paper-based questionnaires, the 32-item e-Learning Experience Questionnaire, and the 20-item Study Process Questionnaire-Revised (R-SPQ-2F; Biggs et al., 2001), described below.

Table 1
Descriptive statistics for items focusing on quality of teaching in a blended context

No.	Item	Mean	S.D.	Likert scale response (%)		
				Disagree	Neutral	Agree
3	I received too much feedback on-line from my teacher.	1.86	.69	84	15	1
4	The teacher's responses on-line motivated me to learn more deeply.	2.30	.77	62	32	6
5	The teacher helped to guide on-line discussions between students.	2.45	.94	57	27	16
9	The teacher's interaction with me on-line encouraged me to get the most out of my learning.	2.33	.72	63	31	6
12	The teacher's on-line responses motivated me to do more on-line learning than I would have done otherwise.	2.41	.77	58	35	7
15	I didn't receive enough helpful on-line feedback from my teacher.	3.39	.83	15	39	46
28	The teacher helped to focus on-line discussions between students.	2.46	.82	54	37	9%

4.2. Instruments

The previous literature on the structure of the student experience provided initial guidance in item development for scales measuring the e-Learning experience. Research using the Course Experience Questionnaire (e.g. Crawford et al., 1998; Lizzio et al., 2002; Ramsden, 1991; Richardson, 1994; Wilson et al., 1997) has consistently found a factor structure for that instrument consisting of Good Teaching, Clear Goals, Appropriate Workload, and Appropriate Assessment, with some versions of the CEQ including additional scales for Independence and/or Generic Skills Development. Furthermore, Lawless and Richardson (2002) found the Good Teaching Scale separated into two distinct scales in a distance education context, which they named Good Tutoring and Good Materials. Given this result, the initial item bank for the e-Learning Experience Questionnaire was developed by adapting some items from the CEQ which would reflect students' perceptions of Good Teaching, Good Resources (cf. Lawless & Richardson, 2002), Clear Goals and Standards, Appropriate Assessment, and Appropriate Workload in a unit of study containing a substantial on-line learning component. In addition, the previous literature guided the development of items expected to reflect student experiences of Interaction and Engagement; Student Management; and Blended Learning. The initial item bank thus consisted of thirty-one items, plus an overall rating of the quality of the on-line activities and materials of the unit of study for use as a validity check of scales.

This study takes a semi-exploratory approach to the following analyses, as there is relatively little extant research on how the on-line student experience might relate to the face-to-face experience. Its goal is to be guided as far as possible by prior research, while being flexible enough to allow possibilities for future research to emerge. The results of this exploration are given in four parts. Firstly, student *perceptions* of the quality of e-Learning within their course experience are discussed. Descriptive statistics and frequency analyses of the e-Learning Experience Questionnaire items are discussed to explore the ways students responded to the items. Secondly, the study examines how the above items relate to each other at a "latent variable" level using factor analysis, and scale scores are constructed using the results of the factor analysis. In order to investigate how key aspects of the e-Learning experience identified by the factor analysis are associated to student approaches to study, deep and surface scale scores for the R-SPQ-2F were calculated, and correlations between scale scores derived from the e-Learning Experience Questionnaire, the R-SPQ-2F, the "overall satisfaction with quality" item, and student achievement measured by the on-line mark were examined. Finally,

Table 2
Descriptive statistics for items focusing on student interaction and engagement

No.	Item	Mean	S.D.	Likert scale response (%)		
				Disagree	Neutral	Agree
7	Reading other students' on-line submissions clarified some of my own ideas.	2.75	1.02	46	25	29
16	I interacted with students' on-line postings/submissions even if they weren't assessed.	2.35	.95	61	26	13
18	Other students' on-line submissions helped me understand my ideas from a new perspective.	2.61	.87	47	37	16
21	Other students' on-line submissions encouraged me to investigate further sources of knowledge.	2.32	.81	63	30	7

Table 3
Descriptive statistics for items focusing on clarity of goals and standards

No.	Item	Mean	S.D.	Likert scale response (%)		
				Disagree	Neutral	Agree
13	Information needed to understand the purpose and contents of the unit was integrated in one place on-line.	3.30	.97	24	21	55
19	The guidelines for using on-line discussions were clear to me.	3.06	.99	34	26	40
29	Information needed for assignments was integrated in the one place on-line.	3.31	1.00	22	25	53

cluster analysis was used to investigate if there are any distinct experiences of learning, using the above variables, at the level of the student.

