INFORMATION AND COMMUNICATION TECHNOLOGY IN
TEACHING: SINGAPORE UNIVERSITY TEACHERS’
PERSPECTIVES

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INFORMATION AND COMMUNICATION TECHNOLOGY IN TEACHING:
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ABSTRACT

The introduction of information and communication technology (ICT) into education has received both positive and negative responses from the stakeholders, namely, the school administrators, faculty and learners, and research into online teaching and learning has also shown both benefits and limitations offered by ICT. Indeed, resistance to ICT use is common among teachers. Studies have found that teacher beliefs about teaching and learning play a big part in teachers’ adoption of ICT use in their teaching. Similarly, contextual factors have been found to affect teachers’ response to ICT use.

The objective of this study is to explore the relationship between teachers’ understandings of teaching and learning, their understandings of ICT affordances and their use of ICT in their teaching. The area of teacher beliefs is therefore pertinent to the study. Teacher knowledge and teacher learning are discussed in relation to conceptions of teaching and ICT use. Contextual factors are also examined to complete the investigation. Informants are sampled from among engineering and non-engineering faculty at a university in Singapore. Data are collected through interviews, and lexical choices and metaphors used by informants are examined for meaning. The themes are identified and analysed based on two metaphorical models of teaching, namely, Fox’s (1983) theories of teaching and Kember and Gow’s (1994) orientations to teaching. The findings are then presented and discussed in two parts: firstly, teachers’ understandings regarding teaching and learning and regarding ICT affordances, and their use of ICT in their teaching; and secondly, contextual factors that affect teachers’ decision to use ICT.

The findings show, firstly, that face-to-face interaction, thinking and understanding, and the ‘right’ attitude are conceived by the engineering and non-engineering informants as the way that learning takes place. Secondly, the primary theories of teaching espoused by these teachers appear to be transfer and shaping theories. Thirdly, informants perceive ICT as a container, a place and a tool. These conceptions correspond to their teaching theories but only to an extent. Evident from the findings are tensions between beliefs and practice. Linked to informants’ understandings of teaching and learning and of ICT
affordances is their perception of their roles and responsibilities when they use ICT in their teaching. Fourthly, informants generally perceive ICT as playing a complementary role in their teaching. They see the teacher and learner action as the two most essential elements for effective teaching and learning. From their emphasis on learner attitude and action, informants seem to value also the constructivist theory of learning.

Contextual factors are also considered, as conditions can affect change in practice. These factors are found to include time, institutional support, and teacher and learner attitudes. In the discussion on how contextual variables interact with the pedagogical use of ICT, it is found that informants’ technological pedagogical knowledge needs to be developed and that support at policy level is needed to encourage teachers’ use of ICT.

The implications of the findings and the contributions and limitations of the study are discussed in the concluding chapter. Also included in the final chapter are suggestions for future research. It is hoped that this study will help the education community understand teachers’ expectations and the classroom challenges they face as they work with ICT. The study can also help university administrators better meet teachers’ needs with regard to teaching using ICT.
KEY WORDS

Teacher beliefs
Teacher knowledge
Teacher learning
Conceptions
Understandings
Perceptions
Technological pedagogical content knowledge (TPCK)
Information and communication technology (ICT)
Theories of teaching
Orientations to teaching
Affordances
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CHAPTER 1
INTRODUCTION

1.1 Overview
Information and communication technology (ICT) has gained prominence in education, such as in distance and self-access courses in institutions of higher learning. ICT can be used in varying degrees to enable student learning and to support teaching. For instance, learners become skilful in using the computer for study purposes, like searching for information on the Internet, working collaboratively via discussion forums or using multi-media to present information. Teachers, too, may use web capabilities to facilitate collaborative work among peers or design web-based learning activities across a range of curriculum subjects. Web-based instruction is defined as ‘the application of a repertoire of cognitively oriented instructional strategies implemented within a constructivist and collaborative learning environment, utilizing the attributes and resources of the World Wide Web’ (Relan & Gillani 1997, cited in Chou and Tsai 2002, p.634). At the same time, technology is constantly developing and producing new programmes and capabilities. Web 2.0 is the result of how the web has developed from being an information repository (Web 1.0) to being a participation platform. As a second generation of web-based communities, Web 2.0 facilitates networking and collaboration among its users. The tools of Web 2.0 include blogs, flickrs, podcasts, wikis and swickis. Tools like these allow users to own and control data, participate and share information and add value to earlier contributions as the need arises, so that Web 2.0 can be an excellent learning resource. Increasingly, educators find it difficult to ignore the possibility of change that ICT brings to teaching and learning experiences, while school administrators embrace ICT for the opportunities it offers to generate revenue from distance learning.
With more and more ICT options available in the market for computer-based education (CBE) and web-based instruction, like classroom management systems, collaboration tools and modelling capabilities, schools can select the programmes that best fit their curricula needs. However, with the introduction of ICT into educational institutions, several issues on online teaching and learning have surfaced. These issues range from theoretical to practical considerations, such as the principles and effectiveness of online instruction, the impact of technology on pedagogy, online assessment and evaluation, the role of teachers in an online class, environments for successful technology integration, classroom cultures and ICT, challenges in developing effective curricula, encouraging the use of technology, facilitating online discussions, design and development of web-based tools, faculty’s pedagogical and technological perceptions, the ‘time’ factor for faculty, faculty development and copyright issues (Mehra & Mital 2007; Sife, et al 2007; Sutherland, et al 2004; Chou & Tsai 2002; Lynch 2002; Brennan 2000a, 2000b; Cole 2001; McQuillan 1994; Willis 1993). All these issues have generated attention to improving online instruction and learning.

In education, ICT is usually introduced either as a subject in its own right or as a platform for studying other subjects. Technology is seen as an aid to ‘facilitate teaching processes’ (Bryson & de Castell, cited in Watson 2001, p.261); and because technology is new, it has also been claimed to change the way teachers teach (Sutherland, et al 2004; Hannafin & Freeman 1995; Willis 1993). As an example, use of technology is seen to promote the use of constructivist strategies (Brennan 2000a). But it has also been argued that the diffusion of innovation does not always happen among teachers (Knight, et al 2006; McQuillan 1994). Indeed, resistance to technology use is a common response among teachers (Albirini 2006; Chou & Tsai 2002; Dawes 2001; Paris 2001; Hannafin & Savenye 1993; Willis 1993). Similarly, with regard to learning, it has been argued that technology as an instructional medium does not promote learning or lead changes to learning to happen (Sutherland, et al 2004; Brennan 2000b; McQuillan 1994). Related to this is the view that ‘technologies and tools are never value-neutral…; rather, they embody and indeed interact with our values and views’ (Wilson 2004, p.544). What
seems to be needed is well-designed instruction that can maximise the potentials of technology use in teaching and learning (Brennan 2000b; Willis 1993).

With the increasing presence of ICT in the classroom, studies have been conducted on the ways in which ICT impacts teaching and learning, on teachers’ understandings of the nature and place of ICT in education, as well as on teachers’ perceptions of their role in a web-based environment (Webb & Cox 2004; Felix 2002; Rees 2002; Cole 2001; Doherty 2000; Fleta, et al 1999; Harben 1999; Verma & Mallick 1999; Reeves, date unavailable). For teachers, their understandings of the use of ICT could have implications for the work they do in the classroom and by extension, the role they play. It has been shown that teachers take on many different roles, such as manager, human engineer, leader, diplomat, cultural builder; knowledge provider, challenger/agent of change, nurturer, provider of tools, innovator, repairer, gym instructor and artist (de Guerrero & Villamil 2002; Tsui & Cheng 2000). It has also been claimed that with the use of ICT, the teacher’s role has changed from a ‘sage on the stage’ to a ‘guide on the side’ (French, et al 1999, cited in Chou & Tsai 2002, p.626). For example, when providing web links to additional material, the teachers could assign categories to the readings by level of importance, like Critical (must read), Important (should read) and Nice (could read), so as to help learners decide what materials to read and when, depending on their interest and available time. In this example, the teacher as guide provides a ‘knowledge map’ (ibid, p.627). Furthermore, teachers need to understand that for technology to be effective in the instructional setting they, as curriculum designers, should know the strengths and limitations of the technology so that where technical support is needed they can communicate their ideas clearly to the support staff (Chou & Tsai 2002). Moreover, teachers’ cultural perceptions could affect their response to technology. To illustrate, a study of cultural perceptions of high school EFL teachers in Syria toward ICT reveals that general perceptions are influenced by national and school cultures, with a tendency for conservatism toward ICT adoption in education and society (Albirini 2006).

The above example illustrates that teaching practice is tied to teacher understandings. These understandings include beliefs about teaching and learning, the nature of the
subject and the place of management decisions in the school curriculum (Bruce, et al 2006; Young 2004). Contextual factors also play a part in influencing teachers’ classroom decisions. Knowing teachers’ understandings about the place of ICT in education could help teacher trainers, practising teachers and teacher trainees to become better equipped to work with technology that has found its way into educational institutions. To know what teachers think about ICT use in teaching, it would be useful to find out the relationship between teachers’ understandings of ICT affordances, their beliefs about teaching and learning and their use of ICT. (The term ‘affordance’ refers to the ‘relations of possibility’ (van Lier 2004, p.91) and ‘action potential’ (ibid, p.92) offered by things in one’s environment. The theory of affordances is introduced in Chapter 2.) These issues related to the relationship between beliefs and practice and the implications of ICT in education are discussed more fully in chapter 2.

1.2 Rationale and significance of the study

The research site is a university in Singapore where I have been teaching in the Engineering School. My learners were studying both engineering and non-engineering subjects. The university invests much time, effort and money to acquire updated versions of Blackboard, an online learning management system, to suit its teaching and learning needs. When I started the present study, I was teaching a non-engineering subject and I had used ICT for only two years. I used it to manage lesson content and to communicate with my learners via electronic mail. I also used ICT to facilitate group work and encourage learner participation in discussion forums. As a novice ICT user, I saw ICT’s potential for learning and teaching purposes and was keen to learn more about teaching using the online platform. At the same time, I realised that among faculty, there were different responses to ICT, including negative reactions. This surprised me, especially as some colleagues had not used ICT in their own teaching yet had strong opinions about its value for teaching and learning. I thought it would be interesting to find out what my engineering and non-engineering colleagues thought about ICT and how it was used in their teaching.

This led me to a search through the literature on teacher thinking and ICT in education,
and ultimately to the focus of my study on teachers’ understandings regarding pedagogy and ICT and on cognitive metaphors in data analysis. This decision is based on several reasons. First, studies on ICT use among teachers (for example, Harris, et al 2007; Borg 2006; Shulman & Shulman 2004; Loveless 2003; Hannafin & Freeman, 1995; Wankat & Oreovicz 1993) have shown that teachers’ different views of pedagogy and their teaching practice with ICT relate to their knowledge and beliefs about teaching and learning, as well as to contextual factors that affect their teaching with ICT. This matched my interest in my colleagues’ thinking about and response to ICT in their teaching practice. Second, the introduction of Blackboard at the research site was a top-down initiative bypassing faculty’s input on the use of ICT in teaching. This could be a reason for my colleagues’ different responses to ICT use that I thought warranted investigation. Research in this area could illuminate the influence of policy on ICT in teaching practice. Third, there is a lack of studies in the area of ICT integration among academics in the Singapore context, especially in higher education. A study like mine could contribute to our understanding of how university teachers in Singapore handle this educational innovation. Lastly, studies have also shown that information on thinking can be accessed through cognitive metaphors (for example, Zhao & Frank 2003; Sfard 1998; Lakoff & Johnson 1980), an area in which I am also interested and which I saw as a possible data analysis method.

This study is potentially significant in three ways. First, it could help teachers think about the match between their preferred ways of teaching and their expectations of ICT. Second, in revealing the understandings of teachers regarding teaching and learning with ICT, the study could help the education community gain an insight into the expectations of teachers and understand the classroom challenges they face as they work with ICT. Lastly, for the university where the study was conducted, knowing faculty’s beliefs and the reasons for their responses to ICT would be useful, for instance, in helping the administrators direct their efforts more efficiently to meet faculty’s needs with regard to teaching using ICT.

Data collection for the study took place over two years, in 2004 and 2005. At the start of the data collection process, Blackboard had been in use for eight semesters, that is, four
1.3 Objective and scope of the study

The current study aims to explore the relationship between teachers’ use of ICT in their teaching, their understandings of ICT affordances (that is, the possibilities offered by ICT) and their understandings of teaching and learning. Figure 1 illustrates the theoretical framework of the study.

Research on conditions that influence teachers’ adoption of ICT (Mehra & Mital 2007; Borg 2006; Selwood & Pilkington 2005; Li 2002; McDonald & Reushle 2002; Ng 2001; Shamim 1996; Gabel 1994) has identified common environmental and contextual factors, namely, time, institutional support, teacher attitude and learner attitude (Figure 2).
The relevant areas of investigation include engineering and non-engineering teachers’ understandings regarding teaching and learning reflected through teachers’ use of ICT in light of their understanding of what ICT affords and their perceptions of their role vis-à-vis ICT use in teaching. Both engineering and non-engineering teachers are included in the study for three reasons. Firstly, the nature of the subjects that each group teaches suggests different teaching methods are used, which in turn may affect the way each group uses ICT. Next, assuming that engineers, by virtue of their training, are more inclined towards technology than non-engineering teachers are, it is possible that ICT holds different kinds of appeal to each group, thus affecting their response to ICT. Lastly, since the Engineering School has both groups of teachers on its staff, the study would seem incomplete if it included only one group.

In view of the above, the research questions are:

- What are engineering and non-engineering teachers’ understandings of teaching and learning?
- What perceptions do these teachers have of the affordances of ICT?
- How do these teachers at the university use ICT in their teaching?
- What factors influence these teachers’ use of ICT in teaching?

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**Figure 2: Contextual variables**
The study will examine teachers’ interactions with ICT from the way they describe their use of it in their teaching, and look at how the interactions relate to their understandings of ICT and of teaching and learning, namely, their view of ICT in curriculum practice.

As mentioned, the online learning environment used at the university is *Blackboard*. The term ‘online’ is used in this study to refer to any form of ICT, which includes *Blackboard*, the computer, the Internet and software programmes. It is not limited to synchronous communication instances, such as virtual chat or the virtual classroom.

This remainder of this thesis is organised in this way: chapter 2 reviews research on teacher beliefs, theories about teaching and learning, the theory of affordances, the relationship between beliefs and practice, educational change and the implications of ICT use for education; chapter 3 describes the research approach, the context of the study, the sample, the data collection and analysis methods, and ethical issues encountered in the study; chapter 4 presents the findings on teachers’ understandings of teaching and learning and their use and perceptions of ICT affordances, and discusses the relationship between them; chapter 5 examines contextual variables that might affect successful use of ICT in teaching; finally, chapter 6 concludes with a summary of the findings and discussion of the implications, contributions and limitations of the study and presents recommendations for future studies.
## CHAPTER 2
### LITERATURE REVIEW

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CHAPTER 2
LITERATURE REVIEW

This chapter describes the effect of information and communication technology (ICT) on education and its implications for teaching and learning to show the relationship between teachers’ use of ICT and their understandings of learning, teaching and ICT affordances. The areas of educational change and teacher beliefs are reviewed as background to the discussion.

2.1 Information and Communication Technology (ICT) and educational change
Over the past three decades and in many parts of the world, educational institutions have, in varying degrees, embraced ICT into their curricula. As mentioned in section 1.1, the potential benefits to be gained from ICT adoption, such as enhanced learning opportunities, the lure of financial gains especially through distance education, and the notion of being at the forefront of the education scene are some reasons institutions in higher education push their faculty to adopt ICT in their teaching (Knight, et al 2006; Noble 1998). However, in the pursuit of commercial interests, technology vendors and university policy makers view education as a commodity (Davies 1998, cited in O’Neill, et al 2004; Means, et al 2003) promising lower costs and increased revenues in the form of higher tuition fees (Noble 1998). The universities’ decision to adopt ICT with or without considering pedagogical implications has given rise to many issues (see section 1.1), which have attracted much research on online teaching and learning.

Especially where ICT use has been imposed on teachers, the assumption is that of an inadequacy in the classroom situation (Sikes 1992) and technology can be seen as a solution to poor teaching. However, ‘increased availability of ICT is not necessarily reflected in greater use’ (Selwood & Pilkington 2005, p.173). A predominant view among teachers and researchers is that technology should serve pedagogy and not the other way around (Wilson 2005; Sutherland, et al 2004; O’Sullivan 2001; McQuillan 1994). For instance, while it has been found that there is greater student involvement with the use of instructional technology than with the lecture method (Mehra & Mital 2007),
that technology has the potential to encourage constructivist ways of learning (Wulff, et al 2001), and that ICT ‘is an essential tool for developing understanding’ (Higgins 2001, p.170), it is also believed that ‘the effectiveness of technology ultimately depends on relationships between people’ (Ragsdale 1991, p.165) and that online learning environments ‘reflect a set of assumptions and constraints about learning and interaction that affect both teachers’ and students’ thinking and activity’ (Wilson 2005, p.544). In other words, technological, administrative and human factors in e-learning must be considered, such as the technological infrastructure and its sustainability, administrative support, incentives and rewards for faculty, the prior experience of using technology, and the values, beliefs and attitudes of learners and teachers about technology and about teaching and learning (Li 2007; Mehra & Mital 2007; O’Neill, et al 2004; Dennis 2001; Lawson & Comber 1999).

