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Engineering students' conceptions of and approaches to learning through discussions in face-to-face and online contexts

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Abstract

This study focused on students' conceptions of and approaches to learning through face-to-face and online discussions. The study setting was a course in which students ($N = 110$) worked in small teams and in which team discussions took place both face-to-face and online. The design of the study involved a combination of in-depth interviews and self-completion questionnaires using open-ended questions and rating scales. The analysis adopted a phenomenographic approach, leading to the construction of categories for students' conceptions of and approaches to learning through discussions and the testing of associations between conceptions, approaches and course outcomes. Close associations were found between conceptions of learning through discussions with approaches to face-to-face and online discussions and with learning outcomes.

Keywords: Learning through discussion; Online discussion; Higher education; Phenomenography; Conceptions of learning; Approaches to learning

1. Introduction

The growing use of eLearning in higher education is now also resulting in the creation of a body of research on students' learning experiences and learning outcomes (see e.g., Collis & Moonen, 2001; Goodyear, Banks, Hodgson, & McConnell, 2005; Laurillard, 2002; Luppicini, 2007; Salmon, 2001; Wallace, 2003). Much of the eLearning taking place in universities combines eLearning with face-to-face activities: an approach conveniently labelled 'blended' learning, though there are some conceptual difficulties with this term (Bonk & Graham, 2006; Ellis, Steed, & Applebee, 2006; Oliver & Trigwell, 2005).

Some of the reasons documented in the literature for the use of eLearning and blended learning include opportunities for small group discussions and collaboration; the possibility of creating extended learning communities; access

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to specialists who are otherwise difficult to bring in to the university; and access to the specialized tools and resources of the field of study. However, while the *intended* benefits are becoming clearer, we know little about whether and how these potential benefits actually materialize (Sharpe & Benfield, 2005). Nor do we know much about whether and how students are able to manage learning activities that are distributed across material and virtual spaces, or whether they are able to integrate their experiences and make appropriate connections between activity in online and face-to-face contexts.

Teachers introducing blended learning should not assume that the combination of face-to-face and online learning is unproblematic for students. Research over three decades has shown that students often have difficulties in conceptualizing and approaching their learning in productive, meaningful ways (Biggs, 1999; Entwistle & Ramsden, 1983; Marton & Booth, 1997; Marton & Säljö, 1976a, 1976b; Prosser & Trigwell, 1999; Ramsden, 2002). Much of this research has drawn on familiar learning situations. We must now ask what happens to students' conceptions of and approaches to learning when they are also confronted with new kinds of technology-based resources and new ways of interaction.

The study reported in this paper is part of a research project intended to elucidate this question (see also Ellis, Goodyear, Prosser, & O'Hara, 2006; Goodyear, Jones, Asensio, Hodgson, & Steeples, 2005). Students participating in the current research were involved in a course where they were expected to follow ideas and conversations across face-to-face and online contexts, in order to better understand the issues and theories associated with the course. The research investigates the students' experiences of those conversations, how students conceived of what they were doing, the approaches they took and the intentions associated with those approaches. We also report on relationships between these factors and their end-of-course learning outcomes.

1.1. Conceptions of and approaches to learning

Research on student learning in higher education tends to partition the factors that relate to learning outcomes into two sets: student factors and teaching/environmental factors (Biggs, 1999; Entwistle & Ramsden, 1983; Prosser & Trigwell, 1999). As Biggs (1999) points out, what matters most is the nature of the students' activity: what they do, what and how they think when working. Student activity is directly related to learning outcomes. Other factors such as the approach to teaching or the learning resources provided have only indirect relationships (Biggs, 1999; Goodyear, 2002). This is particularly clear when students are given a task to do and their activity extends over a period of time, during which the teacher's interventions are infrequent. Goodyear (2002) argues that it is valuable to distinguish between 'tasks' and 'activities', where a task is the work prescribed by the teacher and activity is what students actually do. In higher education, students are generally expected to interpret tasks, and modify them in creative ways. Differences between task and activity also occur because students are pragmatic and trying to balance competing goals. For example, time pressures can lead to satisficing rather than optimizing responses to tasks. It is in the process of translating tasks into activities that many student and teacher/environmental influences come into play. Students' beliefs about such things as the demands of a course's assessment regime, the standards expected by a teacher, or what it is possible to learn in a given situation, affect the processes that transform the task as set into the activity that results in learning. Resources that come to hand in the students' learning place also have the capacity to shape the activity, sometimes in subtle ways. This adds complexity to the relations between tasks, activities and outcomes, especially where activities are distributed across virtual and material 'worlds' (Bliss, Säljö, & Light, 1999; Pea, 1993).

Research from a phenomenographic perspective has shown that students' conceptions of learning and their approaches to learning are related to each other and to the quality of learning outcomes. We used the term *activity* (above) to denote what students actually do (physically and mentally). Much activity is not accessible to the researcher. We use the term *approach to learning* as a way of characterizing what students say they do, and we follow the phenomenographic convention of considering both *structure* (strategy) and *reference* (intention) when describing an approach to learning, namely what is done and why (Entwistle, Hanley, & Ratcliffe, 1979; Marton & Booth, 1997; Marton & Säljö, 1997; Prosser & Trigwell, 1999). By *conceptions of learning*, we mean the ways in which students conceive of what learning is and what its outcomes might be. Conceptions of learning are similar to personal epistemologies: beliefs about the nature of knowledge and of coming to know (Hofer & Pintrich, 1997; Marton, Dall'Alba, & Beaty, 1993; Perry, 1970). Conceptions of learning are typically broader and more stable (across contexts and time) than approaches to learning, though there is recent evidence of variation between students in the stability of their approaches to learning (Nijhuis, Segers, & Gijselaers, 2008).

