UNDERSTANDING CFL PRACTICES IN HIGHER EDUCATION IN TERMS OF ACADEMICS' EDUCATIONAL BELIEFS: ENHANCING REEVES' ANALYSIS

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ABSTRACT

The research reported here is concerned with the design and use of computer-facilitated learning (CFL) in higher education, and is based on the premise that the educational context in which students learn is heavily influenced by the epistemological and educational assumptions of their academic teachers. The paper reports a preliminary analysis and comparison of two illustrative cases drawn from a larger study in which the beliefs and CFL practices of 24 university academics were studied through intensive interviews supplemented by resource and archival material.

The research uses qualitative/ interpretative methods to describe academics' beliefs about teaching and learning practices. The cases are introduced by narrative descriptions which provide an overview of their salient features and of the connections between beliefs and practices. The cases are then analysed and compared on 12 dimensions some of which were drawn from Reeves, some from an earlier study of ours based on archival materials alone, while others emerged as the research progressed.

In addition to its focus on academics' educational beliefs and practices, the paper briefly considers the advances that have been made over the dimensional framework proposed by Reeves.

KEY WORDS

Educational beliefs, computer-facilitated learning, pedagogical dimensions, narrative method, learning environment, higher education.

1. INTRODUCTION

The research reported in this paper is concerned with the influence of academics' educational beliefs on the ways in which they design and use computer-facilitated learning (CFL). The impetus for the research derives from growing evidence from the school sector (Pajeres, 1992; Richardson, 1996; Thompson, 1992), plus some from higher education (Bain, 1998; Quinlan, 1997), indicating that the nature and impact of educational practices depend on the beliefs and assumptions of the teachers concerned. Our research also has been influenced by Reeves' (1992) work which seeks to analyse CFL in terms of its underlying 'pedagogical dimensions'. We will demonstrate that these dimensions can be augmented with others, as Reeves anticipated, to more fully understand the beliefs and practices of academics and how they are connected.

1.1 BELIEFS AND PRACTICES OF SCHOOL TEACHERS

Although none of the research with school teachers has attended specifically to teachers' use of CFL in the classroom, there is solid evidence that school teachers' practices are framed by their beliefs about the nature of knowledge, the disciplines they teach, and the processes and outcomes involved in teaching and learning (Pajeres, 1992; Richardson, 1996; Thompson, 1992). Most of the recent studies have used narrative descriptions of a small number of teachers to demonstrate these connections. Brickhouse (1990), for example, studied three junior high school science teachers over a four month period, obtaining data from interviews, classroom observations and resource materials. Her three teachers differed markedly in their views, as did their classrooms. One teacher, for example, thought of scientific theories as intellectual tools for solving problems, that theory frames the observation process, and that scientific progress occurs with the creation of new ways to interpret existing observations. Consistent with these beliefs, much of her classroom activity was focussed on students posing and solving problems, using theory to frame the thinking process, and examining the interplay between theory and observation. By contrast, another teacher viewed theories as truths that had been uncovered by rigorous experimentation, that science involves the induction of theory from observation, and that scientific progress is marked by the accumulation of facts rather than by changes to theory. Consistent with his aggregative view of science, this teacher emphasised worksheets and tests which focussed on whether students 'knew' theory and associated facts and could obtain correct answers by following predetermined procedures. Similar studies have been reported for mathematics (Thompson, 1984) and history (Wilson & Wineburg, 1988).

1.2 BELIEFS AND PRACTICES OF ACADEMICS

In contrast to the emphasis on narrative description of beliefs and practices in school teacher research, most of the research in higher education has focussed on developing analytic frameworks within which academics' educational beliefs can be described and compared (Fox, 1983; Kember, 1997; Prosser *et al.*, 1994; Samuelowicz & Bain, 1992).

Samuelowicz and Bain (1992), for example, inferred five educational orientations from interview data by categorising whole interview transcripts through the constant comparative method (Glaser & Strauss, 1967). These orientations were characterised in terms of five belief dimensions derived in a second stage of the analysis by comparing and contrasting the orientations. At one extreme, the 'imparting information' orientation reflected the beliefs: that students should know more (rather than differently); that the desired knowledge is limited to the curriculum (rather than being a way of interpreting the world); that students' existing understandings are not considered (in contrast to being a reference point for teaching); that teaching is predominantly a teacher-to-student communication (rather than a two-way dialogue); and that the teacher should control the content to be learnt (in contrast to the student having some say in what is studied). Kember (1997) has shown that this framework has much in common with others developed independently.