The introduction of ICT into education may be seen as an educational change. The issue of change in education is not a new one (Daugherty, et al 2001). This section discusses how the teacher responds to change, for the teacher is regarded as a central element in the change process (Fullan 2001), and ‘if change is to happen it requires teachers to understand themselves and to be understood by others’ (Watson 2001, p.259).

Successful implementation of educational change depends on various factors – perceived need for a solution, clarity of goals and means for achieving the goals, complexity of the change required, quality of the suggested programme, social conditions and physical settings (Fullan 2001). According to Fullan (2001), the teacher is paramount to the success or failure of educational change. For example, it would help for teachers to have a sense of ‘shared ownership of something new’ (ibid, p.92) or they would find it difficult to change their behaviour (or practice) to accommodate the desired change, especially when it is an imposed change (Sikes 1992). Hence, for change to be successfully implemented by teachers, administrators need to understand that ‘change involves human, not merely technological, issues’ (Daugherty, et al 2001, p.189). Above all, teachers themselves, as subjects and agents of change (Dale 1988, cited in Sikes 1992), must have a deep understanding of what the change means to them, for ‘significant
educational change consists of changes in beliefs, teaching style, and materials, which can come about only through a process of personal development in a social context’ (Fullan 2001, p.124; emphasis in original), referring to teachers getting collegial support through talking with their peers about the meaning of change. Hence, change does not happen overnight. Time is needed for substantial change to take place and for teachers to prepare and plan for it (King 2002; Sikes 1992). And even then, behavioural change may not happen because, as mentioned, change in practice may require a change in belief and values. The difficulties for teachers to adopt change are compounded by the background of classroom demands.

The case for developing the human factor seems clear. The purpose of staff development is to help teachers ‘increase their capacity for dealing with change’ (Fullan 2001, p.123). It is believed that staff development provides teachers with the skills to use technology effectively, although it is also found that often, training sessions are focussed on tools and not on strategies to use them well (Young 2004). The creation of a learning community (Dawes 2001; Fullan 2001) is deemed essential to success in change implementation, as teachers benefit through ‘sharing of instructional resources and reflections in practice’ (Fullan 2001, pp.129-130).

On the relationship between behaviour and belief, two views are considered. One view is that ‘changes in behaviour precede rather than follow changes in belief’ (Fullan 2001, p.92), that ‘teachers’ beliefs can only be modified while teachers are in the thick of change – taking risks and facing uncertainty’ (Sandholtz, et al 1997, cited in Towndrow & Vallance 2004, p.180). The contrasting view is that ‘change is influenced by the teachers’ ideologies: in other words, by the beliefs and values’ (Sikes 1992, p.38). Taking both views into account, I recognise that the relationship between behavioural and belief change is ongoing and reciprocal (Fullan 2001), and that it is ‘not possible to change one aspect (of the teaching process) without affecting all the others’ (Sikes 1992. p.38).

One may ask how ICT as an educational change has been received by the teaching community. While it is believed that a small group of innovators is needed for the
adoption of the innovation to be diffused among their peers, this has not happened with ICT in schools or universities (Watson 2001). One reason given relates to the teacher (Hannafin & Savenye 1993). To illustrate, teachers resist adopting the innovation as they fear appearing incompetent at handling technology or they fear ‘losing control of “centre stage”’ (ibid, p.27). Hannafin and Savenye (1993) assert that ‘teaching with a computer requires not only technical proficiency but also the acceptance of a decidedly different role’ (p.28). If indeed the teacher is key to the success or failure of change implementation (Fullan 2001; Sikes 1992), then the issue of teacher beliefs should be examined. There is, in fact, general consensus that the study of teacher beliefs is useful in the study of teaching (Borg 2006, 2003; Fung & Chow 2002; Wankat & Oreovicz 1993; Pajares 1992), especially for understanding the teaching process and ways of improving teaching (Donaghue 2003; Hativa & Goodyear 2002). The following section reviews work done in the area of teacher beliefs.

2.2 Teacher beliefs

Beliefs can be defined as ‘judgements and evaluations that we make about ourselves, about others, and about the world around us. Beliefs are generalisations about things such as causality or the meaning of specific actions’ (Yero 2002, p.21; emphasis in original). Beliefs can be challenged and questioned in order to bring about change (Burns 1992). Beliefs are thought to arise from one’s experiences, especially those from one’s childhood, or from one’s observations (Yero 2002), or what Nespor (1987) calls ‘critical episodes’ (p.320). It is also thought that beliefs ‘support and reflect our values’ (Yero 2002, p.26; Borg 2001) and ‘guide people’s thinking and action’ (Borg 2001, p.186). So, if teachers value interaction with learners to facilitate learning, they are likely to carry out that belief in the classroom and in the process influence their learners (Yero 2002). However, beliefs ‘frequently involve moods, feelings, emotions and subjective evaluations’ (Nespor 1987, p.323) and may be conscious or unconscious, so that one may be aware of certain beliefs that one holds but is unconscious of others (Borg 2001).

Teacher beliefs are ‘personalised theories (that) lie at the heart of teaching and learning’ (Burns 1992, p.64). Beliefs do not change easily (Pajares 1992) and are thought to be
‘more inflexible and less dynamic than knowledge systems’ (p.311) because the affective components in belief systems are ‘not open to outside evaluation or critical examination’ (Nespor 1987, p.321). Beliefs are sometimes viewed as a part of teachers’ practical knowledge (Borg 2006, 2003; Gabel 1994; Pajares 1992; Feiman-Nemser & Floden 1986). As mentioned, beliefs may change, and to change teachers’ beliefs, there need to be ‘alternative or new beliefs to replace the old’ (Nespor 1987, p.326). Therefore, ‘to understand teaching from teachers’ perspectives we have to understand the beliefs with which they define their work’ (ibid, p.323).

2.2.1 Relationship between beliefs and practice

Studies on teacher beliefs (Hativa & Goodyear 2002; Martin, et al 2002; Yero 2002; Murphy 2000; Borg 1999; Bailey & Nunan 1996; Dunkin 1995; Burns 1992; Brousseau, et al 1988) discuss how teachers’ beliefs about their role, their learners and their discipline ‘are a critical ingredient in the factors that determine what happens in classrooms’ (Gabel 1994, p.64; Bruner 1999; Hannafin & Freeman, 1995). They also show ‘an interplay between belief and decision-making’ (Burns 1992, p.63), the relationship between beliefs and teaching practice (Loveless 2003; Loveless, et al 2001; Wehling & Charters 1969), teaching styles, approaches, strategies and methodologies (Ramsden 1992, cited in Kolari & Savander-Ranne 2002; Turner-Bisset 2001; Trigwell & Prosser 1996; Gabel 1994; Feiman-Nemser & Floden 1986), the effect of teacher’s belief of self-efficacy on classroom practice and student attainment (Ireson, et al 1999), the difference between novice teachers’ and expert teachers’ understandings of teaching (Meskill, et al 2002; Milne & Taylor 1995), and the relationship between teacher beliefs and educational reform (Gabel 1994; Wankat & Oreovicz 1993). However, teacher beliefs are not ‘simple cohesive systems which have a direct causal bearing on teachers’ actions’ (O’Loughlin 1990, cited in Gabel 1994, p.61). In his study, Borg (2006) concluded that the relationship between teacher cognition and practice is neither linear nor unidirectional, and that change in one does not necessarily imply a change in the other. Here, contextual factors are found to play an ‘intermediating influence’ on teacher cognition (ibid, p.275). Examples of contextual factors include the curriculum, the educational setting, and teaching and learning theories espoused by practitioners.
Just as there is research showing strong links between teacher beliefs about knowledge, teaching and learning and classroom practice (Borg 2006, 1999; Phillips & Soltis 2004; Trigwell, et al 2002; Yero 2002), there are also studies showing incongruence between teachers’ espoused theories of teaching and their classroom practice (Fung & Chow 2002; Murray & MacDonald 1997; Benson 1989, cited in Gabel 1994). For example, in their study with student teachers in physical education, Fung and Chow (2002) found that teachers’ espoused views of teaching do not concur with their actual classroom practices. It was found that while the teachers thought themselves to be student-centred in their teaching approach, they were, in fact, teacher-centred, acting as transmitters of knowledge and as role models for their students, and thereby assuming the role of subject-matter expert (p.319).

Questions have also been raised as to how understanding teaching conceptions can improve teaching (Murray & MacDonald 1997). Similarly, there is lack of consensus on whether it is possible to change teacher beliefs and conceptions. Hativa (2002) and Radloff (2002), for example, claim it can be done, as results from their studies suggest. For instance, in Hativa’s (2002) study, after undergoing an instructional treatment, the two professors who had held poor conceptions of themselves and ‘harmful beliefs’ (p.313) about their students reported a change in conceptions and beliefs, and consequently, a change in their classroom behaviours. On the other hand, in his study on teacher beliefs about technology use, Churchill (2006) found that teachers’ reflections on their own theories on learning did not necessarily lead them to change their classroom practice. (In teacher research, reflection is used as a tool for change – see, for example, Shulman & Shulman 2004; McAlpine & Weston 2002). This was due in particular to constraints such as assessment requirements and the way in which management communicated and implemented changes. This is supported by other studies showing how teachers’ theories of teaching and learning interact with and influence teachers’ actions (Samuelowicz & Bain 1992; Cornett, Yeotis & Terwillinger 1990; Benson 1989 cited in Gabel 1994).
Hence, there seems also to be a need to consider the impact of contextual factors on teaching, for these factors ‘can have powerful influences on teachers’ beliefs and affect their classroom practice’ (Fang 1996, cited in Hativa & Goodyear 2002, p.340), and to recognise that ‘attention to these factors is central to a fuller understanding of teachers’ thoughts and actions’ (Borg 2006, p.16). The term context refers to the ‘social, institutional, instructional and physical settings’ (ibid, p.275). For instance, on ICT use, conditions in the teaching environment influence teachers’ decision to use ICT and the extent of use (Mehra & Mital 2007; Selwood & Pilkington 2005). These contextual variables include age and educational background of teachers, teaching and administration workload, experience with ICT, availability of ICT resources and types of ICT training. Another important aspect of context is the cultural context of the classroom (Li 2002; McDonald & Reushle 2002; Ng 2001; Shamim 1996; Gabel 1994). In Shamim’s (1996) study in a Pakistani classroom, for example, it was found that implicit cultural beliefs of her students, such as perceptions of a teacher’s authority and assumptions about appropriate classroom behaviour, played a big part in learner resistance to new teaching methodology. Similarly, Ng (2001) describes Asian learners from various Asian countries, such as Singapore, Japan, Korea and China, as being highly examination-oriented, silent and passive, unwilling to take charge of the learning process but viewing the teacher as the expert source of knowledge, not questioning and therefore, not challenging authority, afraid to take risks and to fail, and in the face of conflict, unwilling to openly contradict the other party. Therefore, the influence of the classroom context on teachers’ beliefs and changing classroom practice needs to be acknowledged, for ‘although classrooms are very dynamic, they can also be very resistant to change’ (Watkins & Mortimore 1999, p.6).

As seen, educational research has produced contrasting evidence on the relationship between teacher beliefs and classroom practice. The study of this relationship remains relevant so that we may more fully understand the teaching process (Borg 2006) and make sense of the ‘ill-defined’ (Nespor 1987, p.324) problems in the contexts and environments that teachers work in.
2.2.2 Terminology

In teacher cognition research, the broad terms attitudes, beliefs, perceptions, concepts, conceptions, cognition, thinking, images, understandings, theories, orientations and knowledge have been used, among numerous others, highlighting multiple concepts of teacher thinking (see Borg 2006 and Pajares 1992 for a review of this). For example, Nespor (1987) distinguished between beliefs and knowledge systems (p.319), but Dunkin (1995) did not distinguish between beliefs and knowledge when studying teachers’ concepts of teaching. Dunkin (1995) compared novice and expert teachers’ beliefs about teaching effectiveness to find out ‘what counts as knowledge about teaching’ or what teachers’ ‘conceptual repertoire’ (p.22) is. Similarly, Woods’ (1996) study of teachers’ beliefs, assumptions and knowledge showed how thinking is closely related to beliefs. These multiple concepts seem to embody the same characteristics as teacher cognition, though in varying degrees – ‘teacher cognition has a practical orientation, is personally defined, often tacit, systematic and dynamic. …teacher cognition is also highly context-sensitive’ (Borg 2006, p.271). These characteristics highlight the complex nature of teacher thinking.

At this point, clarification must be made regarding the use of terminology in this thesis. This thesis uses interchangeably the terms beliefs, perceptions, conceptions, understanding, thinking and knowledge, as the intent of the study is not to examine the complex nature of teacher beliefs or teacher cognition but to understand teachers’ choice of ICT use, choices which could be influenced by their knowledge, conceptions, beliefs or perceptions. One could argue that knowledge should be distinguished from belief. However, as Dunkin (1995) found out, teachers’ beliefs illustrate their ‘conceptual repertoire’ (p.22). This is supported by Shulman (1999), who outlined seven ‘categories of knowledge that underlie teacher understanding’ (p.64). These studies suggest that knowledge, understanding and belief are closely related.

Following the background discussion on the introduction of ICT as an educational change and the place of teacher beliefs in educational research, the next three sections will look
at conceptions of learning, conceptions of teaching and teachers’ beliefs about technology.

2.3 Conceptions of learning
Learning theories explain the way people learn. A teacher who knows how their students learn can select content and design activities that best suit the way they learn. There are, however, many different theories about how people learn. In this section, the discussion moves from an overview of these theories to conceptions of learning in higher education and, where applicable, engineering education.

2.3.1 An overview
First, learning is commonly conceived of as either a product or a process. As a product, learning could be a transfer of facts, an increase in knowledge, an accumulation of new information in memory, the appropriate and competent application of knowledge, the ability to abstract meaning, the ability to interpret and understand reality, or the change brought about in a person’s behaviour and/or understanding (Bain & McNaught 2006; Bruce, et al 2006; James 2006; Leach & Moon 1999; Smith 1999; Dunkin 1995; Glaser & Bassok 1989; Säljö 1979). As a process, the focus is on how learning takes place. The key question is: To what extent is the learner aware of what is going on? (Smith 1999) This is similar to the perspective of learning as ‘an object of reflection’ (Säljö 1979, p.446), that is, learning is thematized, where the learner is aware of the learning process and talks about it, such as when reflecting on the different approaches and strategies available for learning. The result of this awareness of one’s own learning may be that one becomes better equipped to deal with learning difficulties that one may meet along the way (ibid, p.451).

Next, learning is believed to happen at two levels – the individual and the social. This is evident in various perspectives on learning, such as information processing, behaviourist and cognitive orientations to learning (Smith 1999); constructivism (Chou & Tsai 2002; Brennan 2000a; Wankat & Oreovicz 1993); and social orientation, that is, building a learning community (Joyce, et al 1997). Early theories emphasized the learner as an
individual in the learning process. According to the classical theories of learning offered by Plato and Locke and behaviourist views offered by scientists like Pavlov and Skinner, the learner ‘may be a passive recipient of stimulation or experience’ (Phillips & Soltis 2004, p.53; Dunn 2000; Watkins & Mortimore 1999). The Gestalt approach to learning, on the other hand, stresses the importance of insight and activity in learning, especially in problem-solving. Work on learning theories by researchers like Dewey and Piaget builds on this concept and holds that learning takes place when the learner actively explores and interacts with the environment. In other words, the learner constructs meaning through experience. Developmentally, the learning process may be conceived of in this way: acquiring information, building up knowledge, applying knowledge and skills, making sense of ideas and the real world, and finally, developing as a person (Säljö 1979, cited in Hativa & Goodyear 2002). Whether passive or active, the learner is believed to be born with a mechanism that enables learning, even learning on their own, as they go through the stages of cognitive development. However, later work on learning theories, in particular the work of Vygotsky and Lave and Wenger, emphasize the social nature of learning. Vygotsky’s idea is that interaction with others, or guidance from adults and peers, draws on the young learner’s potential to learn and ability to imitate and eventually develop higher faculties of thinking. Lave and Wenger take this notion further in their communities-of-practice model where engagement is essential to learning (Smith 2003). In this model, the novice learns from the periphery of the community, but as they grow more proficient in their craft, they move to the centre of the community and so become ‘full participants’ (Phillips & Soltis 2004, p. 63).

Metaphors used to describe learners and the learning process (Inbar 1996, cited in Yero 2002; Ellis 2001; Sfard 1998; Gabel 1994) also indicate conceptions of learning. A metaphor is a ‘rhetorical and conceptual device’ (Zhao & Frank 2003, p.833). (Chapter 3 discusses the use of metaphors in revealing how a person seeks to understand concepts and experiences.) For example, the conduit metaphor is a dominant image in education, suggesting that education involves the act of transferring objects, like knowledge and skills (Yero 2002; Gabel 1994). Learning is often seen as a journey and knowledge as ‘a landscape across which the learning journey travels’ (Yero 2002, p.44-45). Similarly, the
learner is viewed by the teacher, among many other things, as a sponge absorbing knowledge; receptacle of knowledge; clay in the potter’s hands to be shaped by the expert craftsman (the teacher); and tiny seedling or delicate bud requiring the right environment to grow and develop (ibid, pp.63, 66-67). Each of these metaphors suggests a particular view of knowledge, the learner and the learning process. As can be seen, these metaphors reflect the conceptions described above, such as learning as a transfer of information and learning as a process through which the learner develops as a person.