Phenomenographic research has investigated *approaches to learning* in different subject areas and on different academic tasks. For example, studies have focused on approaches to reading (Marton & Säljö, 1976a, 1976b), approaches to writing (Hounsell, 1984), approaches to practical work in physics, and approaches to problem solving in engineering (Laurillard, 1997; Marshall, Summers, & Woolnough, 1999). Such research has led us to understand that students vary in their approaches to learning at university and that such approaches exhibit qualitative differences. In short, there is *surface approach* in which there is an orientation towards memorization and reproduction of knowledge, sometimes accompanied by a lack of personal engagement in learning activity, and *deep approach* in which there is an orientation towards understanding, personal sense-making and active learning. In addition, Entwistle and Ramsden (1983) and Biggs (1987) identified a *strategic approach*, in which students are highly focused on maximising the grades earned by their efforts. One consistent result from this research is a set of relationships between approaches and the quality of learning outcomes; surface approaches tend to be associated with lower quality outcomes, and deep approaches with higher quality outcomes.

Phenomenographic research into *conceptions of learning* has identified hierarchical categories of conception, where the more elaborate conceptions include the simpler conceptions. Broadly speaking, these conceptions of learning can be categorised as *fragmented* (or multistructural) and *cohesive* (Marton et al., 1993; Säljö, 1979). Fragmented conceptions dwell upon the accumulation, reproduction and (sometimes) use of pieces of knowledge. Cohesive conceptions include ideas about new learning causing the restructuring of existing knowledge, about conceptual development and about change as a person. There are logical but also empirically verified associations between approaches to learning and conceptions of learning: cohesive conceptions complementing deep approaches; and fragmented conceptions complementing surface approaches (Crawford, Gordon, Nicholas, & Prosser, 1998; Prosser & Trigwell, 1999).

Higher education pedagogies that value 'active' learning and give a central place to students' engagement in the construction of their own knowledge have not, to date, been the site of much research on students' conceptions of or approaches to learning (Struyven, Dochy, Janssens, & Gielen, 2006). There are even fewer studies examining conceptions of and approaches to learning in situations in which students are using eLearning technologies for discussions or other collaborative purposes. Light and Light (1999) found tentative evidence of an association between a deep approach to learning and relatively high levels of participation in an online computer conference. Goodyear, Asensio, Jones, Hodgson, and Steeples (2003) found some evidence of weak positive correlations between students' reported levels of satisfaction with their engagement in collaborative eLearning activities and both deep and strategic approaches to learning. They also found weak negative associations between this satisfaction measure and surface/apathetic approaches to learning. Goodyear, Jones, et al. (2005), drawing on the same data set, found that students displaying a strategic approach to learning also reported an increase over time in the worth or value that they ascribed to their collaborative eLearning experiences. Students with deep or with surface/apathetic approaches did not report such an increase. Goodyear, Jones, et al. (2005) and Struyven et al. (2006) also concluded that how students interpret and experience a course is more important than the course's underlying pedagogical intentions. Mere use of collaborative eLearning, or of active constructivist pedagogy, does not guarantee good outcomes. If students sense that a course is badly implemented, that they are overloaded with work, that there are no clear goals and poor feedback then they are more likely to respond with surface than deep approaches, irrespective of the pedagogy or the technology being deployed by the teacher.

1.2. Learning through discussions

The study reported below is from a research project focused on learning through discussions in higher education. There are a number of very active lines of research relevant to this topic, but it is a surprisingly neglected area in the mainstream of research on learning in higher education, and there are very few studies that ask students about their experiences of learning through discussion.

Mapping how students interact with each other, the roles they adopt in discussions, and key discourse features, have been important objects of research (de Laat & Lally, 2003; Luppicini, 2007; Pilkington & Walker, 2003). Also relevant are studies that involve distributed online discussions as well as classroom talk in front of computers (Dillenbourg, 1999; Mercer, 1995), research on the collaborative construction and refinement of conceptual artefacts, and scripts for the collaborative construction of knowledge (Bereiter, 2002; Schrire, 2006; Weinberger, Ertl, Fischer, & Mandl,

2005), the learning of argumentation skills (Marttunen & Laurinen, 2001), and of communication skills more generally (McAteer, Tolmie, Crook, Macleod, & Musselbrook, 2002).

Turning to students' experiences of learning through discussion, Askell-Williams and Lawson's (2005) study includes some data from university students, pointing to broad variations in conceptions of how educational discussions might be of benefit. Some students proved to be very articulate about the benefits and difficulties of learning through discussion, highlighting information acquisition, knowledge construction, motivational and mnemonic benefits. Other students appeared to have rarely or never thought about what they were meant to be doing when engaging in educational discussions. Guiller, Durndell, and Ross (2008) provide data from an undergraduate course that combined face-to-face and online discussions. Discourse analysis indicated that students were better able to make use of evidence in argumentation in the online condition than in the face-to-face condition, whereas face-to-face discussion was better than online discussion for establishing shared meaning. Some students' expressed preferences for mode of discussion could be interpreted to reflect an understanding of the affordances of each mode, but such inferences are restricted by the small numbers involved.