5. Results

5.1. Student responses to the e-Learning Experience Questionnaire

This section firstly examines students' responses to the 32 items of the e-Learning Experience Questionnaire, by focusing on groupings of items which were considered similar on a priori grounds. Items 3, 4, 9, 12, 15, and 28 in Table 1 identified important student perceptions about the quality of teaching in an e-Learning context. In Table 1 and the following tables, the mean and standard deviation are given, as well as the percentage of students who responded with "Disagree" "Strongly Disagree" (% Disagree); the percentage who responded using the "Neutral" category (% Neutral); and the percentage of students who responded with "Agree" "Strongly Agree" (% Agree).

Students' responses to most of the above items were not overly positive. Across most items, similar proportions of students disagreed that the teaching in an e-Learning context was supportive of learning. Exceptions to this general conclusion are seen for item 3 and item 15, suggesting the potential problems of receiving too much or too little on-line feedback were not viewed by students as major issues in the present context.

Items 7, 16, 18, and 21 in Table 2 focus on issues of student interaction and engagement. The results suggest respondents did not tend to find other students' on-line submissions overly helpful in clarifying and extending their own ideas (items 7 and 18), and that other students' postings did not appear to be especially intrinsically motivating (items 16 and 21).

Items 13, 19, and 29 in Table 3 focus on the clarity of goals and standards for the on-line component. Respondents were generally positive about the degree to which the course website made goals and standards clear for the unit in general, and assignments in particular (items 13 and 29), but respondents were less clear about the usage of on-line discussions (item 19).

Items 8, 17, 20 and 23 in Table 4 focus on the quality of on-line resources. Respondents were most positive about the degree to which on-line materials appeared interesting (item 20), but less positive about the on-line activities (item 17), and the degree to which on-line materials were perceived as supportive of face-to-face situations (item 23). Students were most negative about the explanatory value of the on-line teaching materials (item 8).

Items 1, 10, and 26 in Table 5 focus on the appropriateness of assessment in an e-Learning context. While respondents perceived quite strongly that the on-line materials supported key assessment tasks for the unit of study

Table 4
Descriptive statistics for items focusing on quality of on-line resources

No.	Item	Mean	S.D.	Likert scale response (%)		
				Disagree	Neutral	Agree
8	The on-line teaching materials in this unit of study are extremely good at explaining things.	2.72	.87	40	43	17
17	The on-line activities are designed to get the best out of students.	3.19	.87	20	38	42
20	The on-line teaching materials are designed to really try to make topics interesting to students.	3.28	.98	23	26	51
23	The on-line learning materials helped me to learn during the face-to-face situations in this unit of study.	3.02	.94	32	32	36

Table 5
Descriptive statistics for items focusing on appropriate assessment

No.	Item	Mean	S.D.	Likert scale response (%)		
				Disagree	Neutral	Agree
1	To do well in the on-line quizzes all you really need is a good memory.	2.86	.78	28	55	17
10	On-line quizzes helped me to learn effectively.	3.13	.80	19	51	30
26	The on-line materials supported some key assessment items in this unit.	3.62	.89	14	16	70

(item 26), they were much less likely to rate on-line formative assessment tasks (e.g. on-line quizzes) positively (items 1 and 10).

Items 11, 14, and 22 in [Table 6](#) focus on the appropriateness of workload related to on-line materials and activities. While just over half of the respondents agreed that there was sufficient time to understand the things to be learned on-line (item 14), fewer than half disagreed with the other items (items 11 and 22), suggesting the overall workload required on-line might be perceived as onerous.

Items 2, 6, and 31 in [Table 7](#) focus on issues related to student management. Students were most positive about the extent to which the teacher provided continuous access to relevant on-line materials (item 31), but were less positive about the regularity of updates (item 6), and less positive again about the use of the on-line environment to keep students updated about results (item 2).