2.3.2 Application to higher education and engineering education
Conceptions of learning in higher education and engineering education can be reviewed by way of the definitions assigned to the notion of learning. These conceptions include reception/processing of information, experiential learning, constructivism and social learning.

2.3.2.1 Reception/Processing of information
One view of learning is that it is ‘a two-step process involving the reception and processing of information’ (Felder & Silverman 1988, p.674). The reception step sees the learner accepting or rejecting information gathered from external stimuli or arising from introspection. The processing step ‘may involve simple memorisation or inductive or deductive reasoning, reflection or action, and introspection or interaction with others’ (Felder & Silverman 1988, p.674). It is found that engineering students in particular display five categories of learning styles, namely, intuitive, auditory, deductive, reflective and sequential (ibid, p.675) but that ‘most engineering students are visual, sensing, inductive, active, and some of the creative students are global’ (ibid, p.680).

2.3.2.2 Experiential learning
Another view of learning is that it is ‘a process whereby knowledge is created through the transformation of experience’ (Kolari & Savander-Ranne 2002, p.61). This is known as experiential learning, which emphasises that knowledge comes from ‘grasping experience and transforming it’ (ibid). In other words, this theory views experience as playing a central role in learning. To illustrate, let us consider the use of laboratory sessions. In
such sessions, learners gain concrete experience of abstract concepts. They are first given a problem to solve, which leads to disequilibrium. Disequilibrium happens when one’s previous knowledge about a topic is challenged, so that one seeks an answer to the problem that one faces. This is followed by a discussion of new terms to help learners accommodate the new data. Lastly, learners try out more exercises to link new information to existing knowledge so as to retain the new information (Felder et al, 2000; Wanket & Oreovicz, 1993).

The theory of experiential learning draws from Kolb’s (1984) Learning Style Inventory, created to assess individual learners’ orientations to learning. In Kolb’s model are four ways of grasping and transforming experience, namely, concrete experience, reflective observation, abstract conceptualisation and active experimentation. Hence, in grasping experience, learners may perceive new information through relying on sensing the concrete world, that is, through concrete experience; or they may grasp new information through analysing and planning, that is, through abstract conceptualisation. In the same way, when processing or transforming experience, learners may observe others and reflect on what is happening, that is, through reflective observation; or they may want to get into the task right away, that is, active experimentation. Kolb’s model also describes four learning styles, namely, convergent, divergent, assimilation and accommodative. The notion of learning styles is associated with experiential learning to explain how learners choose the best method of learning to cope with the different forms of knowledge that they encounter. To illustrate, in a problem-solving situation, learners with an accommodating learning style prefer to work with other people rather than analyse the problem on their own. Research suggests that the typical engineers, scientists and technologists are convergers and assimilators (Wankat & Oreovicz 1993). This means that these professionals learn best through acquiring knowledge and developing concepts, as well as through knowing how something works and therefore how to apply this knowledge. This aligns with the views of engineering informants in the current study regarding what is important in teaching and learning engineering subjects.
2.3.2.3 *Constructivism*

A third view of learning is the constructivist view, which defines learning as a process in which ‘learners actively create, interpret, and reorganise knowledge in individual ways… when (they) reconcile formal instructional experiences with their existing knowledge, with the cultural and social contexts in which ideas occur, and with a host of other influences that serve to mediate understanding’ (Windschitl 1999, reproduced in Abbeduto 2006, p.151). A simple application of constructivist learning is in *active learning*, which proposes that learners ‘must be actively engaged in their learning for it to be effective’, where the teacher provides the structure for activities and where engagement in activities occurs ‘in small groups under their own direction’ (Lander, et al 1995, p.53).

In a constructivist environment, ‘learning is problem solving based on personal discovery, and the learner is intrinsically motivated’ (Cooper 1993, p.17). The learner engages in dialogue with the teacher, asking questions, and exploring ideas and assessing previously known information, as well as collaborates with their peers. Constructivist learning is, therefore, interactive and collaborative. In constructivist learning, the learner uses the induction method to discover meaning from problems or data, and reflects on these experiences. Therefore, knowledge is not stagnant but is constantly evolving as the learner compares new knowledge with what is already known. As in experiential learning, the premise in constructivist learning is that one develops cognitively when one is able to accommodate new information into one’s existing mental structures so that one returns to a state of equilibrium. A state of disequilibrium may motivate one to either change the structure or reject the new information. This learning is done in a social setting where one learns in collaboration with one’s peers (Gabel 1994).

In case it is misunderstood that constructivist learning comprises just one way of learning, it must be clarified here that as an approach, constructivism ‘gives space and opportunity for various learning styles’ (Kolari & Savander-Ranne 2002, p.67), allowing that ‘students develop their own styles and preferences for learning using a variety of different resources’ (Brennan 2000a, online).
2.3.2.4 Social learning

The social nature of learning is proposed by researchers such as Dewey and Vygotsky (Phillips & Soltis 2004), who see the role of education as that of preparing humans ‘for more complex activity in the larger social community’ (Glassman 2001, p.4). Social learning theory clearly deviates from Piaget’s idea of the learner as a lone scientist; instead, it sees the learner as a social being who learns through interaction with others, specifically, through observing other people (Smith 1999). An example of learning through interaction is learning through talk (Alexander 2005b), as ‘talking, thinking and knowing are intimately connected’ (p.10). As with constructivist learning, inquiry plays a critical role in social learning, as the learner ‘is forced to confront issues not easily reconciled by current thinking’ (Glassman 2001, p.10). But when engaging with others in problem-solving, the learner uses the medium of the spoken language to communicate ideas. Learning results when ‘the concepts and relationships captured in language are transmitted and acquired in a social medium’ (Phillips & Soltis 2004, p.59). This is similar to Vygotsky’s notion of ‘scaffolding’ (Alexander 2005b, p.11), for in the course of interaction, there may be ‘the use of carefully structured interventions to bridge…the gap between the (learner’s) existing knowledge and ways of solving problems unaided and the understanding which can be attained only with the guidance of the teacher or a ‘more capable peer’ (Alexander 2005b, p.11). In this sense, learning progresses ‘not from the individual to the social, but from the social to the individual’ (ibid).

There are two extended notions of social learning – collaborative learning and situated learning. Collaborative learning is applicable in online learning and in group work in face-to-face classes (Lea 2005). In this approach, ‘learning is a social activity… in which the autonomous student learner is seen to take responsibility for his/her own learning’ (ibid). Situated learning views learning as participating in a community of practice (Smith, 1999). Again, the key concept here is engagement in a social setting. To illustrate, let’s consider a class of engineering students. These students form a community, though on a smaller scale. Their task as learners is to work together not only to gain more knowledge or to solve problems but also ‘to develop leadership skills,
communication, conflict resolution and time management skills’ (Felder, et al 2000, online). To function effectively in the wider sociocultural context, students will have to learn to apply multiple intelligences, social intelligences, creativity and intuition (Kezar 2005). Thus, it seems to me, social learning to ‘foster such human qualities’ (Barnett & Hallam 1999, p.138) is what higher education should aim to achieve, alongside its traditional emphasis on ‘abstract learning and pure reason’ (Kezar 2005, p.54).

Knowing conceptions of learning that apply to higher education and engineering education is only one piece of the puzzle to understanding what happens in the learning process. It is also necessary to know the conceptions of teaching that may affect teaching practice. The following section describes some of these conceptions.

2.4 Conceptions of teaching
A teacher performs several tasks, sometimes a few at the same time, like providing information, motivating students, catering for students’ different abilities and pace of learning, deciding the content to be taught, preparing and presenting learning materials, giving timely feedback, handling classroom equipment, keeping classroom discipline and imparting social and group skills (Phillips & Soltis 2004; Ireson, et al 1999; Verma 1999; Dunkin 1995; Anderson & Burns 1989). Despite these different functions that a teacher undertakes, teaching can be defined simply as ‘planned efforts to bring about learning in others’ (Harvey & Knight 1996, p.146) or as ‘helping students change conceptions’ (Trigwell, et al 2002, p.251). Good teaching ‘brings learners to transformation’ (Harvey & Knight 1996, p.147). However, a broad definition does not help us understand the planning and decision-making processes that a teacher goes through with regard to their teaching. Nor does it help us know the perceptions that teachers have of learners or their conceptions of the way learners learn as the teachers design and plan learning activities. What is known is that teachers hold different conceptions of what teaching is and what it involves. These different conceptions constitute personal models and theories of teaching. It is, therefore, untenable to expect that teacher conceptions can be adequately illustrated in a single framework (Åkerlind 2004). It might be useful, however, to address the topic of teacher conceptions from the angle of teacher knowledge and teacher learning, in
consideration of what knowledge base teachers have and how they use it as ‘the grounds for making choices and actions’ (Shulman 1999, p.69), and to examine how conceptions interact with practice.

This section highlights in the overview the conceptions of teaching at higher education and engineering education, followed by a review of literature on what teachers know and how they learn.

2.4.1 An overview
Teaching has been described in different ways, such as transmitting knowledge, breaking tasks down into knowledge and skills, facilitating collaborative learning, helping learners find motivation and/or become excited about learning, bringing about different perspectives of events, and changing learners’ conceptions (Bruce, et al 2006; Devlin 2006; Kember & Kwan 2002; Shulman 1999; Trigwell & Prosser 1996; Gabel 1994; Samuelowicz & Bain 1992). Related to conceptions of teaching are perceptions of the goals in education. Two primary goals in higher education have been identified, namely, enhancing students’ intellectual ability and developing interpersonal skills (Hativa & Goodyear 2002; Felder, et al 2000; Wankat & Oreovicz 1993). Other goals include helping students to apply knowledge and principles, improving oral and written communication skills, encouraging openness to diverse perspectives, and promoting independent, life-long learning skills (Hativa 1997, cited in Hativa & Goodyear 2002). In engineering education, the same goals apply, summed up as teaching students ‘to become a good problem-solver and (learn) how to learn’ (Wankat & Oreovicz 1993, p.6).

Conceptions of teaching have also been found to relate to teacher roles, teachers’ approaches to teaching and teaching methods and classroom activities (Kember & Kwan 2002; Radloff 2002; Stark 2002; Yero 2002; Leach & Moon 1999; Kember 1997, cited in Hativa & Goodyear 2002; Leach & Moon 1999; Wankat & Oreovicz 1993; Feiman-Nemser & Floden 1986). For instance, the teacher may be seen as a ‘gardener’ (Yero 2002), who is expected to know her ‘plants’ and be able to provide the right nutrients for their growth while tending them with tender loving care. This metaphor suggests the
teaching approach is likely to be one that is nurturing and tolerant of learner differences and the teaching methods likely to be constructivist, encouraging learner inquiry and promoting interaction and collaboration. Further, in higher education and engineering education, induction is thought to be more beneficial to learning than deduction (Felder, et al 2000; Felder & Silverman 1988). Hence, active learning, evident in laboratory-based experiments, inquiry-based techniques and problem-solving methods, is expected to help learners discover meaning. Co-operative learning is also proposed as an effective method to teach teamwork, communication and interpersonal skills (Felder, et al 2000), although it is acknowledged that certain conditions need to be present for cooperative learning to enhance learning, such as learners who are motivated and teachers who value facilitation of learning (Gabel 1994). Also related to conceptions of teaching is the question of educational aims and goals (Leach & Moon 1999). Higher education, for instance, seems to be focused on preparing learners for the world of work (Ireson, et al 1999). This has implication on the teaching approaches that teachers adopt.

As with conceptions of learning, conceptions of teaching can be placed on a continuum. At one end, teaching is described as ‘teacher-focussed and content-oriented, with an emphasis on the reproduction of correct information’, and at the other end, it is described as ‘student-focussed, learning-oriented, and concerned with conceptual development’ (Entwistle & Walker 2002, p.20-21). Research into science education over the past ten years, for instance, has advocated a constructivist approach to the teaching of science, where traditionally, science teachers have viewed their discipline as a body of objective knowledge and have adopted the transmission mode of teaching (Milne & Taylor 1995; Gabel 1994). Also, it has been found that conceptions of teaching should take into account learning styles as well (Felder, et al 2000). What this refers to is that there are differences in the way humans learn, so that understanding learning styles helps the teacher to adopt appropriate teaching methods or courses of action to optimise learning opportunities. It has been found that ‘most engineering courses... emphasise concepts rather than facts and use primarily lectures and readings to transmit information’ and that most professors’ teaching style does not match learners’ learning style (Felder & Silverman 1988, p.676). This could be due to the emphasis in higher education and
engineering courses on subject matter knowledge (Kolari & Savander-Ranne 2002). In fact, it is common to find teachers wanting to give learners as much knowledge as possible (Feiman-Nemser 1990, cited in Anderson & Mitchener 1994).

Metaphors of teaching have also been presented by educational researchers to illustrate conceptions of teaching. Teacher roles, in particular, can be understood through metaphors. For instance, the teacher has been seen as cook, concierge, entertainer, facilitator, information filter, manager, mediator, negotiator, pathfinder, policeman, provocateur and theme park manager (Yero 2002; Bonk 2001; Tsui and Cheng 2000; Milne & Taylor 1995; Gabel 1994). The entailments of each of these metaphors suggest different ideas of what the teacher is expected to do in the classroom. For example, as an information filter, the teacher decides what information the learner should know and functions as provider of ‘correct’ answers. But as a provocateur, the teacher presents the learner with questions and creates situations in which the learner can challenge the ‘facts’, because the teacher sees that knowledge must be individually constructed (Gabel 1994). Alternatively, teaching metaphors can be grouped into four themes: delivery, change, enlightenment and human development (Gurney 1990, cited in Yero 2002). Each of these corresponds with learning conceptions, as described (see sections 2.3.2.1 to 2.3.2.4). Delivery corresponds to the conduit metaphor; change corresponds to the view of learners as growing plants; enlightenment corresponds to the view of learning as a journey of discovery; and human development corresponds to the social and humanistic aspects of learning, that is, the view of learning as a human activity where interaction and collaboration are very important. It appears that all these themes are applicable also to teaching conceptions in higher education and engineering education (see section 3.5.2).

2.4.2 Teacher knowledge and teacher learning

In considering teacher knowledge in the current educational environment where teachers are encouraged to integrate ICT into their teaching, we begin with the types of knowledge that a teacher needs to have to do their job well. The primary components of teacher knowledge have been identified as content knowledge, pedagogic knowledge and technological knowledge (Harris, et al 2007; McCormick & Scrimshaw 2001). Content,
pedagogy and technology are viewed as interrelated aspects of teacher knowledge (Harris, et al 2007) giving rise to the following intersections: pedagogical content knowledge, technological pedagogical knowledge and technological content knowledge. In other words, teacher knowledge is ‘a complex mixture of knowing how [procedural knowledge] and knowing that [declarative knowledge]’ (Fisher, et al 2006, p.7). At the core of the intersections of these facets of knowledge is technological pedagogical content knowledge (TPCK) (Harris, et al 2007). Put simply, this means that a teacher working with ICT must know not only what ICT affords for teaching and learning, but also how ICT can be used to teach content in different ways to meet learners’ needs and bring about learning. The interaction, therefore, of these types of knowledge, represented by TPCK, helps teachers to cope with the diverse challenges of teaching.

The issue of professional learning is relevant to examining how conceptions interact with practice, where both the individual and social aspects of teacher knowledge are taken into account (Fisher, et al 2006, p.8). Teacher learning is seen as ‘an active, experiential process, through which knowledge is enacted, constructed and revised…. subject to many influences… (and) is complex and resistant to standardisation’ (ibid, p.2). Learning as they teach thus enables teachers to become knowledge builders, collaborators and reflexive practitioners (Fisher, et al 2006), aspects that are in line with the concept of ‘pedagogy’ (Banks, et al 1999). Together, the features of vision, motivation, understanding, practice, reflection and community (Shulman & Shulman 2004) reflect what it means to be a teacher – one who is ready, willing, able to teach and learn, and who is a member of the professional community.

Besides personal factors, contextual factors, such as school ethos and practices, have been found to influence teacher learning, so that learning may be viewed as taking place in ‘activity systems’ (Fisher, et al 2006, p.13). In other words, teacher learning occurs when there is purposeful activity, use of a variety of tools and resource sharing with other learners (Fisher, et al 2006). In the case of ICT in education, Loveless et al (2001) assert that practice is changed not by technology but by the people who use it, as their knowledge, understanding, skills, beliefs and goals change. Teacher learning thus
considers teachers’ response to learning (to teach), that is, how teachers learn and adapt to new approaches and ways of teaching, such as knowing what potential ICT affordances offer to enhance learning environments (Fisher, et al 2006), as well as understanding how teacher learning develops within communities and contexts, like institutional learning and the policy environment, as ‘the individual and community levels are both independent and interactive’ (Shulman & Shulman 2004, p.267). The issue of policy brings to the fore debates and tensions about pedagogy/curriculum and policy (Fisher, et al 2006). According to Shulman and Shulman (2004), ‘the policy world is both the sustainer and the executioner of the innovations in teaching and learning that occupy our attention’ (p.268). As such, policy makers (and management) are responsible for providing resources, or metaphorically capital, like curriculum, technical support and staff development (ibid). For instance, time to develop skills and confidence in using ICT was found to be teachers’ biggest challenge (Moseley, et al 1999, cited in Fisher, et al 2006). Thus, to understand how teaching conceptions interact with practice and ‘to answer the question of why ambitious reforms appear to work successfully in one setting only to fail, in whole or in part, in others’ (Shulman & Shulman 2004, p.269), we must also take into account the conditions under which improvement of teaching practice can take place.