An important lesson from the existing literature is that it is unsafe to assume that students know how best they can learn from discussions, or that the linguistic and interactional skills they have developed in everyday life are adequate to meet the challenges of learning through discussions. Educational discussions, whether online, face-to-face, or both, can be problematic. Students can benefit from guidance, models, scaffolding, scripts and well-chosen tools, as well as from direct instruction about how to participate effectively in discussions with their peers.

To summarise, students' beliefs and intentions with respect to learning have a significant relationship to the ways they interpret tasks set for them; new combinations of technology and pedagogy may be well motivated but their relationship to learning is necessarily mediated by the way students use the technologies. It cannot be assumed that students are skilled in learning through discussions (whether face-to-face or online) and in the absence of well-honed discussion skills their interpretations of task demands are likely to have an amplified effect on activity and outcomes. Research that sheds more light on students' beliefs, intentions and actions with respect to new combinations of pedagogy and technology is therefore timely and important.

1.3. Aims – Hypotheses

Consequently, our research aims can be expressed in terms of the following questions:

1. How do students conceive of learning through discussions in face-to-face and online contexts? Our hypothesis was that students will vary in their conceptions of learning and that conceptions of learning through discussions in a face-to-face context would not necessarily differ from the ones in the online context despite the different affordances each context allows (Hypothesis 1).
2. How do they approach learning through discussions? (With what intention? Using what strategies?) Our hypothesis was that it would be possible to identify surface and deep approaches as these approaches have been found to be present across domains or modes of learning (Hypothesis 2).
3. Are there associations between conceptions of and approaches to learning with achievement when students are engaged in face-to-face and online discussions? Our hypothesis was that there would be associations among qualitatively different conceptions, approaches and course outcomes (Hypothesis 3). For example, surface approaches would be associated with fragmented conceptions and low course outcomes irrespective of the context of learning, that is, face-to-face or online.

2. Method

2.1. Design

Students in a third year engineering course studied the fundamentals of setting up an e-commerce business. They were assessed through a final examination (50%), face-to-face and online discussions leading to a project report (30%), and short answer questions and quizzes (20%). The face-to-face discussions in the laboratory and the online discussions were directly related to the project report, each helping the students to reflect on and demonstrate their understanding of the key stages of establishing an e-business. Students used a bulletin board within the dotLRN

system (www.dotlrn.org) for their asynchronous online discussions. All students in the study had the same instructor for the course. Students were aware, from an early point in their course, that they would be asked to report on their experiences and that their participation in the research was voluntary. They had not previously participated in courses that used the pedagogical methods described here.

The data collected for the study included (a) student responses to an open-ended questionnaire as well as interviews used to probe issues raised in the open-ended questionnaire more deeply and (b) a set of three closed-ended questionnaires that used Likert-type rating-scale responses. All were administered in the last two weeks of the 13-week course. The interviews lasted about 40 minutes each and were transcribed in full.

2.2. Participants

From a total of 166 students enrolled, 110 students participated in the study. Of them, 75% were males and 25% were females. Seventy open-ended questionnaires were received from students (with 12 of these students also completing the interviews) and 88 students completed the three closed-ended questionnaires. For reasons of student workload, 48 students completed both the open-ended and closed-ended questionnaires. As a consequence, the two samples were treated separately in the analysis. The range of ages was from 20 to 33 years and the average age was 23 years (SD = 1.7, $n = 70$; SD = 1.6, $n = 88$, respectively).

2.3. Instruments

2.3.1. The open-ended questionnaire and the interviews

The same set of questions was used in the open-ended questionnaire and interviews. Question 1 elicits conceptions of learning through discussions. Questions 2 and 3 elicit the intention and strategy components of approaches to learning through discussions (face-to-face and online).

Question 1: What did you learn through discussions in your course? This includes all of the discussions that you were involved in the course (that is, any discussions held in lectures, tutorials, laboratories, online, etc.).

Question 2: How did you approach engaging in face-to-face discussions in your course? What sorts of things did you do to engage (or not) in the discussions? Why did you use those strategies to engage (or not) in the discussions?

Question 3: How did you approach engaging in the online discussions in your course? What sorts of things did you do to engage (or not) in the discussions? Why did you use those strategies to engage (or not) in the discussions?

2.3.2. The closed-ended questionnaires

The three closed-ended questionnaires addressed ‘‘Conceptions of learning through discussions’’, ‘‘Approaches to learning through face-to-face discussions’’, and ‘‘Approaches to learning through online discussions’’, respectively. The development of these three instruments was informed by the work of Crawford et al. (1998) and Biggs (1987). Earlier versions of the instrumentation and a discussion of construct validity and scale reliability can be found in Ellis and Calvo (2006). Students responded to the items using a five-point Likert-type response scale, on which the extreme responses were labelled ‘rarely true’ and ‘almost always true’.

The Conceptions of Learning through Discussions questionnaire is divided into two subscales: cohesive and fragmented. The cohesive subscale is orientated towards a conception which views discussion as a way of deepening understanding and promoting reflection. It comprised five items and Cronbach’s alpha was 0.80 in the present study. Example items are ‘‘By discussing I can develop my understanding of the things I am studying in this subject’’ and ‘‘Discussing in this subject is like a process of reflection that allows us to better understand the things we study’’. The *fragmented* subscale is orientated towards a conception which views discussions as only about finding solutions and developing generic communication skills. It comprised three items and Cronbach’s alpha was 0.63 in the present study. Example items are ‘‘The purpose of discussions in this subject is to learn how to win the argument’’ and ‘‘Discussing in this subject is just about finding the right answer’’.