Items 24, 25, 27, and 30 in [Table 8](#) focus on issues related to blended learning - that is, the degree to which on-line materials and activities support face-to-face learning — and item 31 taps the overall satisfaction with the quality of on-line materials and activities. Students were most positive about the extent to which the unit of study website related to the whole unit (item 30) and the degree of clarity in the relations between on-line resources and assessment requirements (item 24). They were somewhat less positive about the expressed clarity of the relation between the unit as a whole and on-line resources (item 27), and the extent to which on-line activities supported face-to-face activities (item 25). Overall, fewer than half the respondents were satisfied with the quality of the on-line materials and activities.

5.2. Exploratory factor analysis and reliability analysis of student experience items

Having developed a set of items tapping the student experience of e-Learning, where there was clear variability in student endorsement at the item level, the next goal was to determine whether a smaller number of underlying factors might explain the variability in student responses to individual items. Exploratory factor analysis was used to assess the dimensionality of students' responses to the initial thirty-one items of the e-Learning Experience Questionnaire. The aim was to identify a coherent set of scales, with minimal cross-loadings between latent factors. Student responses across the 31 items did not appear to cohere according to the postulated eight scale factor structure (Good e-Teaching, Good e-Resources, Student Interaction and Engagement, Clear Goals and Standards, Appropriate Assessment, Appropriate Workload, Student Management, and Blended Learning). However, using principal axis estimation with oblique rotation to simple structure, by eliminating items with low loadings (less than 0.4) and/or cross-loadings between factors, a subset of eighteen items with a clear factor structure across four factors was identified. These factors were labelled Good e-Teaching, Good e-Resources, Student Interaction, and Appropriate Workload. The items and factor loadings are given in [Table 9](#).

Table 6
Descriptive statistics for items focusing on appropriate workload

No.	Item	Mean	S.D.	Likert scale response (%)		
				Disagree	Neutral	Agree
11	The workload for the on-line component of this unit of study is too heavy.	3.03	1.02	35	27	38
14	I generally had enough time to understand the things I had to learn on-line.	3.25	.92	24	24	52
22	The sheer volume of work for the on-line component of this unit of study means it can't all be thoroughly comprehended.	2.91	1.03	42	27	31

Table 7
Descriptive statistics for items focusing on student management

No.	Item	Mean	S.D.	Likert scale response (%)		
				Disagree	Neutral	Agree
2	The teacher used the on-line environment when appropriate to keep students informed about results.	2.90	1.03	38	29	33
6	The teacher used the on-line environment to regularly update students about relevant unit of study information.	3.21	1.01	28	27	45
31	The teacher ensured continuous access to the relevant on-line materials throughout the semester.	3.56	.91	14	22	64

5.3. Correlation analysis and reliability analysis

The next step in this exploration of the student experience of e-Learning was to investigate how these experiences of part of the unit of study are associated with the aspects reflecting the whole; in this case, students' approaches to learning for the unit of study, and their final grade. To investigate these associations, based on the exploratory factor analysis, scale scores were created for Good e-Teaching, Good e-Resources, Student Interaction, and Appropriate Workload. Pearson product-moment correlations were then calculated between the above e-Learning Experience scale scores, students' overall ratings of the quality of the on-line learning materials and activities (item 32), approaches to learning (using Deep and Surface scale scores from students' responses to Biggs et al.'s Revised R-SPQ-2F), and students' final grades for the courses in which blended learning was used.

Comparability of grades between the two different years was achieved by transforming grades within each cohort to *z*-scores (Tilley, 1993), then combining these scores into a single variable. Inspection of the distributional characteristics of the resulting variable indicated considerable skewness and kurtosis, so the *z*-scores were transformed to normal equivalent deviates, a process which maintains the mean, standard deviation, and rank ordering of scores while reducing skewness and kurtosis (Jöreskog, Sörbom, du Toit, & du Toit, 2001). The resulting correlation matrix and scale reliability estimates are given in Table 10. Reliability estimates using Cronbach's (1951) alpha ranged from .84 (Deep Approach) to .61 (Appropriate Workload). While the latter result is somewhat less than is usually considered desirable in behavioural science research (e.g., .70), Schmitt (1996; p.350) has noted that "[e]ven relatively low (e.g., .50) levels of criterion reliability do not seriously attenuate validity coefficients".