Two recent studies employing the narrative method have begun to investigate the relationships between academics' beliefs and practices. Bain (1998), for example, investigated how two effective academic teachers conceptualised and implemented mathematical modelling in their disciplines. One construed mathematics as socially constructed knowledge and stressed collaborative 'real world' exercises for her students. The other academic viewed mathematics as the basis through which the 'deep structure' of natural phenomena can be revealed by scientific inquiry and stressed that students should undertake extensive practice with models established by such inquiry. Analogously, Quinlan (1997) has reported the cases of two historians who differed in the forms of knowledge they believed their undergraduate students should acquire, one favouring the ability to interpret ambiguous primary sources, the other preferring that students acquire a coherent narrative relatively free of alternative interpretation. Much as Wilson and Wineburg (1988) reported for secondary history teachers, Quinlan found that the classroom styles of the two historians differed in thematically consistent ways.

1.3 ACADEMICS' CFL BELIEFS AND PRACTICES

In a preliminary study within the present project, Bain *et al.* (in press) used the same method as Samuelowicz and Bain to investigate academics' uses of CFL, and demonstrated that the learning environment afforded by CFL cannot be fully understood on the basis of the 'type' of CFL involved (Perkins, 1991), but must also take into account the full teaching/learning context in which the CFL is embedded. Perhaps because they relied on entirely archival material (grant applications, reports, articles), the analytic scheme reported by Bain *et al.* focussed more on CFL practices than on supporting beliefs. However, much as Reeves (1994) and others (Kember, 1997; Prosser, *et al.*, 1994; Samuelowicz & Bain, 1992) might have anticipated, the categories ranged from practices that were instructivist (or teaching-centred) in character to others that were constructivist (or learning-centred), with several intermediate variants. All categories could be described as unique 'profiles' in five qualitative dimensions of CFL practice inferred from the data. We have adapted some of these dimensions for use in the present study.

Reeves (1992; Reeves & Reeves, 1997) developed his 'pedagogical dimensions' to demonstrate that the educational impact of interactive and web-based learning systems is determined by their pedagogic, not their media, properties. His dimensions were not derived from a data set, as in Bain *et al.* (in press), but were formulated to reflect educational contrasts in the research literature. Although Reeves did not separate his dimensions into beliefs and practices, it is possible to do so with some benefit for our present purposes.

1.4 PURPOSES OF THE STUDY

This study examines the beliefs and practices of academics who implemented two CFL projects with the assistance of competitive funding. Our purpose is to describe and code their beliefs and practices, and demonstrate how they are interrelated.

2. METHOD

The cases included in this paper are drawn from a larger study of 24 CFL projects that were funded by the Committee for the Advancement of University Teaching (CAUT) during the period 1993-1995. The 24 projects were sampled on the basis of a preliminary analysis of CFL practices (and implied beliefs) contained in the CAUT grant applications and final reports. The analytic framework reported by Bain *et al.* (in press) was used as the sampling plan. Participants were interviewed extensively about the design and use of their CFL and about their educational beliefs (two interviews, each of about two hours duration). These interviews were recorded and fully transcribed, and are being analysed in conjunction with additional archive material (journal articles, book chapters) and resources (handouts, texts, exercises, assessments). The data are being coded with a large set of dimensions (18 belief, 16 practice; and 2 scholarship) which will be reduced in size once redundancies have been established. The two cases reported in this paper represent two of the three major categories in the Bain *et al.* framework. The dimensions used are a subset derived from Reeves (1992; Reeves and Reeves, 1997) and from our data. They were selected to highlight important beliefs and practices of the two cases, and to allow cross-referencing with the narrative descriptions. Pseudonyms have been used to protect the identities of the participants.

3. FINDINGS

Because of the detail and complexity of the two cases, the narrative descriptions are presented first before they are analysed and compared on the belief and practice dimensions.

3.1 JOY TEACHES SPEECH PATHOLOGY

Joy and her colleagues have developed a CFL program aimed at improving skills in perceptual voice analysis. The CFL is integrated into the second year of a four-year speech pathology course, in which clinical practice with real clients does not occur until the final year. Joy believes there are a number of 'fundamental principles' upon which an understanding of speech pathology is based, notably the anatomical, physiological and acoustic features of voice production. These principles have been revealed by research in the discipline and have general applicability in the clinical setting. However, Joy was concerned that students were learning about component aspects of speech pathology without being able to see how their knowledge would be used in practice.