The Approaches to Learning through Face-to-Face Discussions questionnaire is divided into two subscales: deep and surface. The *deep* subscale is orientated towards an approach that involves using the experiences of others to better understand the issues being discussed. It comprised five items and Cronbach's alpha was 0.69 in the present study. Example items are "I find that at times the discussions in class help me to understand the topic from the experience of others" and "I find that discussions in class help me to understand the topic being discussed more deeply". The *surface* subscale is orientated towards an approach that uses discussions in instrumental and less reflective ways, such as to reduce reading time or help find answers quickly. It comprised four items and Cronbach's alpha was 0.61 in the present study. Example items are "I discuss issues in class so that I do not have to do as much reading on a topic" and "I engage in discussions in class only in order to finish a task".

The Approaches to Learning through Online Discussions questionnaire is similarly divided into deep and surface subscales. The *deep* subscale is orientated towards an approach that reviews the postings of others before composing one's own, using alternative perspectives as a way of broadening one's own, etc. It comprised of four items and Cronbach's alpha was 0.61 in the present study. Example items are "In looking at postings online, I integrate key ideas into my own understanding of a topic" and "I generally read the postings of my colleagues in class to improve my understanding of the topic before making my own posting". The *surface* subscale is orientated towards an approach that tends to use postings sparingly often only to meet expectations. It comprised three items and Cronbach's alpha was 0.61 in the present study. Example items are "When I look at online postings, my main concern is to avoid posting something that suggests I don't know what I'm talking about" and "I usually make online postings at the last moment possible".

The Cronbach alphas fall within an acceptable range compared with similar previous studies (Ellis, Goodyear, et al., 2006; Ellis, Steed, et al., 2006; Ramsden, Martin, & Bowden, 1989).

3. Results

We now turn to the analysis and discussion of the qualitative data gathered through use of the open-ended questionnaires and the interviews. After that we present the analysis and discussion of the quantitative data from the three rating-scale instruments.

3.1. Analysis of the qualitative data

The analysis of the data used a phenomenographic method, which involves the development of a hierarchy of qualitatively different categories of student conceptions and approaches (Marton & Booth, 1997). In this process, extracts from the students' responses are allocated to different categories. The responses provided by students in this study were analysed by three researchers. The outcomes of those analyses are shown in Tables 1–6. The process of analysis, for each of the three questions, is as follows.

Each researcher independently read the student responses to the question. After individual reflection, the researchers met to discuss the main forms of variation in the student data. Key themes were identified through discussion among the researchers, grounded in the data. The researchers grouped the themes into logically related areas and identified those themes which seemed to encompass other themes. These higher-level themes began to form the *outcome space*[1] for conceptions and approaches. One of the researchers used the initial thematic groupings to classify all the questionnaires and developed draft sets of categories of conceptions and approaches. These categories were used by all researchers to classify 30 of the questionnaires in order to test the communicability and the robustness of the categories. Representative quotations from the student responses (questionnaires or interview transcripts) were chosen to highlight some key aspects of the categories. These helped with the decisions about the final categories as shown in Tables 1 and 2.[2]

The percentage of agreements among the three researchers on the categories ranged initially from 75 to 90% and after consultation from 85 to 100%. In this research tradition, an agreement of 80–90% after consultation between the researchers is considered appropriate (Säljö, 1988).

[1] Prosser and Trigwell (1999, p. 57) define "outcome space" as logical and hierarchical categories of description that characterise differing student experiences of learning and understanding.

[2] The draft categories and the representative quotations draw on the SOLO taxonomy for their underlying structure and hierarchy (Biggs, 1999).

Table 1
Conceptions of learning through discussions

Category/structural	Description/referential	Representative quotations
A (Fragmented)	Discussions as a way of meeting extrinsic requirements	"Through discussion I had a new way to interact with people online. I have not really done this before although discussion forums are popular. Face-to-face discussions help students to develop team skills, which is absolutely essential nowadays."
B (Fragmented)	Discussions as a way of sharing ideas to meet extrinsic requirements	"From discussions in class with other students or tutor, I learnt about ideas and what to do in assignments. Online discussions, I only participated to get the marks. I did not interpret or use any ideas suggested by other people. I did read replies, but didn't feel they were very useful."
C (Cohesive)	Discussions as the development of ideas to create new awareness to meet intrinsic requirements	"I think discussions are good because you function as a sounding board for the other person's concepts and the other person does the same thing for you. So you bounce ideas off and it's sort of like pushing limits, it's a bit like an evolution of ideas … you have a kernel of an idea and discussions and things just lay filters in front of them that you perceive that idea through and it takes your view of an idea, it helps you better justify yourself."
D (Cohesive)	Discussions as filtering different perspectives to promote deeper thought to meet intrinsic requirements	"Different perspective, how each person views a situation weighted against benefits and risks. Synergy, how to bring together different viewpoints to form a cohesive goal/viewpoint via items such as projects specification documents. Reality, learn factors that could influence our decisions and affect our success more."