Inspection of the correlation matrix indicated several salient results. Firstly, using a criterion of $p < 0.05$ for statistical significance, students' responses on each of the proposed scales correlated with ratings of the overall quality of the on-line materials and activities. These correlations ranged from .25 for Student Interaction, to .50 for Good e-Resources, indicating moderate to strong levels of correlation. The overall rating of quality of the on-line materials and activities was included as a check on the validity of identified scales, as is standard practice with the Course Experience Questionnaire (e.g. Lawless & Richardson, 2002; Wilson et al., 1997); thus, the present results indicate the constructs underlying the proposed scales are perceived by students as important facets of a quality e-Learning experience.

Secondly, perceptions of student interaction were reliably correlated with the extent to which students adopted a deep approach to study ($r = .21$). The correlation between perceptions of Good e-Teaching and a deep approach was marginally significant ($r = .17$, $p = .051$), as was the correlation between positive perceptions of resources and a deep approach ($r = .17$, $p = .058$). However, contrary to other investigations of associations between students' perceptions of the learning environment and approaches to learning (e.g. Crawford et al., 1998; Lizzio et al., 2002), there were no

Table 8
Descriptive statistics for items focusing on blended learning and overall satisfaction with on-line experience

No.	Item	Mean	S.D.	Likert scale response (%)		
				Disagree	Neutral	Agree
24	It was clear if on-line resources were related to assessment.	3.52	1.03	18	17	65
25	The on-line activities helped me to understand the face-to face activities in this unit of study.	3.20	.96	21	35	44
27	The relationships between the on-line resources and the whole unit of study was clarified on the unit's website.	3.29	.95	23	25	52
30	It was clear to me how the website for this unit related to the whole unit of study.	3.63	.93	13	18	69
32	Overall, I was satisfied with the quality of the on-line materials and activities of this unit of study.	3.20	.89	21	34	45

Table 9
Exploratory factor analysis structure for e-Learning Experience items

Items	Factor			
	Good e-Teaching	Good e-Resources	Appropriate workload	Student interaction
5. The teacher helped to guide on-line discussions between students.	.68			
2. The teacher used the on-line environment when appropriate to keep students informed about results.	.64			
4. The teacher's responses on-line motivated me to learn more deeply.	.59			
6. The teacher used the on-line environment to regularly update students about relevant unit of study information.	.56			
9. The teacher's interaction with me on-line encouraged me to get the most out of my learning.	.53			
15. I didn't receive enough helpful on-line feedback from my teacher. (reversed)	.48			
28. The teacher helped to focus on-line discussions between students.	.46			
25. The on-line activities helped me to understand the face-to face activities in this unit of study.		.76		
23. The on-line learning materials helped me to learn during the face-to-face situations in this unit of study.		.72		
20. The on-line teaching materials are designed to really try to make topics interesting to students.		.67		
8. The on-line teaching materials in this unit of study are extremely good at explaining things.		.47		
17. The on-line activities are designed to get the best out of students.		.44		
22. The sheer volume of work for the on-line component of this unit of study means it can't all be thoroughly comprehended. (reversed)			.71	
11. The workload for the on-line component of this unit of study is too heavy. (reversed)			.54	
14. I generally had enough time to understand the things I had to learn on-line.			.47	
21. Other students' on-line submissions encouraged me to investigate further sources of knowledge.				.75
18. Other students' on-line submissions helped me understand my ideas from a new perspective.				.67
16. I interacted with students' on-line postings/submissions even if they weren't assessed.				.47

statistically reliable correlations between perceptions of the e-Learning environment and self-reports of a surface approach to learning.

Lastly, students' grades were positively correlated with perceptions of Good e-Teaching ($r = .19$) and a deep approach to learning ($r = .21$). The correlation between grades and perceptions of Good e-Resources ($r = .16$, $p = .070$) may also have represented a real effect. Thus, in conjunction with the results for the overall rating of quality of materials and activities, these results suggest several constructs have been identified which are part of a quality e-Learning experience.