2.5 Beliefs about technology

As mentioned in section 2.2, teacher beliefs are related to their pedagogical choices and behaviour. So, too, are teachers’ perception and knowledge of the affordances they have in the teaching environment (Loveless 2003; Shulman 1999). This section describes briefly metaphorical conceptualisations of ICT in education and the theory of affordances to highlight teacher understandings of ICT, and examines the relationship between ICT and practice.

2.5.1 Metaphors for ICT in education

In the literature on ICT in education, a range of metaphors for ICT can be found to illustrate conceptions of ICT. Some examples are provided below.
Metaphor is considered to be ‘pervasive in everyday life, not just in language but in thought and action’ (Lakoff & Johnson 1980, p.3-4), as our conceptual system is thought to be metaphorical in nature. Metaphor is, therefore, recognised as a way of understanding a person’s thought and experience (Gibbs 1999). Metaphors are known to be grounded and structured; they have relationships within their structures and are defined in terms of our natural experiences (Pugh, et al 1992). An example of a common metaphorical concept that is often cited is Lakoff and Johnson’s (1980) ARGUMENT IS WAR metaphor, which is reflected in various everyday expressions such as \textit{attack a position}, \textit{strategy} and \textit{gain ground} (p.7). Metaphors have also been described as ‘sense-making tools’, ‘bridge’ and ‘translators’ of experience (Koro-Ljungberg 2001, p.371-372). Within metaphor research, metaphor is seen as signifying ‘an “aboutness” relation’ (Evans, date unavailable, p.3), so that the use of metaphor ‘facilitates activation of a range of cognitive models, and thus increases the range of information provided’ (ibid).

Conceptual metaphors for ICT – stretching from ICT terminology to the role of ICT in the change process (Czerniewicz, et al 2007) – can be grouped as follows: \textit{machine} to describe the computer as an object with no life or personality; \textit{web} and \textit{network} to illustrate the interconnectedness of web-based technologies; \textit{tool} (a dominant conception) and the related \textit{vehicle} to highlight the efficiency of ICT in performing specific tasks; \textit{library} (and negatively, \textit{dump}) to describe ICT as access to content; (\textit{larger}) \textit{classroom} to illustrate the use of ICT in extending communication; \textit{door}, \textit{horizons} and \textit{staircase} to signify the use of ICT for improvement and is, therefore, related to the idea of progress; and \textit{ecology} and \textit{bloodstream}, from a systemic approach, to describe how ICT features in the change process. The idea of ecology is broached also by Zhao and Frank (2003), whose ecological metaphor is used to show how factors interact to affect technology uses in schools, suggesting an evolutionary (as opposed to a revolutionary) approach to ICT adoption in schools. In their ecological model, schools are ecosystems, computer uses are living species, teachers are members of a keystone species and external educational innovations are invasions of exotic species. Their model emphasises ‘interactions, activities, processes, and practices’ (ibid, p.833). They suggest that success of ICT integration depends on the qualities of computer uses and users, and interactions between
the users and the (ecosystem) environment. It is through the dynamic process of interaction that ‘the species co-evolve and adapt to each other’ (ibid, p.817); applied to ICT and practice, this can be seen in the teacher’s role changing from instructor to facilitator and the computer used as a tool to support that.

More examples of conceptual metaphors for ICT are found in Pulkkinen (2003). To begin, ICT is seen as a product or as an object, like package, which could refer to software and courseware, and resource, which links learning content to the processes of learning as other elements in the learning process, like learners and teachers, are included. ICT is also conceptualised as an instrument, as in tool, for solving a problem, manipulating data, as well as communicating and collaborating with others. Related metaphors are aid, support and assistant. Together with tool, they suggest that ICT in education is a means to an end, that is, ICT in itself does not change education; it is only through the use of ICT does change happen. Next, ICT is seen as being related to transport, such as vehicle, information highway, post and avenue, where information and ideas are moved from one place to another. The idea of ICT as a flow is reinforced with reference to the contracted form ‘e-’ (for ‘electronic’) in expressions such as ‘e-learning’ and ‘email’. This electricity-related metaphor for ICT suggests that information and communication via ICT flow like electricity from place to place, so that electricity is now the delivery method, and ICT is no longer seen as a tool but as a (new) way of delivering education (compared to the traditional face-to-face classroom) where learners have the freedom to learn what they want, as and when they want. Another conceptual metaphor for ICT is related to interface, such as presentation, where ICT performs a mediation and communication function. Then there are environment-related metaphors, like platform, which suggests stability, a solid foundation and a two-dimensional site; room, which is three-dimensional; and space, as in ‘cyber space’ and ‘virtual world’. Last but not least, ICT is viewed in terms of social group/event/activity-related metaphors, such as distributed community, network community, and knowledge-building community, which relate these communal applications of ICT to social systems.

The above are instances of metaphors for ICT in education, suggesting the relevance of
metaphor to understanding conceptions (see section 3.5).

2.5.2 Theory of affordances

The theory of affordances, according to Gibson (1979 cited in van Lier 2004), examines the relationship between an organism or actor (animal or human) and its environment (or context). Specifically, it refers to what the environment ‘offers the animal, what it provides or furnishes, either for good or ill’ (ibid, p.91; emphasis in original) or to ‘whatever it is about the environment that contributes to the kind of interaction that occurs’ (Greeno 1994, p.338). In other words, affordances are ‘both the attributes of the ‘setting’, which can provide for action and engagement, and the potential of the ‘tool’ to enable that action and engagement’ (John & Baggott la Velle 2004, p.321). More importantly, what the environment offers is perceived by the organism in relation to itself. In other words, the organism acts on what is offered as it interprets a relevance to its needs and is, in this way, in an active relationship or engagement with its environment. This notion is similar to that of ‘capability’ (Loveless 2003), which refers to ‘an ability which is used actively, involving understanding and choice’ (Fisher, et al 2006, p.21). In this sense, ‘perception, action and interpretation are part of one dynamic process’ (van Lier 2004, p.105). Therefore, the key notions in the term ‘affordance’ are possibility, enablement, opportunities, constraints, meaning potential and action potential. ‘Affordances’ in this study are understood in terms of ICT and contextual conditions. The rest of the section elaborates on these two aspects.

In the case of ICT as an affordance, examples of its possibilities include accessibility, immediacy, speed, accuracy, interactivity, multimodality, and communication and collaboration (Fisher, et al 2006). Studies on use of technology in education provide many examples of how ICT is perceived and used to enhance teaching and learning (Yeo & Hung 2007; Rogers & Finlayson 2004; Towndrow & Vallance 2004; Forsyth 2003; Felix 2002; Larson, et al 2002; Higgins 2001; Wilson 1995; Wankat & Oreovicz 1993; Jones 1986). ICT applications reflect ‘certain assumptions about the subject domain, the nature of the learning process, prevailing teaching methodologies and other relevant knowledge from adjoining fields and disciplines’ (Noss & Pachler 1999, p.206; Song &
Grabowski 2007; Miller 2001; for a discussion of what a constructivist design process involves, see Jonassen 1994). Learning management systems are an example. These systems purport to aid the teaching and learning processes, from providing easy access to course information and materials to enabling online collaborative work to helping teachers detect plagiarism in students’ work. One such learning management system is Blackboard. Some of its features are described here to give an idea of what it offers teachers and learners. There are three main functions in the Blackboard learning system: Content creation and Delivery; Communication and Collaboration; and Assessment and Evaluation. For content creation and delivery, the system offers Powerpoint-based audio and video presentations with interactive quizzes, course cartridges from textbook providers, and web and PDA-based learning content. For communication and collaboration, the system offers online discussion forums, mentoring sessions, classes and even seminars. Finally, for assessment and evaluation, the system offers test items that incorporate media objects and mathematics equations, plagiarism detection and a secure environment for online assessments (Centre for Educational Development, 2004).

In the educational environment, ICT affordances are ‘tools which afford learners the potential to engage with activities’ (Fisher, et al 2006, p.19), as they possess features that are potentially capable of activity. So, when the learner (who, in this case, may be the teacher as well) perceives that ICT has this potential and engages with activities through ICT, learning opportunities arise from this participation and use (van Lier 2004). Examples of ICT affordances include word processing applications such as Microsoft Word and NotePad; calculating tools such as the Microsoft Excel spreadsheet (Rogers & Finlayson 2004); the digital camera (Towndrow & Vallance 2004); webcasts (Horton 2000); information repositories such as videodiscs (Wilson 1995); communication tools such as electronic mail, video conferencing and blogs; authoring tools such as HyperStudio and math-manipulation software such as Geometric Supposer (Wilson 1995); visualisation tools such as Weather Visualizer (Fishman & D’Amico 1994, cited in Yeo & Hung 2007) and Climate Visualizer (Gordin, et al 1996, cited in Yeo & Hung 2007); and language learning software such as Webquests, Hot Potatoes and collaboration tools such as iStorm and SubEthaEdit (Towndrow & Vallance 2004). As
tools, ICT affordances are conditions in the environment perceived to be capable of leading to successful teaching and learning (Greeno 1994). For instance, online communication is possible because there are affordance conditions, which in this case include at the most basic level, the computer and computer programme with communication functions.

A more inclusive notion of ICT affordances applicable to teaching practice is Fisher et al’s (2006) ‘clusters of purposeful activity’ (p.21). These are the clusters of knowledge building, distributed cognition, community and communication, and engagement. These clusters are not mutually exclusive but are ‘overlapping and interweaving aspects of activity’ (ibid). Through them, ICT affordances can be seen as tools in expressing and developing the dimensions of vision, motivation, understanding, practice, reflection and community (see section 2.4.2). To illustrate, the cognitive distribution cluster makes possible access to information and resources, so that teachers can produce more, and potentially better, learning material (Fisher, et al, 2006). In addition, these clusters exist within an activity system in an ‘interactive context’ (ibid, p.20). What this means is that ICT affordances should not be viewed as stand-alone artefacts; they should, instead, be regarded in relation to the individuals who use them – with their values, beliefs and preferences – and the context in which they are used. Context, therefore, is an important and necessary factor in Fisher et al’s (2006) description of ICT affordances. For this reason, their understanding of ICT affordances is pertinent to this study’s discussion of perceptions and use of ICT.

In spite of their potential to enhance learning and teaching, ICT affordances have not always been picked up by teachers. There are various reasons for this. One reason is that an ICT affordance may be perceived in terms of constraints (not just of opportunities) and responded to accordingly. An example is electronic mail. As written text, an email message may be taken out of its context and posted to others unknown to the original writer. Hence, teachers may choose not to convey information, especially of a sensitive and confidential nature, to their students via email, opting instead for face-to-face communication with them. Therefore, depending on the situation, the affordance of email
can be considered in terms of both the opportunity and the constraint it offers the user. Other constraints in the educational environment have been discussed (see section 2.2.1) and will not be repeated here. However, these constraints need not become barriers to picking up the affordance; critically evaluating what is offered may help (Fisher, et al 2006). An example by Jones (1986) highlights how constraints can be overcome and the affordance made relevant to the user’s needs. Here, the teacher used an adventure game in his language class ‘by dividing the game into small achievable tasks and organising his lessons so as to maximize interaction and minimise frustration’ (p.175). By doing some work, the teacher turned a commercial computer programme into useful and motivating lesson material. Another reason for teachers resisting ICT is the influence of teacher beliefs on pedagogy (see section 2.5.3). In the teaching of subject matter, an ICT affordance may be perceived as a resource, but ‘academics are not likely to adopt a teaching resource … unless it ‘fits’ with their assumptions about appropriate and viable methods for their content domain’ (Bain & McNaught 2006, p.100; Ali 2003; Loveless 2003), as it has been found that there are ‘significant connections with their subject knowledge and pedagogy’ (Rogers & Finlayson 2004, p.299; Higgins 2001). It is, therefore, suggested that ‘prior to using technology, there should be a reason to consider the need and the way to use it (and) the best ways to integrate technology with teaching and learning’ (Ali 2003, p.51-52). A third reason is related to the practices of technology implementation (see section 2.1), as it is often assumed that positive experiences that some teachers have with ICT use can be replicated by other teachers (ibid, p.52). Related to this are issues of staff development and motivation (Williams, et al 2000; Noss & Pachler 1999), both of which are instances of affordances in the teaching context.

Studies on factors influencing the use of ICT in teaching have shown the important role played by context (also described as setting or environment) (Loveless 2003; Zhao & Frank 2003, Zhao, et al 2002). Access to technological resources and ‘a supportive ‘computer culture’’ (Loveless 2003, p.315) are seen as favourable conditions for technology integration. Other conditions include technology proficiency, pedagogical compatibility (between pedagogical beliefs and technology) and social awareness (related to the innovator); distance from school culture, distance from existing practice, distance
from available technological resources, dependence on others and dependence on technological resources (related to the innovation); and human infrastructure, technological infrastructure and social support (related to the context) (Zhao, et al 2002). For example, in the interaction between distance and dependence (ibid), successful technology integration was most obviously apparent in cases with little distance from the school culture and existing practice and low dependence on others, or little distance from technology and low dependence on technology. This suggests that teachers need to know the affordances (and limitations) of ICT, how it could support their teaching practices and goals, and how to use ICT. Teachers also need to be aware of the contextual factors that will enable successful technology integration. But consideration of context alone is insufficient; to be examined also is the complex interplay between contextual features and the ICT user so as to illustrate the relationship between ICT and practice. In their use of an ecological metaphor to describe the interaction between ICT and the components of the ecological system, such as teachers and subjects taught in the school, and to explain how this interaction affects technology uses in schools, Zhao and Frank (2003) conclude that successful integration of technology in schools depends on ‘their compatibility with the teaching environment’ (p.813).

Other studies have shown that where contextual affordances are favourable, that is, where support and resources are available, where training and retraining of teachers is available, where rewards or incentives are present, where the transition into new teaching styles and approaches is effectively managed, where administrators and managers lead by example, and where there is a framework for thinking about change, ICT integration can be a less painful process (O’Neill, et al 2004; Mellon 2003; Gillespie & Barr 2002; Zhao, et al 2002; Ely 1999, cited in van Melle & Cimellaro 2003; Willis 1993; Sikes 1992). In contrast, contextual obstacles to ICT integration include limited access to resources and support, time constraints, curriculum pressure, the fear that technology will take away real learning, limited availability of ICT, teachers’ lack of confidence, experience and training in ICT use, lack of motivation to change teaching practices, lack of a sense of ownership, lack of a systemic approach to implementation, and teachers’ fear of losing their job (Li 2007; Ali 2003; Becta 2003; Zhao & Frank 2003; Dawes 2001; Fullan 2001;
Williams, et al 2000; Wright 2000; Willis 1993). Moreover, in higher education, research is emphasized over teaching, which is often not valued by tenure committees; as a result, professors do not see the need to enhance their teaching through ICT (Sife, et al 2007; Young 2004). Unfavourable contextual factors can, therefore, work against ICT integration in teaching.

2.5.3 Relationship between teacher beliefs and teachers’ responses to ICT
Teachers’ responses to ICT in teaching have been both positive and negative, depending on their perceptions, attitudes, expertise of and experiences with technology (Loveless 2003; Zhao & Frank 2003), such that ‘the value of any technology for education is proportional to the need for that technology to realise educational objectives’ (Brennan 2000b, online). Depending on their perceptions and use of ICT, teachers fall into different categories of response to ICT (for the different categories, see Mehra & Mital 2007; Towndrow & Vallance 2004; Mellon 2003; Gillespie & Barr 2002; Meskill, et al 2002). An example of teacher categories – cynics, moderates and adaptors – comes from Mehra and Mital (2007). Cynics have strong pedagogical beliefs and negative perceptions of ICT and are often unwilling to change; moderates, on the other hand, are ready to change and adapt to newer pedagogical practices, while adaptors continue to improve their teaching by introducing the latest technologies into the classroom (Mehra & Mital 2007). Whatever the terms used, teachers’ responses can be examined via teacher beliefs.