Table 2
Approaches to face-to-face and online discussions

Category/structural	Description/referential	Representative quotation
A (Surface)	Engaging in face-to-face discussions to develop emergent skills	"Nothing much was needed to engage in face-to-face discussions. One just talks and the other listens. And vice-versa."
	Engaging in online discussions to identify problems with the content of postings	"Engaging in online discussions seemed to be how can I tell other groups what they did wrong." "When discussing with other people, I found that I was highly critical."
B (Surface)	Engaging in face-to-face discussions to manage task processes	"I discussed with the tutor things about assignments, and what sort of things should be in the sections of the assignment. I did some discussion with my partner about ideas, mostly for things in the assignment or tutorial work."
	Engaging in online discussions to find interesting ideas	"As for the replies, I read through as many as I can until I find two that made me ask a few questions about it. I find ones that interest me and reply to them."
C (Deep)	Engaging in face-to-face discussions to negotiate understanding and clarify ideas	"With face-to-face discussions, we looked at what had to be achieved, i.e., what had to be completed in the tutorial. After looking at what was required, we discussed what we thought would be the question and why we thought (it). We then combined our answers to provide a thorough answer. These strategies got us thinking about the project and what we wanted to achieve."
	Engaging in online discussions to integrate feedback on the topic to improve understanding	"Online postings are really useful for me. By people looking through my posting, they can give me advice; indicate where I need to improve. The most important benefit is that they can find deficiencies in my posting that I am not able to see. This really helps me."
D (Deep)	Engaging in face-to-face discussions to critically evaluate real-world feasibility	"We were able to discuss various ways of tackling problems, not just going by the book, but rather thinking of 'real-world' issues. From our conversations, we were able to learn about e-businesses from another's perspective."
	Engaging in online discussions to receive and provide feedback on the topic to improve collective understanding	"After reading the online discussions and analysing the problem, I asked the author about the disadvantages, provide constructive criticism and provide my own views." "I approached online discussions by reading the post, then thinking of ideas and issues that could be useful to the author of the point. This was the most effective way to approach online discussions."

Table 3
Distribution of conceptions of and approaches to learning in the various categories

	Category	*n*	% of Responses
Conception			
Fragmented	A	23	33
	B	25	36
Cohesive	C	19	27
	D	3	4
Total		70	100
Approach face-to-face			
Surface	A	19	27
	B	37	53
Deep	C	12	17
	D	2	3
Total		70	100
Approach online			
Surface	A	9	13
	B	45	64
Deep	C	13	19
	D	3	4
Total		70	100

3.1.1. Conceptions of learning through discussions

These results summarise and analyse student responses to the question "What did you learn through discussions in your course?" Four categories of conceptions were identified. These are labelled from Category A, which is the most fragmented conception, to Category D, which is the most cohesive conception. We follow Marton and Booth (1997) in analysing these phenomena in terms of their *structural* and *referential* aspects. The former is the identification of key parts of the object of research and the latter is the meaning attributed to those parts. We also follow Prosser, Trigwell, and Taylor (1994) in using the terms *extrinsic* and *intrinsic requirements* in a particular sense. The former is meant to convey a quality of being required to do something whether one thinks it is a good idea or not. The latter is meant to convey a quality of wanting to do something because one conceives of the value or importance of doing it (cf. Ryan & Deci, 2000). Table 1 shows the categories and their descriptions. Limitations of space prevent extensive illustration here. Instead, a representative quotation is used to illustrate key aspects of each category.

Categories A and B are *fragmented* conceptions of learning. Structurally, Category A does not suggest any awareness of associations between discussions and high level learning outcomes such as filtering, synthesizing or

Table 4
Associations between conceptions of and approaches to learning through discussions

Context	Conceptions of learning through discussions	Approaches		Total
		Surface approaches Categories A and B	Deep approaches Categories C and D	
Face-to-face	Fragmented (A, B)	48	0	48
	Cohesive (C, D)	8	14	22
	Total	56	14	70
Online	Fragmented (A, B)	47	1	48
	Cohesive (C, D)	7	15	22
	Total	54	16	70

Face-to-face: $\chi^2(1, N = 70) = 38.1$, $\phi = 0.74$, $p < 0.001$; Online: $\chi^2(1, N = 70) = 37.4$ $\phi = 0.73$, $p < 0.001$.

Table 5
Associations between face-to-face and online approaches

Face-to-face approaches	Online approaches		Total
	Surface approaches Categories A and B	Deep approaches Categories C and D	
Surface approaches (A and B)	52	4	56
Deep approaches (C and D)	2	12	14
Total	54	16	70

$\chi^2(1, N = 70) = 39.2$, $\phi = 0.75$, $p < 0.001$.

reconceptualising the key ideas of the course. Instead, it indicates awareness only of the existence of different mediums of discussion. Referentially, it is orientated to pragmatic concerns such as meeting course requirements and decontextualised generic communication skills.

Structurally, Category B is also a fragmented conception of discussions. It emphasises the assessed products students had to create while working together on this part of the course. Comments often refer to the relationship between these products and the final mark. Referentially, this conception focuses on the products themselves and how discussions can provide some ideas for their completion in order to meet assessment requirements.

Categories C and D are *cohesive* conceptions of discussions. Structurally, Category C is one that reveals an awareness of close associations between discussions, the ideas they generate and the learning outcomes of the course. In this category, as in Category D, there is a strong element of the students wanting to use the discussions as a way of improving their understanding, as if the requirements to do so are intrinsic. Referentially, this conception includes a strong awareness of how classmates can push each other to greater insight through discussions, embracing the application of ideas to the real world of e-commerce and evaluating the ideas of discussion in terms of their applicability in business contexts.

Category D identifies the structure as a range of viewpoints on the topic discussed and the people who are making their perspective heard, using reality to provide a framework in which to reflect on their viewpoints and decisions. Referentially, it involves conceptualizing discussions as a way of promoting thought through the intersection of a number of perspectives on the same issue, almost as if the range of perspectives on the issue combines to provide a filter that improves the clarity of ideas being considered.