The CFL provides access to disordered speech in several settings: a classroom, a party and a clinic. In these contexts, students listen to the recorded voices of actual clients, view a range of video, audio, and textual clinical data, and diagnose the speech disorders. There are guides available for advice; these guides are practising clinicians who have been interviewed and recorded. Students use a matrix of rating scales to identify speech disorders; this strategy clearly shows the multi-faceted nature of the problems they face as clinicians. Students have to make a number of judgements requiring manipulation and rating of data in order to analyse the voices presented in the CFL. 'Experts' offer suggestions to the learner after incorrect responses are made. These include advice to repeat the procedure, to use the glossary, or to research the topic. In most instances the experts avoid saying directly that the answers are 'wrong', but will suggest that the answers do not correspond to those of 'most clinicians', giving reasons for why this is the case. After feedback, students can revise their ratings to get closer to those of the clinicians.

The tasks which follow the use of the CFL are case-based problem-solving tasks which are assessed. Students are required not only to analyse and diagnose speech pathology, but also to design appropriate interventions.

Joy thinks of learning as beginning with repetitive learning of foundational knowledge and skills followed by the development of professional understanding based on extensive clinical practice (or simulated practice in the early years). She sees her role as structuring and presenting foundational knowledge (which students are expected to reproduce and use) then supporting students as they attempt clinically relevant practice; in their final year she want students to 'integrate or synthesise' the various knowledge areas. Joy's educational goals are quite focused, structured and assessable, but she believes that they are not easily taught by direct instruction alone because of the many factors which combine to form a more complete understanding when clinical cases are considered.

Her case-based learning approach has been influenced by the difficulties past students have had with the complex skill of perceptual voice analysis, and the CFL was designed to make the knowledge more accessible to students. The supports she provides, personally and in the CFL, derive from her structuring of the knowledge but also include more subtle gradations from simple to complex, such as in her choice of clinical examples, the tools and cues provided to facilitate analyses and diagnoses, and by the feedback provided by experts. Joy experiences a dilemma about her role as a teacher, acknowledging that although she provides the frameworks, clinical examples and resources to facilitate understanding, such frameworks can restrict students. She sees the frameworks students develop for analysing voices as largely hers. Joy does not allow much leeway in what individual students should understand (it is a vocational course and students are expected to meet appropriate standards of competence), but she allows for differences in the learning pathways that students prefer to follow.

Joy's beliefs about the need to build complex knowledge upon simpler knowledge are evident in the subject curriculum as well as within the CFL.

She is committed to maintaining communication between herself and her students, and amongst students, as part of the learning process. Most students choose to work individually on the CFL; however, Joy demonstrates her strong belief in the importance of discussion in the teaching/learning process by organising weekly small group discussion sessions, where support for students can occur by a process of probing questions and interactive discussions.

3.2 FRANK AND JOHN TEACH FIRST YEAR CHEMISTRY

Frank and John decided to develop their computer-based chemistry tutorials because the students enrolling in their first year chemistry course had vastly different backgrounds in chemistry. The idea began with an attempt to simulate certain laboratory procedures and evolved through discussion to include more of a question and answer style which was recognised as having a wider teaching and learning potential. The resulting CFL is extensive, covering all of the concepts of a first year terminating chemistry course.

Frank and John share a foundational view of introductory chemistry. It is based on well-established information about the chemical composition, properties and functions of known substances, and requires the ability to manipulate and work with those substances as well as familiarity with an extensive nomenclature.

Learning is viewed as developmental, progressing from the simple acquisition of different bits of factual knowledge to understanding what results when these bits of knowledge come together in a coherent framework. Understanding is recognised by the ability to use the knowledge appropriately and ultimately to contribute to the development of the knowledge base itself. They agree that this type of understanding should be the objective of teaching but acknowledge that it is often only achievable at post-graduate level and concentrate their efforts on basic training in the first year course.

Both the teacher and the student contribute to the teaching and learning process. The role of the teacher is to provide the facts together with the theory in a structured way and to support the learner through the provision of resources. The student has the responsibility of actively engaging with the course content and utilising the resources that are made available. Thus the student, rather than the teacher, is responsible for the quality of the learning that occurs, within the boundaries of the opportunities provided for them. The primary role of the teacher in first year is to get the basic underlying facts in place and to structure the knowledge so that it can fit into a recognisable pattern.