According to Zhao and Frank (2003), ‘most factors do not directly influence technology uses in a linear fashion; rather, their influence is mediated or filtered by teachers’ perceptions’ (p.817). They conclude that unless a teacher is positive about technology integration, they are not likely to use it in teaching. On the other hand, it is thought that change in teaching practice occurs because teachers intentionally shift to a new pedagogy and that ICT use suggests the teacher’s beliefs about teaching and learning (Loveless, et al 2001). In her study on the interaction between primary teachers’ perceptions of ICT and their pedagogy, Loveless (2003) found that perceptions of ICT among these teachers were ‘influenced by the nature of the activities which the new resources facilitated… which were authentic in the teachers’ own experience of planning, preparing and
implementing relevant learning activities’ (Loveless 2003, p.322). The study showed ‘the mutuality between the practice within the community of the school and teachers’ perceptions of ICT’ (ibid, p.323). It also found that teachers’ perceptions of ICT capability interacted with their knowledge of ICT, their content knowledge and their pedagogic knowledge, that is, their technological pedagogical content knowledge (TPCK) (see section 2.4.2). In another study, teachers who adopt ICT acknowledge the potential advantages in the technology for learning, such as motivating students ‘to participate … by exploring and playing with the lesson material … (to) provide an active, independent, student centred and tutor facilitated engagement’ (O’Neill, et al 2004, p.317). They also acknowledge its possible benefits for teaching, such as preparation time saved in creating reusable teaching materials and in sharing teaching materials and good practices; support given to the individual learner when needed as online materials are easily available; faster feedback for the purpose of formative assessments, reduced record-keeping efforts; production of better quality (multimedia) materials; and the possibility of support or intervention on learner progress and performance (Selwood & Pilkington 2005; Means, et al 2003). ICT is used when teachers recognise ‘it has a particular resonance with their pedagogic and subject philosophy’ (Watson 2001, p.260). To adopters, ICT is seen also as making possible a change in teaching strategies, especially from the transmission mode of teaching to the constructivist mode (Brennan 2000a).

On the other hand, there are teachers who resist using technology in their teaching. Teacher resistance to ICT has been found to be a ‘significant factor impeding the implementation of new delivery strategies’ (Brennan 2000a, online). These teachers counter-argue that technology does not always change ways of teaching (Knight, el at 2006; Wright 2000; McQuillan 1994), perhaps because they do not see a link between ICT and their pedagogic and subject philosophy (Watson 2001). To illustrate, unless teachers see the value of learning through simulation, they may not choose to use software that creates virtual problems, cases and laboratories (Forsyth 2003). Similarly, teachers who do not value learner-centred learning may not choose to empower learners by creating individualised projects that require learners to use the Internet or certain
software programmes. Furthermore, with many variables at work in improving learner performance, ‘there is little or no evidence that technology actually improves instruction’ (Paris 2000, p.96; Higgins 2001). A similar claim is reported by Mehra and Mital (2007) that there is no significant relationship between pedagogy and perceived usefulness of ICT. Teachers’ resistance could also stem from teachers having their own set of theories and models of teaching and learning (Wilson 2005; Hannafin & Freeman 1995). As an example, learner variables are believed to be an important consideration in online teaching, like different learning styles, so that ‘online courses must be appropriate for both traditional and non-traditional students’ (Brennan 2000b, online). A second example is the belief that the teacher is mainly responsible for what happens in the classroom (Jedskog & Nissen 2004; Wright 2000) and hence, classrooms (where, traditionally, learning happens) cannot be without the teacher (Selinger 2001). An explanation for this view is that when students engage in online learning, ‘teachers do not have the same opportunity as before – when all of them were in the classroom – to follow and control pupil work’ (Selinger 2001, p.42). Shifting ‘influence and power’ (ibid, p.43) from teacher to learner is something not all teachers are comfortable doing. In addition, ICT use may be conceived as a threat to established ways of teaching (Herrington & Oliver 2001) and thus a threat to job security.

Closely related to teacher beliefs is the question of teachers’ perception of their roles in the online environment (Sife, et al 2007; Liu, et al 2005; Scrimshaw 2001; Gabel 1994; Hannafin & Savenye 1993). To some teachers, teaching with ICT is a new experience, so it is necessary to look at the online instructor’s role (Maor 2003; Selinger 2001). Teachers’ roles can be located on a continuum – at one end is the teacher as director, expert and supplier of knowledge (Carey 1993; Hannafin & Savenye 1993), and at the other end is the teacher as advisor, coach, facilitator, guide, manager and observer (Spanier 2001; Hannafin & Savenye 1993). One argument is that ICT might not, after all, replace the TEACHER AS SAGE image, as increased access to ‘packaged information’ (McDonald & Reushle 2002, online) may result in reinforcing the traditional model and ‘the gains achieved in terms of access and efficiency might not correspond to gains in depth of learning and understanding’ (Paris 2001, p.98). On the other hand, in higher
education, the online lecturer is administrator, guide, technical support and evaluator (O’Neill, et al 2004). (See section 2.4.1 for more teacher roles.) The new roles, when accepted, may entail a change in conceptions of teaching and teaching styles, and require well-designed instruction (Miller 2001; Brennan 2000b; Willis 1993). Again, this may not be acceptable to teachers for it is not easy to change conceptions (see section 2.2) – ‘change in people’s worldviews and core assumptions are often the most difficult to make’ (Kezar 2005, p.55) – and thus teachers resist using ICT.

If it is accepted that effective education is important, then ICT should be used to enhance education rather than drive curricular and pedagogical practices (Snyder 2001). Studies have shown the importance of considering the interactions between teachers’ perceptions of ICT and their pedagogy (Harris, et al 2007; Loveless 2003), that current approaches to technology integration in the classroom are often inadequate, for they focus on technological capabilities rather than on the interaction of the interdependent components of content, pedagogy and technology (Harris, et al 2007). A recommendation is for teacher learning and staff development programmes to be focused not only on the use of ICT but also on how to teach content with ICT, that is, weaving content, pedagogy and technology into TPCK-based approaches and activities (Harris, et al 2007; see section 2.4.2 for a description of TPCK), for in teaching with technology, ‘improving pedagogy … cannot be a matter of a technological fix’ (Barnett & Hallam 1999, p.145).

In relation to ICT as an educational change, if we view teachers as ‘active agents rather than passive workers’ (Feiman-Nemser & Floden 1986, p.523), we acknowledge that they are ‘constructing perspectives and choosing actions’ (ibid). Not only are teachers change agents, they themselves undergo change (Fisher, et al 2006), and therefore, their values and views matter (Wilson 2005). This reinforces the current study’s stance that it is important to consider teacher beliefs about teaching and learning and their perceptions of ICT affordances for an understanding of teachers’ pedagogical reasoning and for significant changes in the classroom (Harris, et al 2007; Bruce, et al 2006; Webb & Cox 2004; Gabel 1994). For instance, professional development programmes could recognise how teachers’ perceptions of the purpose and potential of ICT are grounded in a
sociocultural context (Loveless 2003). Teacher awareness could be encouraged regarding the differing perspectives of ICT and its place in education. They could be helped to see that ICT affordances and limitations can be enabling and complementary (Fisher, et al 2006) or to accept the tension between perspectives and know that there are different ways in which ICT can be used in practice, as long as the tools are used appropriately (Loveless 2003).

In conclusion, in relation to the first two research questions in the current study about what engineering and non-engineering teachers’ understandings of teaching, learning and ICT affordances are, this chapter has reviewed literature relating to educational change and the impact of ICT and contextual conditions on teaching and learning. Also reviewed are beliefs about technology, beliefs about learning among faculty in higher education and in engineering education in particular, conceptions of teaching, and the relationship between teacher beliefs and teachers’ responses to ICT. The next chapter describes the research approach, context of the study, sample, data collection method and data analysis tools.
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CHAPTER 3
DATA COLLECTION AND ANALYSIS

To review, the objective of the study is to explore the relationship between teachers’ use of ICT and their understandings of ICT affordances and of teaching and learning. This chapter, therefore, describes the research approach, the context of the study, the sample used, as well as the data collection and analysis methods. The chapter ends with a look at the role of ethics in qualitative research and how the issue of research ethics is managed in this study.

3.1 Research approach

Educational research seeks to increase our knowledge and understanding about the world of education, and is generally goal-oriented, leading us to action (Cohen, et al 2000; Walker 1982). The positivist and interpretivist approaches within educational research differ in their perspectives of phenomena. The positivist approach is interested in ‘what can be firmly established’ (Cohen, et al 2000, p.8), so that ‘unverifiable statements are held to be meaningless’ (ibid). Hence, it is concerned with quantifying phenomena and testing hypotheses (Cohen, et al 2000; Johnson 1984). The positivist social science researcher, then, is ‘an observer of social reality’, analysing and interpreting from a distance, whose analyses ‘must be expressed in …law-like generalizations’ (Cohen, et al 2000, p.8-9). To this researcher, human behaviour is ‘passive, essentially determined and controlled’ (ibid, p.19); the notions of ‘intention, individualism and freedom’ (ibid) are largely disregarded. This is the reason the positivist approach is generally unsuitable in educational research, where investigations of human interactions in complex contexts such as the classroom and school demand a look into the reasons and intentions governing behaviour.

More suited to educational research is the interpretivist approach, which stresses that ‘educational settings cannot be examined without properly referring to the meanings participants give to their activities’ (Scott 1996, p.52). Unlike positivism, which is not
concerned with ‘values, informed opinion, moral judgements and beliefs’ (Cohen, et al 2000, p.19) and which rejects the idea that we are capable of offering interpretations of our experiences, interpretivism acknowledges that ‘people actively construct their social world’ (ibid, p.21). Such educational research, therefore, examines ‘the direct experience of people in specific contexts’ (ibid, p.20). Consequently, proponents of interpretivism believe that ‘events and individuals are unique and largely non-generalizable’ (ibid, p.22). Moreover, as social situations and events change over time, research is meaningless without express reference made to ‘political, ethical and reflexive concerns’ (Scott 1996, p.52), or the ‘situational context’ (McMillan 2000, p.253). Interpretivism also rejects interference or manipulation by the researcher, and the viewpoint of the detached observer is not as important as that of the actor. The interpretivist approach allows for multiple interpretations of an event as it recognises the complexity of social reality; in most instances, research using this approach provides ‘thick descriptions’ (Geertz 1973, cited in Cohen, et al 2000, p.22). Last but not least, in interpretivism, ‘fidelity to the phenomena being studied is fundamental’ (ibid). However, critics of the interpretivist approach argue that negotiated meanings are not absolutely accurate and trustworthy (Cohen, et al 2000), as the qualitative researcher may fail to appreciate ‘the power of external …forces to shape behaviour and events’ (p.27).

Since educational settings provide a rich interaction of factors and processes, the research method chosen must be able to obtain the available data. In its need for verification, the positivist approach is traditionally reflected in data collection methods such as the experiment and the survey questionnaire. It is believed that with quantitative methods, ‘objective reality can be grasped; researchers can remain neutral with their values separate from the descriptions of reality they provide; observations and generalisations are a-situational and a-temporal; causality is linear; and enquiry is an objective activity’ (Scott 1996, p.55). On the other hand, the interpretivist approach shows ‘a concern with phenomena, the things we directly apprehend through our senses as we go about our daily lives’ (Cohen, et al 2000, p.22). Hence, in seeking to gain ‘insight into a perspective’, (Johnson 1984, p.21), the interpretivist approach uses qualitative methods such as the interview (especially with open-ended questions) to allow the voice of respondents to be
On choice of research methods, the educational research community is split in opinion regarding the value of methods within the quantitative and qualitative divide. More recently, there has been greater acceptance of using a combination of methods (McMillan 2000; Scott 1996). Moreover, it is acceptable to use the same data collection method, whichever research paradigm is chosen (Scott 1996; Johnson 1984). A good example is the interview, where different types of questions would produce different types of data.

In educational research, the use of particular methods to collect information may not be as adequate as other methods (Scott 1996; Mercer 1991). For instance, while experiments have been used in classrooms to test hypotheses or to identify variables to determine how phenomena are causally related, it is also true that this method is limiting. As a classroom is a complex interaction of many variables, each dependent on political, cultural and social considerations (Verma & Mallick 1999), in the attempt to understand phenomena within a social entity such as an educational institution, other methods, like the survey questionnaire, interview and diary study, may be more appropriate. These methods, however, are not without their constraints either (Krishnan & Lee 2002; Cohen, et al 2000; Scott 1996). To illustrate, one has only to look at the positioning of researcher and researched in an interview situation to realise the potential biases that may appear in the data (Scott 1996). It is, therefore, imperative for researchers to be aware of the merits and limitations of any method they may choose to use, and to consider the topic of enquiry, the purpose for which a method is used and the resources, such as time and manpower, available.

Therefore, both quantitative and qualitative methods are available to educational researchers, who make their choice based on such practical issues as the purpose of their research, the topic of enquiry and the resources available to them, like time and manpower. For instance, research on the effectiveness of a particular method of assessment is likely to use quantitative methods, where test scores and statistical accuracy
matter, as an indication of how well the assessment method works. On the other hand, research on beliefs is likely to use qualitative methods, where respondents’ descriptions of experiences will reveal their thoughts and feelings (Loveless 2003; Woods 1996). To the qualitative researcher, this description is of more value and interest than number of occurrences.

My study adopts a qualitative approach as it seeks to explore and understand perspectives. As my investigation is about teacher understanding, it is about exploring perspectives. I believe that these perspectives can best be explored through ‘the “lens” of the teachers’ perceptions as represented by their verbalisations’ (Woods, 1996, p.35). To gather these perceptions, appropriate methods for data collection and analysis have been chosen. Sections 3.4 and 3.5 present these methods in more detail.

3.2 Context of study
This section describes the research site in terms of the engineering schools’ curriculum structure, the role of the Centre for Educational Development (CED) in ICT promotion among teachers and the level of support for ICT use shown by the school management.

The study site is a university in Singapore. At the time of the study, the university included a business school, a communication studies school and a college of engineering, which comprised five engineering schools. From its inception until now, the university has always enjoyed the reputation of having a strong engineering curriculum. The study was conducted with faculty from the five engineering schools; the sample consisted of both engineering and non-engineering teachers. Non-engineering teachers teach subjects that are considered ‘soft skills’, that is, subjects to complete the broad-based education that the university offers. At the time of the study, my place in this organisation was as a non-engineering faculty member in one of the engineering schools. My role was to teach English language proficiency and communication skills courses to engineering students in the first two years of their study. At the start of my research, permission was sought from the Dean of the College of Engineering for the study to be conducted among the teachers of the college.
The academic year at the university is made up of two semesters. Each semester consists of 13 teaching weeks followed by an examination period of approximately 4 weeks. The curriculum is based on a modular system where learners accumulate as many credits as they can within a semester so as to graduate in the shortest possible time.

At the university, all first-year engineering students go through a common engineering programme. The engineering curriculum requires learners to take core subjects not only in engineering but also in non-engineering disciplines like human resource management and communication skills. This is a broad-based programme intended to introduce learners to the major areas of study in the engineering curriculum, so that learners could be better informed of the choices for specialisation when the time came for them to decide which area of engineering they wish to pursue their studies in. The subjects in this common programme are taught by staff from all the engineering schools. The programme includes both engineering and non-engineering subjects. Examples of non-engineering modules are Chemistry, Mathematics, Communication Skills and Human Resource Management. After a year in the programme, learners are allocated a place in the engineering school of their choice if their academic results permit it. Otherwise, they are offered their next choice.

The engineering curriculum at the research site has always included lectures, tutorials and laboratory sessions as the main modes of instruction. For engineering courses, each face-to-face lecture could be one or two hours long, each tutorial is usually one hour long and each laboratory session is three hours long. For non-engineering courses, there may be lectures and tutorials of one hour each or tutorials only that last two hours every session. The core courses include both engineering and non-engineering modules, although generally, engineering modules are assigned more academic credit and class time per week than non-engineering modules. At the time of the study, the first and second year cohorts, in particular, were in very large classes, with at least 1000 learners per level. Lectures were conducted in large groups in lecture theatres, while tutorial groups managed to remain small at 25 to 30 per group and were conducted in tutorial rooms.
Most teaching and learning activities were conducted on campus. Most modules evaluate learners through two assessment components, namely, continual assessments (CA) and an end-of-semester examination. The weighting of assessments is not the same across modules, meaning that some modules may have a heavier CA component compared to other modules.

At the beginning of each semester, student representatives usually collect prepared lecture handouts and tutorial questions from the lecturers. They help print copies for the rest of the student body by level of study. This is to facilitate the printing and distribution of lecture handouts in preparation for the new semester. In May 2000, the university installed Blackboard, an online learning management system, as its online teaching and learning platform, in its bid to place the university as a world-class institution with the latest in technology and facilities for teaching and learning. July 2000 (the beginning of the academic year 2000/01) marked the beginning of wide-scale adoption of ICT in large classes, namely in lecture groups. This refers to the uploading of lecture notes and tutorial material onto their Blackboard course sites. This allows learners the flexibility to download the materials and print them for themselves rather than buy hard copy notes from student representatives. Lecturers also posted video-recordings of the lectures they conduct in the lecture theatres. The recordings would then be uploaded onto Blackboard so that learners could have easy access to them. This move was strongly encouraged by the then president of the university.