Table 6
Associations between conceptions, approaches and achievement

Aspects of learning through discussions	Achievement		
	Low	High	Total
Conceptions			
Fragmented	32	16	48
Cohesive	8	14	22
Total	40	30	70
Approaches face-to-face			
Surface	36	20	56
Deep	4	10	14
Total	40	30	70
Approaches online			
Surface	35	19	54
Deep	5	11	16
Total	40	30	70

Conceptions: $\chi^2(1, N = 70) = 5.65$, $\phi = 0.28$, $p < 0.05$; Face-to-face approaches: $\chi^2(1, N = 70) = 5.83$, $\phi = 0.28$, $p < 0.05$; Online approaches: $\chi^2(1, N = 70) = 5.67$, $\phi = 0.28$, $p < 0.05$.

3.1.2. Approaches to face-to-face and online discussions

This section presents the analysis of students' responses to the questions: ''How did you approach engaging in face-to-face (or online) discussions in your course?'', ''What sorts of things did you do to engage (or not) in the discussions?'', and ''Why did you use those strategies to engage (or not) in the discussions?''

Table 2 summarises approaches to face-to-face and online discussions in three columns, presenting the category of approach, description and representative quotation. There are two rows for each category. The first row in each category is the face-to-face approach. The second row in each category is the online approach. While the variations within and across the contexts are presented together to save space, it should not be assumed that there are direct relations between the categories. Rather, the relationships are more complex and subtle as shown in Tables 4 and 5.

Category A is a *surface* approach to discussions. Face-to-face approaches of this kind show no evidence of an intention to negotiate understanding of the key ideas being discussed, nor any awareness that the issues are linked to real issues in e-business. The referential aspect is an awareness that focuses on emergent skills of discussion, such as asking questions, getting answers, engaging in conversations in order to develop some general type of communication skills. The structural aspect is restricted to concrete artefacts such as having a list of questions to ask, taking notes, and writing responses.

Online approaches in Category A fail to recognize any associations with the purpose of improving ideas about what it takes to set up an e-business. The referential aspect of the approach is a predominately negative one, offering no chance for self-reflection and understanding. The structural aspect focuses on the postings of others and does not indicate any awareness of involving reciprocation.

Category B is also a surface approach. In face-to-face discussions, it separates discussions from the outcomes of learning tasks and the understanding that they are intended to promote. Comments categorised in this approach suggest that the underlying referential aspect is instrumental (focused mostly on the best way to manage processes related to tasks) and that the structural aspect is restricted to the parts of the task itself.

Online approaches in Category B have vague links to course outcomes preferring to emphasise less specific goals such as finding something 'interesting'. The referential aspect does not reveal any indication of an intention to seek improved understanding through feedback. There is some indication of assessment concerns driving this category of approach. The structural aspect is restricted to searching and reading.

Category C is a *deep* approach. In face-to-face discussions, the referential aspect of the approach can be understood as using discussions as a sounding board for ideas, and improving them in order to engage with the projects. The structural aspect of the approach involves negotiation, clarification and synthesis.

Online approaches in Category C show an awareness that a key purpose of the online discussions was to raise issues and ideas that could help with understanding how e-businesses work. The referential aspect is one that uses the postings as a way of seeing things that may not have been noticed, as a way of rethinking ideas from different perspectives. The structural aspect emphasises the importance of feedback in the approach and the redesign or review of key concepts.

Category D is also a deep approach to face-to-face discussions. The main difference with Category C comes from links between the approach and an awareness of real-world feasibility. The referential aspect is the assessment of ideas in terms of the likelihood of their success. The structural aspect emphasises the critical evaluation of ideas.

The main difference between Categories D and C in approaches to online discussions is that the awareness of improving understanding goes beyond the individual, and includes members of the class. The evidence of this awareness is displayed by intent to provide feedback in ways that will help the understanding of others, as well as receiving feedback to improve one's own understanding. The referential aspect is improved understanding using reciprocal feedback. The structural aspect involves both the postings and the Web site concepts of others.

3.1.3. Relationships between conceptions of and approaches to learning

Table 3 shows the distribution of student responses elicited by the open-ended questionnaires and interviews, grouped into the categories of conception and approach described above. It is evident from Table 3 that although a significant number of student responses can be placed in the 'cohesive' or 'deep' categories, these are in a minority and the numbers that can confidently be placed into Category D are, in each case, very small.

Table 4 shows that students who reported conceptions of discussions consistent with a fragmented category also reported approaches that were classified as lacking in an intent to engage meaningfully in those discussions, whether they were face-to-face or online.

Table 5 shows that students whose comments were classified as surface approaches online, also tended to make comments that were classified as surface in face-to-face contexts. The same relationships were identified with comments classified as deep in online and face-to-face contexts. There appears to be consistency of approach across online and face-to-face contexts.

Table 6 shows that students with cohesive conceptions and deep approaches to discussions in face-to-face and online contexts had higher levels of achievement, as measured by the end-of-course grade. The level of achievement was established as being either high or low based on both statistical (the median point for the distribution of marks was 64) and pedagogical reasons (the change between 64 and 65 is the difference between receiving a pass or credit grade within a grading structure of pass [55], credit [65], distinction [75], and high distinction [85]).

3.1.4. Discussion of the results of the qualitative analysis

Our hypotheses were primarily concerned with unpacking the students' experience of learning through discussions when they occur across face-to-face and online contexts. Our first hypothesis aimed to establish whether there are any variations between students in their conceptions of learning through discussions (both online and face-to-face) and to characterise the structure of such variations. The results from the qualitative analysis suggest that conceptions of learning through discussions vary in a way similar to the variations in conceptions of learning found in prior research, in so far as they can be categorised as falling into fragmented and cohesive conceptions.