The knowledge base for chemistry is developed through the acquisition of an orderly array of material that is sequentially accessed and ultimately fits into a recognisable pattern. Before the whole pattern can begin to emerge a minimum base level of factual knowledge and skills are required. These facts, however, should be taught in conjunction with theory to facilitate the development of an overall pattern or matrix of knowledge. Once this initial knowledge base is in place students can be exposed to problem solving and collaborative activities where facts and theory presented together can be explored in ever deepening spirals of learning.

The teaching and learning framework is provided by lectures, tutorials, laboratory sessions and workshops. When the CFL was first conceptualised there were three lectures a week. The primary purpose of these lectures was the organised presentation of the curriculum content and concepts. This structure was changed in 1996 to one lecture a week the purpose of which is to review a suggested study plan for the week and to discuss the basic knowledge and skills that will be needed as students work through the tutorial, laboratory and workshop sessions. The new structure gives students greater opportunity to work at their own pace through the specified materials and to develop greater responsibility for their own learning. The lecturer, during the one lecture, has the opportunity to impart his/her insights and understanding to the students. The time that the other lectures absorbed has been allocated to CFL tutorials.

The CFL tutorial sessions take place in the computer laboratory and students are given flexibility in access times to the laboratory. Students are able to work collaboratively during these sessions and are often seen working in pairs or small groups, however, this is entirely a matter of choice as no requirement is placed upon them to do so.

The CFL is unique in that it spans an entire first year chemistry course and has become the primary means through which the content is presented and engaged with. Each module presents the student with background material on a particular topic which is supported by animation, video, diagrams or detailed explanation followed by a series of questions that the student has to work through sequentially. The questions use different formats depending upon the subject matter and are designed to make the student test their knowledge as they are developing it. A student, after at least one attempt at a question, may ask for hints or an explanation with the answer.

Frank and John highlight three aspects of the way the computer modules facilitate learning.

- The continual questioning helps students check their understanding as they are developing it and allows them to remediate any misunderstanding timeously. This ongoing questioning also helps to develop self-study skills within the students.
- The animation and video provided enables students to visualise and revisit potentially difficult concepts. This empowers students to answer questions on the basis of what was observed rather than just recalling from memory.
- It allows students control over the pace of their own learning although targets and expectations are set in the framing lecture.0

The laboratory sessions and associated workshops are considered an important part of the course as students learn essential practical skills in these classes. The CFL can help prepare students for these classes but cannot replace them. Both Frank and John believe it is important for students to actually work with the 'stuff' of chemistry. Assessment is through means of a traditional three hour examination which is knowledge-based.

3.3 ANALYSIS AND COMPARISON OF THE CASES

The description of some selected dimensions and the coding of the two cases are in Table 1.

3.3.1 Pedagogical Beliefs

Reeves' dimensions: Joy and Frank/John share similar views about the need to set learning goals and objectives that are based on domain knowledge and are common for all students. Accordingly they are similarly coded on Reeves' dimension *Pedagogical Philosophy* (F/J=2; J=3). The small difference between them derives from the fact that Frank and John provide clear objectives for their students in what is a highly structured course, whereas Joy places stronger emphasis on the role of the student in constructing the body of knowledge. Consistent with this slight difference is a stronger contrast in beliefs about the *Teacher's Role* (F/J=2; J=4). Joy sees her role as being more of a facilitator; she provides structured frameworks for the students to explore with her assistance. In this respect she is clearly less didactic than Frank and John who emphasise the presentation of well organised material. Consistent with her beliefs about facilitation, Joy emphasises the importance of discussion in clarifying discipline concepts for students. Frank and John, on the other hand, do not see discussion as a necessary ingredient in learning in first year chemistry, and these differences are highlighted on the dimension *Role of Discussion in Learning* (F/J=1; J=5).

Bain et al. dimensions: Our dimensions help make explicit some of the different ways in which these teachers interpret their roles, and those of their students, during the learning process. For example, despite their differences in relation to the role of discussion in learning, Joy and Frank/John share a pre-emptive approach to teaching and learning (*Accommodation of Students' Conceptions*). That is, while they take past students' difficulties and misunderstandings into consideration by seeking ways to make the ideas more accessible, none of them base the teaching/learning process on their current students' misconceptions.

Coding on the dimension *Valued Understanding Outcome* (F/J=1; J=4) emphasises a difference in what the participants believe should be learnt. Frank and John see the learning of basic chemistry as the coming together of bits of knowledge into a recognisable framework in which understanding is enhanced by seeing the connections. For Joy, the ideas, although taught in a linear sequence, must be used in clinical practice where professional understanding develops.