At the heart of the push for the use of ICT in teaching and learning at the university is a ‘Centre for Educational Development’ (CED). The centre’s chief responsibility is to enhance online teaching and learning experiences. Hence, when Blackboard was installed in the year 2000 as the preferred online learning management system, CED was entrusted with the responsibility of promoting the use of ICT among faculty and learners and helping teachers and learners become familiar with Blackboard. One of the first things the centre did was to rename Blackboard as ‘edventure’ to personalise its applications at the university and to brand it as a university project. Also, the name sounds like ‘adventure’, suggesting a learning journey that promises to be filled with discovery and
adventure for both faculty and learners. To help teachers use ICT in their teaching, the centre acquires new software programmes; for instance, a programme which the centre calls PreseNTUure allows pre-recording of lectures. Using this programme, teachers can make their presentation and be seen and heard via voice recording and a talking head. Furthermore, the centre organises free talks, seminars and training workshops for faculty, although it is not compulsory for teachers to attend these events. Occasionally, the centre also invites experts in the area of ICT-based pedagogy to share knowledge and expertise on the use of Blackboard. To facilitate teachers’ work on edventure, IT support is offered at two points: the centre’s team of instructional designers (as the staff tasked to help faculty adopt ICT in their teaching are called) and each school’s own IT support team (made up mainly of laboratory technicians who have technical knowledge of IT). CED also helps teachers record their lessons if they want to do it in the centre’s studio. Most of the time, however, teachers refer to their school’s IT support team when necessary, especially when technical problems occur. In 2004, the centre introduced recording of face-to-face lectures for uploading to edventure so that learners can have access to the recorded lectures.

Although use of ICT is encouraged among teachers, online classes are not a compulsory component in the curriculum. Teachers have the choice to include ICT in their teaching, or not. The school management supports teachers’ use of ICT in their teaching by providing a team of laboratory technicians to form the ICT support team. In some engineering schools, teachers have access to a studio for lecture recording. On the other hand, the school management does not include ICT use as a criterion in teaching feedback and evaluation.

3.3 The sample
This section describes the sample selection method, specifically the problems encountered and the way they were overcome. As will be seen, a stratified random sample was used. Two criteria were imposed on the sample selected for this study. First, in order to study teachers’ use and perceptions of ICT and its affordances, it makes sense for informants to have, or have had, experience teaching with ICT, regardless of the type
of ICT used. The other criterion was the length of time they had experience with ICT in their teaching.

With the Dean’s permission to carry out the study with teachers from the engineering and non-engineering disciplines of the various engineering schools, permission was also sought from the director of the Centre for Educational Development (CED) for access to the centre’s team of instructional designers. Permission was granted by the director.

All informants in the study were full-time teachers with the university. (The term ‘full-time’ is a convenient way of referring to teachers who are on the pension or contract schemes, as opposed to part-time teachers employed just for the weeks that they are needed. In this sense, ‘full-time’ teachers have a bigger stake in the organisation than do part-time teachers.) Twenty-two informants were involved in the research. This number was arrived at when it was determined that no new information would be obtained with further sampling. (To clarify, the sampling procedure was not closed before the data collection process as I wanted to optimise the time that was available to me for research purposes.) The informants were all teachers, both engineering and non-engineering, from the college of engineering. The non-engineering subjects include Chemistry, Mathematics, Communication Skills and Human Resource Management. For a look at how ICT was viewed among the teaching staff and its uptake among them, sampling engineering teachers only in the study was not sufficient; non-engineering teachers must be included as well. There were altogether eleven informants in each group. This equal distribution was not planned for. As the university has a predominant focus on engineering, perhaps a bigger ratio of engineering teachers to non-engineering teachers would be more representative of the available sample. However, as will be explained more fully later in the section, sampling problems were encountered during the data collection process, which led to a smaller group of available informants than desired. In any case, sampling stopped when information was repeated and it became evident that new information was unlikely to be obtained with further sampling. Moreover, having an equal number of both groups of informants gives both groups equal prominence. Other than subject discipline, informants varied also in terms of the length of experience
teaching with ICT – from eight years for the most experienced to three years for the least experienced. Both male and female informants were included in the sample. As for nationality, besides those from Singapore, informants came from a number of countries in Asia, such as India, China, Australia and Malaysia. In the report, each informant is referred to by a letter code and a number. The codes EG and NE refer to ‘engineering’ and ‘non-engineering’ respectively. The number assigned to each informant and the order in which I conducted the interviews have no particular significance such as indicating order of importance.

For the sampling, I did not differentiate between uses of the various types of ICT, like simple *Power point* slides or sophisticated teaching software. I was looking for teachers who, at the time of the study, were currently using or had used ICT in their teaching. The criterion for the inclusion of such individuals was that they must have taught using ICT for at least two semesters. However, for me a convenient starting point to obtain my sample was CED, which had information regarding faculty use of *Blackboard* and not use of other types of ICT. So, CED was approached for possible candidates among teachers who would qualify for inclusion. With the criteria that I had listed, CED provided the names of faculty whose courses were found on *edventure* (*Blackboard*). A possible limitation is that if a teacher was using ICT other than *edventure*, he or she would not have been included in CED’s list as a potential sample item. In any case, it is impossible that CED would know who these teachers are who use other forms of ICT besides *edventure*. I did not include teachers who had not taught with ICT, not because they might not have thought about the online platform and its place in the curriculum, but because I believe that they would not have been able to substantiate their opinions with experiential accounts as those with some relevant experience would. Two semesters (not necessarily consecutive) of experience teaching with ICT seemed a reasonable minimum period of exposure for someone to have gained a basic knowledge of its affordances, as well as to have formed an opinion about the online platform. Hence, I adopted two semesters as my cut-off point. There was no imposition of the maximum number of years that someone had taught using ICT. Without CED’s help, it would have been a time-consuming process to find out the names of colleagues who were listed on *edventure* and
therefore, the relevant persons to approach.

Given the sampling criterion, CED generated a short list of thirty-two names of both engineering and non-engineering teachers. However, there were two problems with the list. Firstly, for some reason which CED did not make known to me, the list included only teachers teaching Year One and Year Two courses in that academic year when the data was being collected; teachers of Year Three and Year Four courses had been omitted. Secondly, the list included only teachers who had used edventure for two semesters and not at least two semesters, as requested. As CED later explained, the system did not contain faculty information, so it was not able to accede to my request. A related difficulty for CED was that the number of faculty members who were using edventure could not be easily ascertained even though their names were in the course sites, as the college of engineering course sites were created by each engineering school which offered the course. With about 425 courses (this estimated figure was supplied by CED) for one semester alone, it would be a tedious task to identify faculty whose names appeared more than two times over eight semesters. For this practical reason, I did not pursue the matter of getting the number of actual Blackboard users among faculty from the engineering schools. Hence, the list was neither comprehensive nor accurate in reflecting the level of use among teachers. In spite of that, I used the thirty-two names that CED provided to start the data collection process. But another problem soon emerged. Almost a third of the individuals from the list whom I approached turned down my request for an interview. Some cited non-involvement in any form of teaching using ICT (this means that their name had appeared on CED’s list only because they were subject co-ordinators or tutors in a course that had been posted on edventure and not because they themselves had used ICT in their teaching), while others could not spare the time for the interview. This, of course, shortened the list of potential candidates even further. As some courses were better represented than others, I randomly short-listed names from among the courses, making sure that all the curriculum subjects in the shortened list were represented in the random selection. This is to ensure a fair representation of the subjects engaging ICT use. I then approached these colleagues in no particular order.
Another method of gathering informants was used to complement the first. This was in the form of personal communication when individuals indicated their interest in talking about the research topic. But they had first to fulfil the criteria mentioned above before they were considered for the sampling, that is, that they had taught with ICT and that they have had at least two semesters’ experience at it. The third, and final, way of gathering informants was through snowball sampling. Here, there was no commitment on my part to approach the people recommended, so that the ones proposing others did not know the outcome of their recommendations. As mentioned earlier, for the simple reason of expediency, the sampling process proceeded at the same time as the data collection process.

3.4 Data collection
This section describes the main and secondary data collection methods in this study. The main method is the interview and the secondary method is the written summary of the interview. The section also discusses the appropriateness of these methods in this study in terms of the criteria of authenticity, generalisability, validity and reliability.

The data for the study was collected within the teaching and learning environment at the university. As mentioned, the main data collection tool used was the interview, a method conventionally used in qualitative research (Wellington 2000). The interview is an excellent way of granting the researcher access to situations that they are unable to be present in, as well as to situations where permission for access is denied to them (Burgess 1984, cited in Scott 1996). In the case of the study, this refers to the many varied teaching instances that informants were involved in. The interview was conducted in English as English is an official language in Singapore as well as the language of instruction at the university. The informants in this study were required to describe their experiences with using ICT in their teaching; in other words, ‘where rich and personal data are sought, … a word-based qualitative approach might be more suitable’ (Cohen, et al 2000, p.248). To obtain this rich data, therefore, the interview presents itself as the most appropriate method, especially when it poses open-ended questions allowing a wide range of possible
responses and ‘access to past events’ (Burgess 1984, cited in Scott 1996, p.65). For these reasons, the interview is deemed as an appropriate instrument for this study.

For data validation, summaries of the interviews were written and returned to informants for verification of what they had said and of my interpretation of their comments. This was useful as the study focuses on the interpretations and meanings that informants attach to the phenomena. Of course, frequency counts can be obtained for such categories as type of response (positive or negative), frequency of use of ICT in teaching, and use of the different tools that Blackboard offers. But what matters more is what informants say, that is, the meanings and interpretations that they hold of the topic of enquiry. It was intended that the examination of linguistic evidence, specifically, of words, phrases and metaphors, would reveal the understandings of informants.

Here, it might be questioned why other methods were not considered. One possible method was observation of classroom processes. This method was not chosen for this study for a simple reason: teachers’ use of online resources would be difficult to track, as ICT work can be done at anytime and at any place. Unlike a physical classroom, the ICT-based teaching and learning environment is impossible to observe, unless the researcher sits with the informant and records their actions when using the online platform, or records their verbalisations as they work. In such a scenario, the researcher’s presence is not likely to be welcomed. Even if this was possible, it would be a challenge to carry out the observations well given the study’s sample size. Besides, to base interpretations on observations for each informant is also a contentious issue. Validity and reliability of the data obtained this way can just as easily be questioned, for instance on the grounds of selectivity and subjectivity. Hence, unless there is time allowed for a sustained data collection effort, such as more than one observation per informant, this method could have become unwieldy also in terms of the amount of time expected to complete the process.

The starting point of this study would have been that knowledge of the online teaching experiences of teachers could provide an insight to their understandings about teaching
and learning with ICT, in particular, their view of ICT and its affordances and its use in curriculum practice. One method of gaining this knowledge might be use of the diary. In this study, the diary was not considered an expedient tool as time was an important consideration to my informants. My reason for not using the diary was that faculty would likely be discouraged from participating when they had to keep written reports of what they did and thought, and to have to do this over a period of time.

A third possible method to use was the case study. The primary difficulty with using this method is the intensity in which the informants would be involved, and from personal observation of how busy my colleagues were, I was not persuaded that they would volunteer their time to participate in this way. This method was, therefore, not chosen for this pragmatic reason.

Yet another option was the questionnaire. Although this is a qualitative study, a questionnaire could be used to gather information about teachers’ perceptions and beliefs based on quantifiable item responses. But this method was not chosen for three reasons, all of which were based on my observation and experience with answering questionnaires: one, questionnaires are limiting in the types of questions that can be asked, so that if the majority of questions are open-ended, potential informants may not be inclined to take part; two, the return rate is not likely to be sufficient as there is no obligation for recipients to answer the survey, especially if the topic of enquiry is not something they are interested in; and three, although the questionnaires could be sent electronically (which is preferable as it would aid tracking of the survey forms), mass emailing at the research site is generally not viewed kindly. For these reasons, the questionnaire was not chosen as a data collection method.

Eventually, the interview method was chosen instead as the primary data collection method, as it allows a cross-section of informants to be involved and, at the same time, provides a starting point for perspectives to be explored in some depth. An interview schedule (Appendix A) was designed to draw out informants’ reflections on their experiences using the online platform. A priori topics were used to obtain informants’
views about the effectiveness of online instruction as well as the relationship between their beliefs and the type of communication behaviours that they engaged in through ICT. The topics, derived from study of other researchers’ work (for example, Young 2004; Lynch 2002; Daugherty et al 2001; Noss & Pachler 1999), related to aspects of teaching experience, such as motivation, the ways in which ICT was used for teaching, materials selection and development, course development, assistance required, as well as teachers’ perception of their role as online teachers and of what teaching with ICT meant to them.

As much as I could, I avoided asking explicitly for teachers to state their beliefs or understandings in a structure like ‘Do you believe…?’ so as to avoid the situation where informants might answer ‘towards what is expected in the interview situation than what is actually held in the teaching situation and actually influences teaching practices’ (Woods 1996, p.27). Unlike Woods’ study, mine did not use video-taped lessons to elicit teachers’ comments on their classroom actions and decisions. So, where possible, I sought substantiation of opinion through reasons, explanations and anecdotes – in other words, what Woods refers to as ‘concrete terms’ (ibid, p.28). As Woods explains, ‘a belief articulated in the context of a ‘story’ about concrete events, behaviours and plans, is more likely to be grounded in actual behaviour’ (ibid, p.27). This seemed to work rather well, as the following sample shows. In my interview with EG10, the topic of the effectiveness of online learning came up. In justifying his view, EG10 recalled his experience as a learner in an online course:

EG10: … There are a lot of online courses around. I've tried them but I never got through the second lesson.

Intv: How come?

EG10: You feel bored, you see. You don’t know where to jump to; sometimes you don’t understand, you go back, but it’s just not natural. It could be the design, it could be the limitation of the media. Computer-based training does not really suit the human way of learning. Or maybe it’s my way of learning. I prefer books; I can read a book from cover to cover, but I can never get through the second lesson with computer-based training. Probably the design does not match my need. If the design matches my need, I may be able to finish the course.
Besides the initial questions on the background of the teachers’ online experiences, the majority of questions were related to teachers’ planning and evaluation of their lessons or courses taught through ICT. The final two questions asked informants to think of how they might describe their role as online teachers and their teaching with ICT. This was to obtain metaphors, which is another way of understanding a person’s conceptualisation of a topic (see section 3.5.1). Should informants not understand what was required, they were prompted thus:

- (on teacher’s role) *It might help to think of a simile; e.g., it has been said that a friend is like a mirror, or a friend is like an anchor. What, then, is an online teacher? Think of it as filling in the blank: An online teacher is like a/an _____.*

- (on online teaching) *You might think of online teaching as an object or an activity. If you were to describe online teaching in this way, what would it be?*

These prompts were used on a few occasions with engineering faculty. It could be argued that the attempt to answer these questions (or the prompts) might have affected the way the issues were thought about. Even if that were so, the answers would still be legitimate and valid as they were offered by the informants themselves. From the look on my informants’ faces, especially the engineering faculty, I noticed that these questions were something of a point of interest, perhaps as informants were asked to think about these topics and to verbalise their thinking in a way that is different from the usual. Two things should be noted, however: one, informants answered the questions as they saw fit, so that not all answers turned out to be metaphors; and two, when the topic of teacher’s role or teaching with ICT was raised in answer to an earlier question, that topic was not broached again later in the interview. For instance, EG11 responded thus to an earlier question on how he went about preparing materials using ICT:

*EG11: I think the priority is always the same. For the lectures, I ask myself, what is my role? Because nowadays students have access to videos and to well written textbooks. In the future, perhaps they can download a lot of videos from other universities like MIT. So I just ask, what is the role I can play? So I think for lectures, the main role is to provide a framework of learning*
for the students. So, what is important and what is not important. The way to learn, that is most important. Detailed knowledge is not important. If you read, you can always get some knowledge. If you spend a lot of time, you always gain more knowledge.

As it was with Woods’ (1996) study, ‘generalizations and information about beliefs and assumptions arose when volunteered by the teacher’ (p.27). The questions in my study were open-ended, the intention being to allow informants relative freedom to express themselves as they wished. At the same time, they allowed me to probe should I feel the need to know more. Hence, some of these questions could be pursued in more depth, depending on informants’ response. For example, the questions on how online teaching compares with face-to-face teaching became redundant when informants themselves volunteered the information in their evaluation of online teaching. Lastly, all interview data were accepted as valuable, whatever the duration of the interview. In other words, longer interviews were not considered more valuable or more significant than shorter ones.

A pilot study was conducted with two teachers from the short-listed names of potential informants. They were chosen randomly: one was an engineering lecturer and the other was a non-engineering lecturer. The interview schedule was tested to see how well the questions worked, especially to check for clarity of the questions and to review the type of responses received so as to avoid ‘imposition of the interviewer’s use and interpretation of particular terms’ (Woods, 1996, p.40). For example, I realised from the pilot study that the term online needed clarification. It was explained to informants at the start of the pilot interviews that by online teaching, I meant teaching using one or more of the following: the computer, a course management system like Blackboard, the Internet, and learning and teaching software. To one informant, however, the term referred only to synchronous teaching, like real-time conference sessions. In the actual study, therefore, the expression online teaching was replaced with a more comprehensive phrase teaching with ICT and again with the above explanation of what I meant by the term ICT. In the pilot study, too, I had to prompt one informant (coded EG below) in a bid to get elaboration. This was when I asked for their perception of ICT:
Intv: Okay. This is the final question. Let’s say a colleague wants to use ICT. And this person knows you’ve been using it for many years. So comes to you and asks you. What is online teaching all about? How would you describe that?