Table 10
Correlations between student perceptions of e-Learning, perception of overall quality, approaches to learning, and grade

	1	2	3	4	5	6	7	8
1. Good e-Teaching ($\alpha = 0.79$)	1							
2. Good e-Resources ($\alpha = 0.77$)	.24**	1						
3. Student interaction ($\alpha = 0.68$)	.31**	.34**	1					
4. Appropriate workload ($\alpha = 0.61$)	.33**	.14	.16 ^a	1				
5. Overall Quality	.40**	.50**	.25**	.33**	1			
6. Deep approach ($\alpha = 0.84$)	.12	.15 ^a	.21*	.10	.10	1		
7. Surface approach ($\alpha = 0.81$)	-.04	-.07	-.13	-.15	.04	-.07	1	
8. Grade	.19*	.16 ^a	.03	.04	.19*	.21*	-.09	1

$n = 127$.

** $p < 0.01$ (2-tailed), * $p < 0.05$ (2-tailed).

^a $0.10 > p < 0.05$.

Table 11

Descriptive statistics for student perceptions of blended learning, approaches to learning, and grade by cluster membership

Variable	Cluster 1 (n=98)		Cluster 2 (n=29)	
	M	SD	M	SD
<i>Student perceptions of blended learning</i>				
Good e-Teaching *	.30	.87	-1.02	.69
Good e-Resources **	.06	.94	-.20	1.18
Student interaction *	.15	.90	-.52	1.14
Appropriate workload *	.26	.92	-.90	.72
<i>Approaches to study</i>				
Deep *	.17	.95	-.59	.95
Surface *	-.20	.93	.69	.95
Grade *	.24	.41	-.80	1.75

* denotes a statistically significant difference between clusters ($p < 0.01$), ** $p = .229$.

5.4. Cluster analysis

The last analytic method used to explore students' experiences of e-Learning was cluster analysis. The goal of this analysis was to identify subgroups of students who varied systematically according to their perceptions of the e-Learning environment, their approaches to study, and overall grade. Following standardisation of scores, a hierarchical cluster analysis using Ward's minimum variance method indicated a two-factor solution was the best representation of similarities and dissimilarities between groups of students. Based on this two-group solution, *t*-tests were used to discern whether the differences between groups on the above variates were statistically reliable. Means and standard deviations on these variates for the two groups are given in Table 11.

The results of the cluster analysis can be described as follows. Cluster 1 can be characterised as a group of students who had relatively high scores on Good e-Teaching, Student Interaction, and Appropriate Workload; relatively high scores on Deep Approach to learning, and relatively low scores on Surface Approach to learning; and a relatively high final grade for the course. Cluster 2, in contrast, had relatively low scores on Good e-Teaching, Student Interaction, and Appropriate Workload; relatively low scores on Deep Approach to learning, and relatively high scores on Surface Approach to learning; and a relatively low final grade for the course. The differences between the clusters on the above variables were all statistically significant, with the exception of the difference between clusters on the Good e-Resources scale, $t(125) = 1.21$, $p = .229$; however, the observed means of the two clusters were in the expected direction. The above results suggest, then, that students vary in their perceptions of the blended learning environment, and that students' self-reports of their approaches to study and learning outcomes covary with these variations.

6. Discussion

The goal for the present study was to begin developing a coherent approach to evaluating the quality of e-Learning, when on-line activities are used to complement face-to-face teaching and learning. Drawing on previous research on students' experiences of coursework and the relation of these experiences to quality learning outcomes (Biggs, 2003; Prosser & Trigwell, 1999; Ramsden, 2002), a set of items were identified which load on four distinct dimensions of an e-Learning experience. The *Good e-Teaching* scale measured student perceptions of the extent to which the teacher was effective in facilitating learning in an on-line context, e.g. through on-line moderation of postings on a discussion board. The *Good e-Resources* scale measured student perceptions of the extent to which on-line materials and activities assisted learning. The *Appropriate Workload* scale measured student perceptions of the volume of work needed to cope with the on-line component of the course. Lastly, the *Student Interaction* scale measured the degree to which other students' on-line postings to a discussion board were perceived as useful and provoked engagement with the topic. Correlational and cluster analyses revealed there were reliable associations between these indicators of the e-Learning component of the student experience of the course, and indicators of the quality of the whole of the course, i.e. students' approaches to learning, and final grade for the course.