Our second hypothesis was that it would be possible to identify the structure and variation of qualitatively different approaches; in fact, deep and surface approaches were clearly discerned, with deep approaches underpinned by an intention to understand in both face-to-face and online contexts, using strategies whose structure were determined by the nature of the context. For example, key aspects of face-to-face approaches included strategies that were related to negotiating understanding and feasibility through reasonably instantaneous interaction, while the online approaches seemed to be related to more reflective strategies allowing students opportunities to use the postings of others' useful ideas to broaden their own understanding.

Interestingly, variation in approaches to learning from face-to-face discussions differed from the variation in approaches to learning from online discussions. In approaches to face-to-face discussions, we found variations between focus on form, demands, ideas and different perspectives on the same phenomenon. In approaches to online discussions, we found differences between focus on posting, receiving comments and mutual exchange of views. In spite of these differences in the structure of the approaches to learning from face-to-face discussions and approaches to learning from online discussions, the two were highly correlated.

Our third hypothesis was that there would be associations among qualitatively different conceptions, approaches and course outcomes. The qualitative results identified statistically significant associations among deep/surface approaches, cohesive/fragmented conceptions, and positive, significant associations between these categories and achievements.

Students with conceptions consistent with cohesive categories did better than students with conceptions consistent with fragmented categories. Students reporting deep approaches tended to do better than students taking more superficial approaches. These results are also consistent with findings from our parallel study on learning through discussions among social work students in an introductory psychology course, although in that study (Ellis, Goodyear, et al., 2006), we did not find a statistically significant benefit for students taking a deep approach in face-to-face discussions.

3.2. Analysis of the quantitative data

Two types of analysis were used to investigate the students' responses to these instruments. Correlation analysis was used to investigate pairwise relations between the variables representing conceptions of and approaches to learning through discussions which were measured by the subscales of the three questionnaires. Cluster analysis was used to see if there were any subgroups of students within the sample that exhibited similar characteristics. The methodology used is consistent with previous related research (Crawford, Gordon, Nicholas, & Prosser, 1994; Crawford et al., 1998).

3.2.1. Relations between variables

Table 7 shows the results of the correlation analyses between the variables of the study. The correlations were calculated for the mean scores of the subscales.

Table 7
Correlations between the subscale scores of the questionnaires on conceptions of and approaches to learning through discussions and course mark

Variable	cc	fc	dfa	sfa	doa	soa	cm
Conceptions							
Cohesive conceptions (cc)	1	−0.18	0.55**	−0.28*	0.48**	−0.13	0.04
Fragmented conceptions (fc)		1	0.05	0.30*	−0.01	0.19	−0.10
Face-to-face approaches							
Deep face-to-face approach (dfa)			1	−0.24*	0.47**	0.01	0.05
Surface face-to-face approach (sfa)				1	−0.09	0.38**	−0.19
Online approaches							
Deep online approach (doa)					1	−0.03	0.09
Surface online approach (soa)						1	−0.13
Achievement							
Course mark (cm)							1

$N = 88$; *$p < 0.01$; **$p < 0.001$.

The *cohesive conception* variable had a moderately high positive correlation with the deep face-to-face approach variable ($r = 0.55, p < 0.001$), a low negative correlation with the surface face-to-face approach variable ($r = -0.28, p < 0.01$), and a moderate positive correlation with the deep online approach variable ($r = 0.48$, $p < 0.001$). The *fragmented conception* variable had a moderate positive correlation with the surface face-to-face variable ($r = 0.30$, $p < 0.01$).

The *deep face-to-face approach* variable had a low negative correlation with the surface face-to-face approach variable ($r = -0.24$, $p < 0.01$), and a moderate high positive correlation with the deep online approach variable ($r = 0.47$, $p < 0.001$). The *surface face-to-face approach* variable had a moderate positive correlation with the surface online variable ($r = 0.38$, $p < 0.001$).

The course mark did not correlate with any of the variables representing conceptions of and approaches to learning through discussions. It seems that the relationships between conceptions of and approaches to learning were in the same direction as we found in the qualitative data. However, in this case the relationships of conceptions of and approaches to learning with course mark, although in the expected direction, were not statistically significant.

3.2.2. Cluster analysis

Cluster analysis was used to look for groups of students who differed systematically in the way they conceived of and approached discussions in face-to-face and online contexts. Students' mean scores on the six subscales and course mark were standardised and a hierarchical cluster analysis using Ward's minimum variance method was used. A two-cluster solution emerged as the best representation of similarities and dissimilarities between the students (Cluster 1, $n = 57$; Cluster 2, $n = 31$). To investigate whether the differences between the two groups were statistically significant, *t*-tests were performed. The results are shown in Table 8.

The two clusters were (a) those with an orientation towards reproduction and (b) those with an orientation towards meaning making and understanding (see Table 8). The students in Cluster 1 can be characterised as a group who had relatively low scores on the cohesive conceptions variable, on the deep face-to-face approach variable, and on the course mark variable as well as relatively high scores on the fragmented conceptions variable, on the surface face-to-face approach variable, and on the surface online approach variable.

In contrast, Cluster 2 shows that these students were orientated towards understanding as suggested by the relatively high scores on the cohesive conceptions variable, on the deep face-to-face approach variable, and on the course mark variable; they also had relatively low scores on the fragmented conceptions variable, on the surface face-to-face approach variable, and on the surface online approach variable.