EG: It’s about the computer. Uh... (long pause)

As the pause was exceptionally long, for almost a minute, I decided a prompt may be necessary to help the informant explain their initial answer. The prompt appeared to have helped the informant, as seen from the reply:

Intv: So, if you were to think about it in terms of an activity or an object, what would it be?

EG: Well, it’s really just a computer. But the computer with all these interactive ways to communicate interactively. It’s not a dead thing. You know now all these computers are not only interactive but intelligent. So it’s not just an object, a dead object.

On the whole, the interview schedule is considered to have worked well, as informants in the actual study had no difficulty understanding what the questions wanted information on. Their responses were also relevant, so there was no need for me to re-word the questions, as I did in the pilot study. From the pilot study, I was also able to assess the duration of the interview; in both instances, the interviews lasted about an hour. As part of the pilot, summaries of the two interviews were given to informants. An explanation of the nature and purpose of summaries is given below.

In the pilot and actual studies, data collection and validation was a four-stage process conducted over a period of approximately nine months, between 2004 and 2005 (Appendix B). The four stages are: conducting the interview, transcribing the interview, summarising the interview and checking of the summaries by informants.

In the first stage, permission for the interviews was sought from short-listed potential informants in two ways. One was in the initial stage, through email followed by a day/time arrangement for the interview, and the second was at the appointed time, before the interview commenced, when an oral consent was obtained. Written consent forms
were not provided for these colleagues, among whom are professors and senior academic staff. It is assumed that they are aware of the ethical implications of given consent and that it would be rather condescending to ask them to sign consent forms. At the start of the interview, informants were told of the purpose of the interview, the topics of inquiry and the expected duration of the session. They were also assured that the interview was given in confidentiality. This was to ensure that informants felt secure about sharing information, particularly where there might be fear of reprisal for honest answers. Once informants gave their verbal consent, interviews were set up. Informants were given a choice of venue. Most preferred to meet with me in their office; only one chose to be interviewed in my office. Each interview lasted between 45 and 60 minutes. Before each interview, permission was sought for the tape-recorder to be used. In two instances, that permission was not granted. In these cases, notes were made on the interview schedule as the interviews proceeded. The interview schedule consisted of *a priori* topics, although the interviews were carried out in a semi-structured manner. On every occasion, I tried to keep to the same wording of the questions. But the order of the questions sometimes varied. I took the cue from informants, depending on what they were saying at any given moment. Any possibility of ambiguity in meanings arising from the answers was immediately clarified. It is important that the researcher be aware of the flow of the ‘conversation’ so as not to interrupt informants’ flow of thought. Awareness of the mood of the interview, informants’ ease at the interview and with the interviewer, and the extent of informants’ willingness to provide information were matters that I bore in mind as I proceeded with each interview. This was to facilitate a congenial atmosphere for the smooth conduct of the interviews.

My assessment of the pilot and actual interviews is that they were successful. During the pilot study, at the end of the interviews, I gathered feedback on the interview questions and interview style. I asked the two informants if there were questions which they had found ambiguous or sensitive. By the latter term, I mean questions that touch on issues which they might have preferred not to have been raised, such as their view on management support of the adoption of ICT in teaching. I also asked if they were comfortable with my style of questioning. Both replied that they had no problem with any
of the questions asked and they were at ease during the interview. This reassured me that my conduct during the interviews was appropriate and that I could carry out the interviews in the actual study in a similar fashion. The result was that during the actual interviews, I sensed that informants were open and forthcoming in sharing information about their teaching experiences and their thoughts and feelings about the use of ICT in their teaching. For example, while some informants were openly critical about the university’s policies and practices regarding education, others voiced their unhappiness about CED’s role and responsibilities. I regard this openness (evident especially in their sharing of negative opinions) as a sign of trust that they had in me. I believe that this trust came about because of the structure and tone of the interviews. As the interviews were conducted in a formal manner, a tone of formality was maintained. At the same time, I tried to turn the interview into a conversation so as to put informants at ease. In both the pilot and actual studies, I perceived the interview atmosphere to be cordial and pleasant, and I felt there was a comfortable rapport between my informants and me. Especially as I was meeting the majority of them for the first time, their willingness and openness in sharing was a positive indication of their regard for the interview (and for me). Some informants in the actual study even gave me suggestions on how I could enhance my research; for example, one suggested that I should seek out colleagues who have tried out large-class online assessments and another suggested that I should seek learners’ opinion on their preference for face-to-face or online learning. I believe that my credibility was established because I had been honest in stating the purpose of my research, I stated clearly the topic we would talk about, I tried to create a conversational tone in the interview and I paced the session so that each one ended within the stipulated time. At the end of each interview, informants willingly granted further access should I need to go back to them for clarification.

In the second stage of the data-collection process, broad transcriptions of the recorded interviews were done. Transcriptions are not available for the two interviews where informants preferred not to be recorded. The main difficulty I faced during the transcribing exercise was in understanding the accent of certain informants. The task was made more difficult when they spoke at a fast pace or were sometimes inaudible on tape.
To check the accuracy of the transcriptions and of the notes of the two unrecorded interviews, summaries of the interviews were written (Appendix C). This is the third stage. In the case of the unrecorded interviews, the summaries were written immediately after the interview sessions, while the events were still fresh in my mind. The summaries included not only the main points of the interview but also my interpretation of what informants had said. However, summaries were not written in these two instances: when the informants articulated clearly and the words were audible on tape, and when the information given was direct/straightforward, so there was deemed no necessity to check for interpretation of meaning. For these reasons, some interviews were not summarised.

In the final stage, the summaries of the interviews were sent back to informants for checking (Appendix D). A possible argument against sharing with informants a version of what is heard is that informants may change their mind about what they have said, therefore bringing into question the validity and reliability of the data. Should an informant change their mind about sharing a particular piece of information, readers may question whether the ‘truth’ was originally told and is now being withheld. The researcher’s dilemma is deciding between keeping to the ‘original’ version (although it is equally contentious whether it is the ‘truth’ that has been told) and respecting the informant’s decision. Finally, we have to remember that in qualitative research, it is the informant’s data, the informant’s voice that we want to hear; if the informant is not allowed to have the final say in the kind of information they want to share, we would have to question who, then, is in the position to verify the data. Would it be the researcher? Or would it be the reader? In other words, before the information goes out to the public domain, the informant has to first agree to the information being published. This is an ethical concern that has to be addressed. As for the question of validity and reliability of the data collected this way, this is a question at the level of qualitative methodology. I assert that the researcher is not in the best position to judge the truthfulness of what is offered by the informant; only the informant can do that. The researcher can, however, find ways to validate the data, as I have done with the interview summaries. My summaries contain words and phrases which informants have used, as well as interpretations that I have gathered from the interviews. Below is an example (the
In your words, ‘you can’t control them’, and you do not know ‘whether it’s a success or failure’. *You seemed resigned about this loss of control* – ‘You can’t do anything about it, right?’ – especially as you could not tell what was happening with students’ learning. (EG3)

The purpose in checking the accuracy of content and interpretation is achieved when informants respond to the summaries, returning them to me, some with revisions and others without. Altogether, five informants (three engineering; two non-engineering) made changes to the original summaries. Through their revisions, informants corrected my misunderstanding of terms, like *tablet* instead of *Tablet PC* (see Appendix D). They also filled in missing information; in the following examples, the underlined words indicate additional information:

*Before each quiz, the server and all 70 client computers must be tested.* (EG1)

*You also felt that you had to ‘speak better’, referring, in particular, to the need for clear pronunciation and no ¹Singlish.* (NE4)

The tapes proved to be useful as a check that the added bits were not new information, like an after-thought. For the unrecorded interviews, however, this was not possible to verify. Informants also made use of the section *Additional comments* to clarify their position, as the following instances show:

*The piece of equipment I use in my lectures is a simple “tablet” connected to a USB port of an ordinary notebook computer. A Tablet PC is a special (and expensive) notebook computer with a screen that is specially designed for one to write on using “digital ink”.* (EG1)

*Yes, but I must clarify that online learning should be used as an auxillary [sic] support to learning; it should not totally replace the face-to-face learning. Other aspects such as the nonverbal behaviours are equally important when delivering a lesson.* (NE1)

The returned version is taken to be the informant’s final word on the topic. Hence, although my summaries are no longer informants’ words as such, they are an attempt at allowing the thoughts of the informants to be represented as accurately as possible. Both

¹ ‘Singlish’ : Singapore English; the variety of English spoken in Singapore, usually in informal situations
the interview transcripts and summaries, therefore, provided the data.

One criticism of the study may be that only one source, the teachers, was approached. The lack of data triangulation could have implications for the claims that are made in the discussion of the data. It may be argued that students and school administrators could have been approached, too. While I recognise the possibility of involving other sources, I feel that since this study is about teachers’ beliefs, students and school administrators cannot speak for teachers and thus would not have been able to give insight to teachers’ beliefs. Although I regard teachers as the primary source of information, I do acknowledge that the use of one source is a limitation and claims about the findings cannot be considered as conclusive. On the other hand, what the study lacks in triangulation, it gains in credibility, as it meets, to a large extent, the criteria of authenticity, generalisability, validity and reliability. The following examines the study in terms of these criteria.

In evaluating the authenticity of the study, the use of informants’ voice is considered. The data is authentic on several counts. First, the informants involved in the study are teachers employed full-time at the university who have had some experience teaching with ICT. Thus, they are familiar with the online learning environment at the research site. Next, through the interview, the study seeks information that is grounded in informants’ experiences of the topic of inquiry. Open-ended interview questions allow informants to share their views in any way that they want. This method of interviewing is preferable to one that requires answers of polarity or presents a limited range of responses, as in a Likert scale. This is because with open-ended questions, informants can choose to dwell on particular issues (or topics), thereby indicating their thinking regarding these issues. Following the interview is a written summary of the interview. The summary is returned to informants for verification of the content of the talk and of the researcher’s interpretation of intended meanings. In the study, therefore, authenticity appears by way of informants voicing their thoughts and supporting their views with accounts of their experiences. Authenticity is enhanced with informants’ confirmation of the results (Zuber-Skerritt 1992) – in this case, the summaries – that I presented to them.
On the question of generalisability, it is recognised that a sample such as that used in this study cannot be truly representative of all teaching practitioners at the university who use ICT in their teaching. However, the results are, to an extent, generalisable to educators who perceive value in using ICT in teaching and learning. The study seeks to increase the sense of objectivity in two main ways. One way is to ensure that a truly random sample has been used (Zuber-Skerritt 1992; Johnson 1984). In the study, the only condition that I impose on sampling is that all informants must have, or have had, experience teaching with ICT, regardless of the type of ICT used. Another way is to look for what Wellington (2000) terms ‘recurring issues and patterns’ (p.138), for recurrence ‘can begin to create some confidence in generalizability’ (ibid). This happens when the same themes are raised by different informants. In my study, although the topics are a priori, the themes and patterns arising from these broad topics come from the data itself, contributing to a measure of validity and reliability. I did not, however, use inter-coder checking on theme identification as I saw this as an individual research effort. I relied on repeated readings of the data to get a sense of the emerging patterns. But the use of inter-coder checking is one area in which the study can be improved.

In general, the interview and summary both allow informants to recall and reflect. There is a potential problem with this, however, specifically, that the verbalisations of the informants may not exactly reflect their experiences (Woods 1996). At this point, we need to consider the question of interpretation, which is a recurrent theme in the discussion of validity. As expressed succinctly by Freeman (2000), ‘in focusing on meaning and interpretation, the qualitative paradigm opened the research process to questions of proprietorship. With regard to data collection and analysis, the issue was not only meaning, but whose meaning’ (p.297; emphasis in original). This relates to two issues of validity in particular.

Firstly, the validity of the researcher’s interpretation of phenomena is questionable. It is not unusual that in attempting to interpret and understand findings, researchers might rely on ‘what it feels like to be a participant in the action under study’ (Verma & Mallick
In other words, the researcher here is part of the activity under investigation, the ‘insider’. Similarly, ‘the researchers rely on their experience of particular settings to be able to ‘read’ the information provided by the subjects involved in the study’ (ibid). It is undeniable that the analysis of qualitative data will be value-laden (Cheah & Chiu 1997). Another criticism is that of the researcher using subjective judgements, the use of ‘insider’ knowledge. In my view, this is not necessarily a disadvantage. As Woods (1996) asserts, ‘it is … unnatural to ask questions as if there is no implicit shared knowledge at all’ (p.40). In this study, as the researcher, I am not involved in any way with other teachers’ online teaching experiences. But as a colleague within the same institution and a teacher who also teaches with ICT, what I take with me to the research are my own teaching experiences with ICT. It is in this way that I see myself as an ‘insider’. I believe that as a member of the same academic community as my informants, my knowledge of the teaching demands imposed on faculty in this institution, and more importantly, my knowledge of the organisational and cultural contexts that my informants work in are helpful to my understanding their utterances. This view of the place of insider knowledge is reinforced by Cohen, et al (2000), who assert that ‘individuals’ behaviour can only be understood by the researcher sharing their frame of reference: understanding of individuals’ interpretations of the world around them has to come from the inside, not the outside’ (p.19-20). Hence, as an informed insider, I am able to make good sense of the data my informants have provided. I believe I can read more accurately the innuendos of their references to institutional policies and practices. In this way, my knowledge derived from personal experience helps me better understand the perspectives of my informants. Secondly, the issue of validity relates to accuracy of information. The information provided in the interviews is, of course, most pertinent here. The accuracy of interview information is checked through the summary.

In the study, to enhance credibility and reliability, the background data on informants, like number of years they have taught with ICT and the levels taught, are requested and provided (Verma & Mallick 1999). It is also essential that the sample is representative or the results risk being skewed. In the study, the twenty-two informants represent both the engineering and non-engineering disciplines. There are an equal number of informants in
both groups. It is hoped that these ways of dealing with the issues of method and sampling make the study reliable. Also, open-ended questions related to the broad topics are posed in the interview rather than pre-coded items, as pre-coded instruments contain assumptions (Scott 1996) and are, in this way, not necessarily reflective of informants’ inner thoughts. In addition, to add a touch of reality to the description of the data, the voices of informants are ‘heard’ in the final report in the form of verbatim quotes (Johnson 1984). To elaborate, the amount of data to be presented may force the researcher to turn to reported speech or summaries. But the use of these techniques could mean that the voice of the informant becomes more distanced, which is why verbatim quotes are useful to counter this. In my interview summaries and in the report on the study, verbatim quotes are used, where necessary and appropriate. In this way, credibility of the data is reinforced.

Criticisms of qualitative research being value-laden and non-replicable (McMillan 2000; Cheah & Chiu 1997) also apply to the issue of reliability. Perhaps it is not fair to accuse the qualitative approach of producing potentially unreliable data simply because of the values and subjectivity that are associated with it. In fact, it is precisely the individual’s response that makes qualitative research a viable option, as the evidence gathered is from ‘the insider’s point of view’ (Verma & Mallick 1999, p.29), that is, it ‘reflects the experiences, feelings or judgments of individuals taking part in the investigation’ (ibid, p.27). Qualitative research, therefore, seeks to study ‘human agents and their interaction with the social context’ (Cheah & Chiu 1997, p.60), to understand how ‘informants being studied interpret and construct their social world, and how this social world in turn affects informants’ (ibid, p.62).

3.5 Data analysis

In any study, the data analysis tools are as important as the data collection methods. The analytic tools adopted will depend on the type of data gathered. This section describes the tools used in this study to analyse the data on teacher understandings, namely, linguistic evidence and the metaphorical models of Fox (1983) and Kember and Gow (1994).
3.5.1 Linguistic evidence

In this study, linguistic evidence, namely the words, phrases and metaphors that informants used, is examined. From that, recurring issues and patterns within the a priori topics are identified. These themes relate to the research questions to explore the relationship between teachers’ perceptions of ICT affordances and teachers’ understandings of teaching and learning.

At the start of the analysis process, I read and re-read many times the interview transcripts and summaries to obtain a general impression of the meaning(s) of the spoken text and to familiarise myself with the data. Lexical items were manually cross-referenced, and views compared and contrasted. This process began, in fact, in the transcription stage, when clearly similar or contrasting items were highlighted and marked for future reference. This happened also when subsequent informants provided significant points for comparison and contrast. Notes were made immediately after these interviews to remind myself of these points for further consideration.

The transcribed data were then coded. The coding procedure was relatively straightforward. The first stage of coding sought to identify the categories of beliefs and technology use. Hence, the broad descriptions were: TEACH (beliefs about teaching), LEARN (beliefs about learning), TECHNO (beliefs about technology) and USE (use of technology). In coding each utterance, the context of the utterance was taken into account. Also, where an item was considered a possible member in more than one category, it was assigned accordingly, as the following examples show:

<table>
<thead>
<tr>
<th>TEXT</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>NE10: They can only validate their learning through the analysis and the questioning.</td>
<td>LEARN</td>
</tr>
<tr>
<td>EG3: They need to go to classrooms, go to laboratories.</td>
<td>LEARN</td>
</tr>
<tr>
<td>EG10: Tools cannot take over the face-to-face interaction.</td>
<td>TECHNO/ LEARN/TEACH</td>
</tr>
</tbody>
</table>

EG10’s comment about tools was in reference to IT as a tool. The utterance was assigned
three codes as the references could be to technology, learning and teaching.