Table 1

Comparison of Cases on Selected Dimensions

Pedagogical Beliefs						
Instructivist	**Pedagogical Philosophy** Reeves '92/'97					Constructivist
Goals and objectives exist apart from the learner, and are drawn from domain knowledge (92). They are presented to the learner sequentially using direct instructional techniques.	*The belief regarding teaching and learning*					Emphasises the primacy of the learner's intentions and experience. Goals and objectives are dependent upon each student's active construction of knowledge.
Instructivist		F & J	Joy			Constructivist
Didactic	**Teacher's Role** Reeves '97					Facilitative
To instruct students through the presentation and explanation of knowledge. Involves more direct instruction	*The belief about the teacher's primary role with respect to students' learning*					To provide thoughtful learning experiences that allow students to explore the knowledge base. Minimises direct instruction while supporting exploration.
Didactic		F & J		Joy		Facilitative
Knowing more	**Valued Understanding Outcomes** Bain et al.					Knowing differently
Involves a deepening or an increased understanding which does not transform the learner's way of knowing.	*The understanding outcome that is sought through the educational process*					Involves the learner viewing the domain / world in a new way; the learner's way of knowing is transformed
Knowing more	F & J			Joy		Knowing differently
Accommodation of Students' Conceptions Bain et al.						
Absent	Pre-emptive					Conversational
No consideration is given to existing or developing student conceptions	Draws upon past students' difficulties to 'transform' discipline concepts into forms that are more likely to be correctly understood. Assumes that knowledge presented in a more student-friendly way will prevent or replace students' naïve conceptions. (Bain & McNaught, 1996)					Students are assisted to translate fluently between descriptions of the world and abstract conceptualisations. Participants share their understandings, and dialogue is adapted by the teacher so that the student's understanding approaches that of the teacher. (Bain et al.., 1997)
	F & J and Joy					
Incidental	**Role of Discussion in Learning** Bain et al.					Central
Adequate learning can be achieved without discussion because it is based upon a single received interpretation	The belief concerning the importance of discussion and the negotiation of ideas in learning					It is through discussion that different interpretations are contemplated and negotiated
Incidental	F & J				Joy	Central

Curriculum Beliefs						
Sum of the parts	**Curriculum Integration** Bain et al.					Coherent integration
Individual curriculum parts are separated for teaching, and mastered in isolation from the total domain with the belief that once the parts have all been mastered the whole should become apparent.	*The belief about the construction of the curriculum and the methods by which the teacher structures the curriculum knowledge and the learner acquires it.*					Considerable effort is made to illustrate continually how the sections of knowledge fit together in a coherent discipline structure with the belief that it is best learned holistically
Sum of the parts			F&J Joy			Coherent integration
Reductionist	**Instructional Sequencing** Reeves'92					Constructivist
In learning a task "components of the task must be mastered independently before they can be assembled into the final performance."	*The belief underlying the instructional design.*					In learning a task novice learners might be placed "in a realistic context ... in which scaffolding and coaching" would be introduced as required.
Reductionist		F & J		Joy		Constructivist
Curriculum Focus Bain et al.						
Knowledge & understanding	Disciplinary & interdisciplinary ways of knowing					Professional/artistic performing
Given discipline concepts and procedures and skills	Developing relevant metacognitive rather than relying on specific facts/ concepts/ procedures					Performance or application of knowledge in different circumstances
F & J						Joy

Teaching and Learning Design and Function						
Academic (Abstract)	**Task Orientation** Reeves '97					Authentic (Experiential)
Traditional academic tasks that do not necessarily have direct practical applicability	*Reflects the contextual nature and purpose of the activities*					Tasks that reflect the real life practical context in which the knowledge or skills will be used.
Academic (Abstract)	F & J				Joy	Authentic (Experiential)
Unsupported	**Metacognitive Support** Reeves'97					Integrated
No learning support strategies are provided to assist the student in the accomplishment of their learning objectives.	*The 'learning to learn' skills that are provided to support the learner*					Learners are provided with strategies to assist them in their learning e.g. problem-solving strategies
Unsupported			F & J	Joy		Integrated
Know More	**Focus of Assessment** Bain et al.					Know Differently
The accrual of knowledge or the depth of understanding	*The type of learning focused on by assessment processes*					Learning in one context is adaptable to different situations
Know More	F & J			Joy		Know Differently