In developing these subscales, the intent was also to link students' perceptions of the on-line learning experience with approaches to study. Previous research (e.g. Crawford et al., 1998; Lizzio et al., 2002; Watkins, 2001) has found that

positive perceptions of key aspects of the learning environment tend to be correlated with deeper approaches to learning, and subsequently more positive learning outcomes. This study found that scale scores for Student Interaction were reliably correlated with a Deep approach to learning, and the correlation of perceptions of Good e-Resources with self-reports of a deep approach may also have represented a real effect. Significant correlations between all of the e-Learning context scale scores and an overall rating of the quality of on-line materials and activities also support arguments for the construct validity of the scales, as do statistically reliable correlations between Good e-Teaching scores, Good e-Resources scores, a Deep approach to learning, and students' grades. However, the expected negative correlations between a surface approach to learning and perceptions of the learning environment were not evident. The cluster analyses provided additional evidence for the argument that a cohesive approach to teaching evaluation in a blended learning environment should investigate the linkages between the "part" and the "whole". Two clusters were distinguished by their responses regarding perceptions of the e-Learning environment (part), and their responses regarding their approaches to study for the course and final grade (whole). These results provide initial evidence that it is possible to consider the quality of the e-Learning component of a course in relation to the quality of the course as a whole.

The present study represents the beginning phase of development of a student-centred approach to quality improvement and evaluation of learning in a blended learning context. There has been little systematic quantitative research to date that has addressed key aspects of student learning in on-line and how they are related to face-to-face experiences of learning. This study clarifies useful ways of addressing this gap in the literature.

While four reliable and valid e-Learning scales were identified from the initial 32 item bank, it is note-worthy that several of the hypothesised latent constructs drawn from previous research, such as Clear Goals and Standards and Appropriate Assessment, did not form stable factors. Further research is needed to determine whether this result is a stable feature of students' e-Learning experience, or if these constructs require alternative item wordings to be measured effectively when evaluating an on-line learning environment.

Although the study is necessarily limited in its generalisability given the relatively small number of respondents, and will benefit from further research is needed to test the robustness of the proposed scales in other fields of study, convergent evidence for the importance of student interaction in a blended learning context has recently been provided by [Davies and Graff \(2005\)](#). Across several courses, Davies and Graff found first year undergraduate business students who failed spent a significantly lower proportion of time in the group and communication sections of the course's website.

The present study has several implications for practitioners. Firstly, it indicates that student-focussed methods of teaching evaluation are possible in the relatively new teaching context of blended learning, and that several key aspects of that context – the quality of on-line teaching, resources, workload, and student interaction – are associated with the quality of students' approaches to study and learning outcomes.

The second implication follows from the first. The study indicates that teachers in blended learning contexts need to focus not only on the technical capacities and functions of on-line materials and activities, but must also seek to understand their students' *perceptions* of this part of the learning environment, and how successfully that part is in supporting student learning across a whole course. The results from this study show that positive student perceptions of the quality of teaching on-line and the level of interaction were strongly related with a comparatively higher grade. This suggests that if teachers want students to get the most out of learning on-line in blended contexts, then teaching strategies that clarify the value of moderation of student postings, and the value of interaction between the students online, are likely to improve both the students' perceptions and their grades. Focusing on the (relatively) objective usability of a course website, for example, runs the risk of failing to understand how students understand the role of the site for learning at large.

Exploratory research such as the activities described in this study is necessary to understand how the on-line environment is being used to complement the face-to-face experience of students. On-line learning is not only part of the experience of students at a distance, but is increasingly an important aspect of campus-based student experiences. More evidence-based evaluative research is needed that provides some indication of how the on-line part of the whole blended experience of student learning is contributing to the quality of student learning in higher education.

References

- Barrie, S. C., Ginns, P., & Prosser, M. (2005). Early impact and outcomes of an institutionally aligned, student focused learning perspective on teaching quality assurance. *Assessment and Evaluation in Higher Education*, 30, 641–656.
- Bell, M., Bush, D., Nicholson, P., O'Brien, D., & Tran, T. (1999). *Universities on-line: A survey of on-line education and services in Australia*. Canberra: DEST.
- Biggs, J. (2003). *Teaching for quality learning at university* (2nd ed.). Maidenhead: Open University Press.