3.2.3. Discussion of the results of the quantitative analysis

The results from the quantitative analysis of the scores from the questionnaires on conceptions of and approaches to learning through discussions are encouraging in that they broadly replicated the pattern of relations found in the qualitative analysis.

Our first hypothesis was that students will vary in their conceptions of learning through discussions and our second hypothesis was that qualitatively different categories of conceptions would be related to qualitatively different

Table 8
Mean standardised scores (and SD) of the subscales of the questionnaires on conceptions of and approaches to learning through discussions and course mark as a function of cluster

Variable	Cluster 1 *M* (SD)	Cluster 2 *M* (SD)	*t*-test	df	*p*
Conceptions					
Cohesive conceptions	−0.29 (0.94)	0.54 (0.87)	16.36	87	0.000
Fragmented conceptions	0.42 (0.93)	−0.78 (0.56)	43.10	87	0.000
Face-to-face approaches					
Deep face-to-face approach	−0.16 (0.83)	0.30 (1.21)	4.37	87	0.010
Surface face-to-face approach	0.43 (0.77)	−0.79 (0.90)	45.07	87	0.000
Online approaches					
Deep online approach	−0.13 (0.99)	0.24 (1.00)	2.77	87	ns
Surface online approach	0.31 (0.97)	−0.56 (0.79)	18.34	87	0.000
Achievement					
Course mark	−0.25 (1.08)	0.45 (0.62)	10.86	87	0.000

$N = 88$; Cluster 1: Reproduction ($n = 57$); Cluster 2: Understanding ($n = 31$).

categories of approaches. At the level of variables, the correlation analysis showed that the cohesive conception was related strongly to deep approaches in both face-to-face and online discussions and the fragmented conception was related moderately to surface approaches in face-to-face discussions. At the level of students, the cluster analysis replicated these results, but across more variables. The only variable not significant in the cluster analysis was the deep online approach.

Our third hypothesis was that there would be associations among qualitatively different conceptions, approaches and course outcomes. This was the case at the level of groups of students in the cluster analysis. In other words, cohesive conceptions, deep approaches and relatively higher marks were significantly grouped together in Cluster 2 and fragmented conceptions, surface approaches and relatively lower marks grouped together in Cluster 1. This association was not identified in the correlation analyses, perhaps because of the sample size. The findings underscore the possibility of using the questionnaires in research with larger samples in future research.

4. General discussion

Before discussing the outcomes and implications of this study, it is important to note its limitations. While this study sheds light on a number of important issues concerned with students' conceptions of, and approaches to, learning through discussions in face-to-face and online contexts, its conclusions are circumscribed by a number of factors. First, the study is highly reliant on students' self-report data – as is the case with much phenomenographic research. It could be beneficially complemented with observational data about what students actually do, particularly when they are translating tasks into activity and when they are reflecting on the adequacy of their approach. Second, it draws strength, but also inherits limitations, from being set in the specific domain of web-engineering. Further studies in contrasting subject areas will be needed to help assess the degree of subject-specificity in the current findings. Third, the quantitative analysis is restricted by the relatively small numbers of students involved. Additional studies allowing us to build up the sample size are required.

The aim of this research project was to investigate the students' experience of learning through discussions in face-to-face and online contexts. Analyses of open-ended questionnaire responses and interview data – as well as correlation and cluster analyses of complementary self-report questionnaire data – revealed evidence of qualitatively different conceptions of and approaches to learning through discussions. They also revealed some connections between variations in conceptions of and approaches to learning and course marks.

The results of this study have important implications for research, design and teaching in blended learning contexts. We found a cluster of students with cohesive conceptions, deep approaches to learning through discussions and a relatively higher course mark (representing a generally higher quality learning experience), namely one characterised as *understanding* rather than *reproduction*. Conversely, we found that fragmented conceptions, surface approaches to

learning through discussions, and a relatively lower course mark are indicative of students with a generally lower quality learning experience, which emphasises reproduction rather than understanding.

The strength of associations between approaches to learning through discussions (face-to-face and online) indicates that there is a relationship between taking a deep or surface approach in one context and taking a similar approach in the other context. There were quite high correlations between cohesive conceptions and deep approaches as well as between fragmented conceptions and surface approaches. Given that the two types of approaches tend to be related to achievement, it is sensible for teachers to adopt teaching strategies which are likely to help students to think about learning through discussions in coherent ways and to adopt approaches – in both contexts – that are likely to improve the quality of the experience. There is no formulaic answer for such teaching strategies (Martin & Ramsden, 1987; Struyven et al., 2006). Rather, it is likely that actions taken by the teacher to help students reconceive the role of learning through discussions are most likely to make the difference – especially with students who do not have elaborate conceptions of how discussions can help promote reflection and a broader perspective on the issues under consideration. In terms of helping students to redevelop their approaches to learning through discussions, it is clear that many students do not necessarily see how to approach discussions (either face-to-face or online) in ways that promote understanding. Setting discussion tasks without helping students see the potential benefits of taking deep approaches is unlikely to lead to good learning outcomes. In this regard, teachers need to pay particular attention to the moments when students are translating task requirements into plans for their own activity. We conjecture that intervention when working groups of students are discussing and forming their plans may prove particularly helpful.

While it is important to understand the structure and meaning of innovative approaches to learning such as those being influenced by information and communication technologies, the results of this study reinforce the importance of looking at well-established learning activities, such as face-to-face discussion, in ways that are likely to reinvigorate our approach to their use and, more importantly, to see how their benefits can be coupled with those of online discussions.

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