Feedback to Students Bain et al.			
Minimal	Fixed	Responsive Direct	Responsive Scaffolded
Limited feedback is provided.	Predetermined feedback responses are structured and built into the process. Does not vary between learners.	Feedback supplied is directly related to learner input or enquiry and is of a direct nature, e.g. providing answers.	Feedback supplied is directly related to learner input or enquiry. It prompts or guides the learner without direct answers.
	F & J		Joy

3.3.2 Curriculum Beliefs

Reeves' dimensions: Coinciding with their structured approach to teaching and learning, Frank and John believe that in first year chemistry knowledge is mastered incrementally before being assembled to form a 'whole'. We have coded the beliefs that underlie the instructional design of their curriculum as more strongly 'reductionist' than 'constructivist' on Reeves' dimension *Instructional Sequencing* (F/J=2). This is in contrast with Joy's more 'constructivist' beliefs about the importance of placing students in more realistic contexts from an early stage, whilst still 'framing' the knowledge and prompting when required (J=4).

Bain et al. dimensions: There are similarities between the two cases, of course. On the *Curriculum Integration* dimension, both cases are the same (F/J=3; J=3). Although Frank and John believe that components of a task can be mastered independently (and that is how they have constructed their CFL), they provide some sense of continuity and context through their lecture/ laboratory/ tutorial structure. Joy also attempts to integrate discipline knowledge in the CFL by placing it in a clinical context.

Our dimensions add some detail to this curriculum coding. For example, on *Curriculum Focus* we coded Frank and John as focusing on 'knowledge and understanding'; in their words, basic chemistry is "an ordered array of material that fits into a recognisable pattern". Joy's intentions are to enhance professional performance in the clinical context – a clearly different focus.

3.3.3 Educational Practice Centred on CFL

Related patterns appear when we examine what happens in teaching and learning. Joy puts her energies into designing authentic tasks for students, while Frank and John focus on the clarity of their academic explanations. On *Task Orientation*, F/J=1; J=4/5. All participants believe in providing *Metacognitive Support* for their students. Frank and John provide tutorial assistance and also enable students to ask for hints or explanations in the CFL package. Joy's designs provide somewhat more scaffolding by building on students' responses more closely (F/J=3; J=4).

Our dimensions provide an opportunity to look at two specific aspects in some detail – *Focus of Assessment* and *Feedback to Students*. Although there should be, and is, a clear link between *Focus of Assessment* and *Task Orientation*, the former dimension pays more attention to the actual design of the assessment tasks. Frank and John favour the traditional examination, which is not surprising for a large first year class but also is consistent with their beliefs about the knowledge and skills to be learned (F/J=1). Joy's emphasis on using clinical problem-solving in her assessment also is consistent with her beliefs (J=4).

Feedback to Students focuses on one aspect of how students' metacognitive skills might be developed. In the chemistry CFL, hints and explanations are preprogrammed and in that sense are fixed, even though they are elicited only on request by the student (F/J=fixed feedback). Joy has more opportunities in her whole course and in her CFL to provide some scaffolding for students' queries through an iterative process of guidance (J=responsive scaffolded).

4. OVERVIEW AND CONCLUSIONS

Despite important differences between the practices and customs of the university and school sectors, the two cases outlined above confirm that related phenomena are at work: academics differ in their beliefs about which forms of knowledge are valuable, how knowledge should be organised for learning, and what should occur during teaching and learning, and these differences influence the methods which they and their students use. This inference applies to the CFL as well as to other aspects of the teaching/ learning environment.

The descriptive dimensions we have used in this paper are by no means exhaustive, and some may turn out to be relatively unimportant for capturing the differences between major categories of CFL usage. We will gain some perspective on that question once the full set of 24 cases has been analysed. Nevertheless, in the interim, the dimensions used here are sufficient to demonstrate that some of the broad distinctions coded by Reeves' dimensions can be augmented by additional distinctions. For example, although Reeves' instructivist/ constructivist and didactic/ facilitative distinctions appear to accommodate the teacher-centered/ student-centered distinction made by others (Kember, 1997; Prosser *et al.*, 1994; Samuelowicz & Bain, 1992), they do not adequately describe such aspects as the nature of the understanding that is desired, the role of discussion in the learning process, and how students' conceptions are taken into account. The first two of these dimensions were important in describing the differences between the cases reported above, while the third dimension (how students' conceptions are taken into account) may be crucial in differentiating the full range of CFL practices (Bain & McNaught, 1996).

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