- Biggs, J., Kember, D., & Leung, D. Y. P. (2001). The revised two-factor Study Process Questionnaire: R-R-SPQ-2F-2F. *British Journal of Educational Psychology*, 71, 133–149.
- Crawford, K., Gordon, S., Nicholas, J., & Prosser, M. (1998). Qualitatively different experiences of learning mathematics at university. *Learning and Instruction*, 8, 455–468.
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16, 297–334.
- Davies, J., & Graff, M. (2005). Performance in e-Learning: On-line participation and student grades. *British Journal of Educational Technology*, 36, 657–663.
- Ellis, R. A. (2004). Student approaches to learning science through writing. *International Journal of Science Education*, 26, 1835–1854.
- Ellis, R. A., & Calvo, R. A. (2004). Learning through discussions in blended contexts. *Educational Media International*, 40, 263–274.
- Entwistle, N., McCune, V., & Hounsell, J. (2002). *Approaches to study and perceptions of university teaching-learning environments: Concepts, measures and preliminary findings*. Available on-line at www.ed.ac.uk/etl/docs/ETLreport1.pdf (accessed 21 March 2005).
- Entwistle, N., & Ramsden, P. (1983). *Understanding student learning*. London: Croom Helm.
- Higher Education Funding Council for England (2004). *e-Learning strategy*. London: HEFCE.
- Jochems, W., van Merriënboer, J., & Koper, R. (2004). An introduction to integrated e-Learning. In W. Jochems, J. van Merriënboer, & R. Koper (Eds.), *Integrated e-Learning: Implication for pedagogy, technology and organization*. London: RoutledgeFalmer.
- Jöreskog, K. G., Sörbom, D., du Toit, S., & du Toit, M. (2001). *LISREL 8: New statistical features*. Lincolnwood, Scientific Software International.
- Katz, R. N. (1999). *Dancing with the devil: Information technology and the new competition in higher education*. San Francisco: Jossey Bass.
- Laurillard, D. (2002). *Rethinking university teaching: A framework for the effective use of educational technology*. London: Routledge.
- Lawless, C. J., & Richardson, J. T. E. (2002). Approaches to study and perceptions of academic quality in distance education. *Higher Education*, 44, 257–282.
- Lizzio, A., Wilson, K., & Simons, R. (2002). University students' perceptions of the learning environment and academic outcomes: Implications for theory and practice. *Studies in Higher Education*, 27, 27–51.
- Marton, F., & Säljö, R. (1976). On qualitative differences in learning I: Outcome and process. *British Journal of Educational Psychology*, 46, 4–11.
- Marton, F., & Säljö, R. (1976). On qualitative differences in learning II: Outcome as a function of the learner's conception of the task. *British Journal of Educational Psychology*, 46, 115–127.
- Prosser, M., & Trigwell, K. (1999). *Understanding learning and teaching: The experience in higher education*. Buckingham: Society for Research into Higher Education and Open University Press.
- Ramsden, P. (1991). A performance indicator of teaching quality in higher education: The Course Experience Questionnaire. *Studies in Higher Education*, 16, 129–150.
- Ramsden, P. (2002). *Learning to teach in higher education*. London: Routledge.
- Richardson, J. T. E. (1994). A British evaluation of the Course Experience Questionnaire. *Studies in Higher Education*, 19, 59–68.
- Schmitt, N. (1996). Uses and abuses of coefficient alpha. *Psychological Assessment*, 8, 350–353.
- Tilley, A. (1993). *An introduction to psychological research and statistics*. Brisbane: Pineapple Press.
- Trigwell, K., & Prosser, M. (1991). Improving the quality of student learning: The influence of learning context and student approaches to learning on learning outcomes. *Higher Education*, 22, 251–266.
- Watkins, D. (2001). Correlates of approaches to learning: A cross-cultural meta-analysis. In R. Sternberg & L. Zhang (Eds.), *Perspectives on thinking, learning, and cognitive styles*. New Jersey: LEA.
- Wilson, K. L., Lizzio, A., & Ramsden, P. (1997). The development, validation and application of the Course Experience Questionnaire. *Studies in Higher Education*, 22, 33–53.