At the next stage, more specific codes were assigned to distinguish items within each broad group. This follows numerous readings of the data and making sense of the general patterns appearing from the data. Where an item had received more than one code, each code was given due attention. For instance, the above utterance from EG10 was coded thus (‘F2F’ refers to the face-to-face mode of teaching and learning):

**TECHNO**

Tools cannot take over the face-to-face interaction.  
**TOOL**

**LEARN**

Tools cannot take over the face-to-face interaction.  
**F2F**

**TEACH**

Tools cannot take over the face-to-face interaction.  
**F2F**

For beliefs about ICT, items were further coded according to how informants perceived ICT. The codes in this group are: CO (container), PL (place), PT (presentation tool) and CT (communication tool). The following are examples of this:

**TEXT**  
**CODE**

EG8: We use it for a few things, such as uploading the notes, like a repository.  
CO

NE1: The Discussion Board is more to share information.  
CT

As for teachers’ understandings of teaching and learning, items were assigned the codes that followed the metaphors used in Fox’s (1983) model, that is, TF (transfer), SH (shaping), TV (travelling) and GR (growing). This was done through identifying key words and key concepts, as detailed by Fox (1983) and Kember and Gow (1994) (see sections 3.5.2.1 and 3.5.2.2). The following samples illustrate how items were coded and assigned:

**TEXT**  
**CODE**

NE3: I think the main thing is how you deliver the lecture…  
TF

EG10: You can’t just say this is the definition of this, the definition of that. The whole thing will not go into their mind… They have to see the sequence, see the symbols,
see the equations, see the diagrams.

NE10: …they should go to explore the opportunities beyond the small local market.

EG9: You need to go interpret the knowledge and then form your own knowledge.

When coding was completed, similar issues were grouped into themes or categories, which again were based on the *a priori* topics in the interview schedule. Those that related to the research questions were then identified. As mentioned in section 3.4, recurring themes and patterns contribute to validity. This is similar to searching for ‘“thematic coherence” – the recurrence of themes in the story that tell us something about the underlying values and beliefs of the culture and about the narrator’s perceptions of it’ (Woods 1996, p.31). To illustrate, the recurring issues related to teachers’ beliefs about how learning takes place are that learning happens through face-to-face interaction with the teacher, through thinking and understanding, through doing assigned work, and through making an effort and having the right attitude. These beliefs became apparent when teachers described how they had used ICT in their teaching and justified their use of this technology in the way that they did. Looking for repeated words and phrases within and across transcripts led to identification and classification of these issues. However, as can be expected, not all items fitted the categories perfectly. To clarify, there were not many instances of these cases as the informants generally kept to the questions asked. I noted these instances separately to later consider how they might fit in with the rest of the data. Where the items were regarded as insignificant or irrelevant to the recurring themes, they were eventually left out of the discussion. One example is the advice NE1 gave to his students on how to handle online tutorials:

> You just have to imagine standing at the screen for two hours. Even online you must tell students, you don’t have to do the online tutorial within two hours. You can do five minutes, take a break, call your boyfriend, girlfriend, go toilet. Ten minutes you come back again. And if you feel tired, just shut down, then go off, next day come back again. Stagger it; don’t do two hours one shot, I told them.

Another example is provided by EG7 concerning copyright to teaching and learning
I am not that concerned in allowing others to use my materials. Recently someone teaching in the polytechnics approached me to seek my permission in using my materials; I allow him access to our course site. He can then download the materials; I am okay with that.

Analysis of the data began after coding was completed. This involved examining words and metaphors, which is one way of discovering meaning (Yero 2002; Freeman 2000; Wellington 2000; Lakoff & Johnson 1980), where the focus is on ‘the immediate conditions of any utterance and the interrelatedness of components of the discourse’ (Heath 2000, p.27). This form of analysis helps to highlight the topics that my informants were interested in, or that were important to them, as key issues are identified through the linguistic patterns that were found. In other words, my interpretations are supported by linguistic evidence (Cohen, et al 2000; Freeman 2000; Wellington 2000). The argument in favour of examining words and phrases is that in seeking to discover meaning through linguistic evidence, ‘validity … becomes a matter of trusting the meanings that are represented in the data, and the speakers are “taken at their word”’ (Freeman 2000, p.295).

In addition to examining words and phrases, metaphors used by informants are also considered. The place of metaphor in understanding a person’s thought and experience was briefly described in section 2.5.1. The usefulness of metaphor as an analysis tool has been broached by educational researchers (for example Marcel 2000; Cameron & Low, 1999; Coffey & Atkinson 1996). Metaphor analysis has been used in investigations on classroom role relations (McShane 2005; Block 1992), teaching and instruction (Hall 2002; Wilson 1995), teachers and learners (de Guerrero & Villamil 2002; Ellis 2001, Oxford 2001); and teacher thinking and beliefs (Yero 2002; Gabel 1994; Munby 1986).

Metaphor analysis, that is, examining metaphorical concepts (Lakoff & Johnson 1980, p. 6), can be viewed as ‘a form of content analysis’ (Wellington 2000, p.148). One way to find out what our conceptual system is like is through examining linguistic evidence.
(Lakoff & Johnson 1980, p.3-4). In other words, ‘since metaphorical expressions in our language are tied to metaphorical concepts in a systematic way, we can use metaphorical linguistic expressions to study the nature of metaphorical concepts and to gain an understanding of the metaphorical nature of our activities’ (ibid, p.7). Hence, metaphors are understood to be not just linguistic expressions but they are reflections of the way a topic is conceptualised through comparison with another object that has an atypical relationship with it. In the words of Lakoff and Johnson, ‘the essence of metaphor is understanding and experiencing one kind of thing in terms of another’ (ibid, p.5). Metaphors are usually reflected in the frame A IS B (following Lakoff & Johnson, 1980). Thus, there are essentially two components to a metaphor. The first component is often termed the ‘Topic’ (sometimes the ‘Tenor’) and the second component is termed the ‘Vehicle’ (Cameron & Low 1999a, p.13). The Topic is that which is being talked about and the Vehicle is the thing that the Topic is being compared to. Both components reflect underlying conceptual systems. In the ARGUMENT IS WAR example, argument (Topic) is seen in terms of war (Vehicle). In metaphor analysis, ‘writers on metaphor through the centuries have consistently seen the Topic and Vehicle terms of metaphor as the surface forms of underlying systems of conceptual information’ (ibid, p.17). However, as Cameron (1999) cautions, the A IS B structure ‘has under-emphasised the potential effect of form on processing and understanding’ (p.12). Another drawback of this kind of analysis is ‘the directness of the inferencing from language use to claims about thought structures’ (ibid, p.18). Cameron suggests that ‘an applied linguistic dimension to metaphor study will hopefully restore and renew interest in language form at word, clause, sentence and discourse levels’ (ibid, p.12) and that future metaphor research might engage ‘a broader “cognitive” approach to language use, and thus to metaphor, which makes use of constructs such as explanation-based concepts and social interactionist accounts of their development’ (ibid).

Arguably, using metaphor analysis can be problematic. For example, there are certain constructs that are closely related to metaphor, such as metonymy, simile, allegory and personification (Cameron & Low 1999b). For the purpose of this study, these constructs are not included. A possible argument against using metaphor analysis is that while
certain aspects of an issue are highlighted through a metaphor, others are hidden that are ‘inconsistent with that metaphor’ (Lakoff & Johnson 1980, p.10; Cameron & Low 1999a). Another argument concerns the issues of accuracy and reliability, for the meaning of a metaphor to someone is based on that person’s understanding that is grounded in experience and, therefore, subjective (Lakoff & Johnson 1980). For instance, the acquisition and participation metaphors (Sfard 1998) are both important in the process and experience of learning, so that giving dominance to one or the other weakens our understanding of what learning is about (ibid).

Also of concern in metaphor analysis is the matter of metaphor identification (Low 1999). According to Cameron (1999), ‘the basic necessary conditions for linguistic metaphors are taken to be domain incongruity and potential transfer of meaning’ (p.118). Specifically, ‘a stretch of language is said to be a linguistic metaphor if it contains reference to a Topic domain by a Vehicle term (or terms), there is potentially an incongruity between the domain of the Vehicle term and the Topic domain and it is possible for a receiver…to find a coherent interpretation which makes sense of the incongruity in its discourse context, and which involves some transfer of meaning from the Vehicle domain’ (Cameron 1999, p.118). I present here an example from the pilot study to illustrate this:

   It’s not a dead thing. You know now all these computers are not only interactive but intelligent. So it’s not just an object, a dead object. (EG)

In EG’s description of the computer, the word dead is identified as metaphoric. Here, the Topic is the computer and the Vehicle is an animate object, like a person or an animal. There is, potentially, an incongruity between the Topic and Vehicle domains. But one can make coherent sense of this apparent incongruity because one can transfer some meanings from the Vehicle domain to the Topic domain. In other words, one can associate with the Topic ideas of aliveness, action and intelligence, along with the connotation that the computer is an intelligent ‘being’ that is able to do things, like a living animate object can.

In spite of these points of contention, metaphor analysis can be useful to examining
perceptions and studying thinking. Ellis (2001), for one, demonstrates how second language learners are constructed by the metaphors of researchers in second language acquisition and concludes that metaphor analysis as a methodological tool can help reveal ‘underlying conceptualisations’ (p.84). In his study, second language researchers see learners as containers, negotiators and machines, whereas learners see themselves as sufferers, problem-solvers, travellers, strugglers and workers. Such conceptualisations have implications for the way that researchers and learners approach second language learning. Other studies have shown how metaphor analysis can reveal content of utterances (Oxford 2001; Block 1999; Cortazzi & Jin 1999; Gwyn 1999; Milne & Taylor 1995). Cortazzi and Jin (1999), to cite another example, believe that ‘a study of the conceptual metaphors produced by teachers and students should…prove revealing, telling us something about their professional perceptions, their thinking and their learning’ (p.150). In their study, elicited and spontaneous metaphors about teaching, learning and language were analysed, resulting in identification of seven reasons for why teachers use metaphors in accounts of learning. They discover that teachers use metaphors to ‘identify for themselves what they actually experience’, add ‘dramatic effect to narratives of learning’, ‘express the meaning more concisely’, ‘invite interaction’, organise ‘systematic concepts in (their) cognitive models of learning’, ‘transform images into models’, and organise ‘(their) interpretation of learning’ (p.160-161). They found, too, that their informants saw teaching as *art*, *fire*, a *creature*, a *machine* or *tool*, *communication*, a *source*, a *text* and a *journey* (p.162). Oxford (2001) tells of how learners’ metaphorical constructions of their language teachers reveal learners’ response to them and suggest the kind of teaching approaches used; these approaches are grouped as autocratic, democratic/participatory and laissez-faire. Within each approach, the teacher is viewed in different ways and described via different metaphors. For instance, teachers who use the autocratic approach are described as *manufacturer*, *witch*, *hanging judge* and *tyrant*; teachers who use the democratic/participatory approach are described as *challenger* and *catalyst*, *entertainer*, *nurturer* and *tool provider*; and teachers who use the laissez-faire approach are described as *blind eye*, *bad babysitter*, *sleep inducer* and *tool withholder*. Similarly, Milne and Taylor (1995), in undertaking to study the metaphors used by science teachers in their classroom discourse, believe that examining the metaphors
which teachers use unconsciously in their everyday classroom discourse is a means to discovering their implicit beliefs. They discover three key metaphors that they believe influence these teachers’ teaching practices: their informants see teaching as a journey, the teacher as pathfinder and knowledge as an object. The teaching as a journey metaphor suggests that the teachers ‘conceive teaching and learning science as a journey along a narrow path… and teachers are concerned that students are “on the right track” and are proceeding carefully along the path “one step” at a time’ (Milne & Taylor 1995, p.43). Similarly, the teacher as pathfinder metaphor ‘provides a personal referent of control which justifies teachers assuming responsibility for organising and setting limits on classroom activities’ (ibid, p.43). Finally, the knowledge as object metaphor suggests that knowledge is seen as ‘an object that has a concrete existence… in other words, because it seems to exist out there (their italics), scientific knowledge might not become fully internalised by students’ (ibid, p.45). These metaphors, the researchers assert, are associated with an objectivist view of scientific knowledge. The researchers conclude that the metaphors which science teachers use in their daily discourses do influence their ‘teaching roles and the image of the nature of science evoked by them’ (ibid, p.47). Studies like these, therefore, illustrate the relevance of metaphor analysis to understanding thinking.

As seen, analysing metaphor use can be a powerful way of deriving meaning from what is said or written. Within education research, ‘researchers agree that metaphors are widespread social habits that are part of teachers’ discourse, providing access to commonly held beliefs about their profession’ (de Guerrero & Vallamil 2002, p.98; de Guerrero & Vallamil 2000; Cortazzi & Jin 1999; Marchant 1992; Munby 1986). Over time, these could become buzzwords, or commonly used expressions. As an example, applied linguists used to describe the language learning process in terms of the input-black box-output metaphor taken from electrical engineering, and gradually the term input was adopted as the metaphor for the target language (Kramsch 1995). In my study, the terms delivery and repository used by informants are examples of such expressions. Teachers talk about delivering lessons and materials and the Course Documents function in Blackboard is described as a repository for course notes and other materials. Due to the
common use of these terms, the question may arise as to how these terms can be viewed as metaphors – a question related to the issue of metaphor identification (Low 1999). I contend that because metaphors arise from our experiences, it is ‘the grounding of metaphor in experience that has made it such a central concern of the cognitive paradigm’ (Taylor 1995, p.140). Hence, where applicable, common expressions found in this study on teacher thinking can be considered metaphorical language that suggests the ‘metaphoric content’ (Wellington 2000, p.148) of the data.

For the actual study, as mentioned, each transcript was given several readings for an overall impression of the meaning(s) of the spoken text. Then, following Cameron’s (1999) metaphor identification procedure (p.117), which is similar to a family resemblances approach (p.116; Cameron & Low 1999b, p.81), I proceeded to look at lexical items that might have been used metaphorically. I grouped similar potential linguistic metaphors together for closer examination. For example, the lexical items describing teachers’ use of ICT such as *put in, put into* and *embedded* were identified as metaphoric. Together with recurring themes and patterns, this was how I identified the metaphors to describe informants’ perceptions and use of ICT affordances (see section 4.3).

Of course, the issues that finally emerge could be points of agreement or points of contention (Wellington 2000), depending on informants’ perceptions and interpretations (Woods 1996). Hence, I am aware of an added dimension to the question of interpretation, which is, that it relates to the possibility of multiple (and/or competing) interpretations. The issue of multiple interpretations is especially pertinent in the examination of metaphorical language, especially in trying to decode the underlying meaning of each metaphor. Perhaps, to counter the charge of multiple interpretations, ‘the best one can give are plausible reasons for a particular interpretation of a (presumed) actual social reality’ (Miller & Fredericks 1996, p.16). One way is to present interpretations to peers in the field to check the researcher’s interpretations against their own. Another is to check understandings of metaphors against other researchers’ work, as I did when identifying the container metaphor (Ellis 2001; Block 1992; Lakoff &
In my study, the primary method I adopted to ensure that my interpretations were valid and acceptable and that the original meanings had been adequately and accurately portrayed was via the interview summaries. However, the summaries did not include analyses of metaphor use, mainly as the analysis process was not conducted at the time that the summaries were being written up. I realise the delay could be problematic for interpretation. Also, to speed up the analysis process, I made unilateral identifications of metaphor use, as other researchers have done (Cortazzi & Jin 1999; Gwyn 1999). This could pose another problem for the study. However, the interview answers were all rather straightforward and presented in clear, simple language, so that there did not appear to be controversial items and identifying metaphors was therefore relatively unproblematic. Still, as Low (1999) argues, there are benefits and problems with the metaphor identification procedures, whether by the researcher, the informants or uninvolved third parties.

One view of the data analysis stage in a qualitative study is that analysing and ‘manipulating qualitative data …is an eclectic activity; there is no one ‘right’ way’ (Wellington 2000, p.150). Assuming this is so, the qualitative researcher must still ensure that the analysis is honest, methodical and rigorous, or they risk obtaining unreliable results. Therefore, at this stage of data analysis, the issue of reliability must be addressed. First, reliability of interpretation depends on the skills of the researcher at recognising significant events, at interpreting and at representing (Wellington 2000). As mentioned, my repeated reading of interview transcripts helped in the identification of issues and themes that appear significant to informants. Next, regarding the analytical skills of the researcher, according to Heath (2000), it is best for the researcher analysing linguistic data to have knowledge of linguistics and related disciplines so as to understand the context of language use; this will increase the reliability of results presented. As a language major and teacher of English and communication skills, I am equipped with the knowledge and skills to analyse verbal data and the non-verbal cues observed during the interview sessions.

In my analysis of the data, I also made use of the notes I had made of informants’ tone of
voice and facial expressions observed during the interviews. Such non-verbal cues were an indication of informants’ affective response to an issue. For instance, EG1 emphasized, through facial expressions and tone of voice, that he was aware of his learners’ preference for ‘entertaining type of classes’, that is, lessons that are ‘lively’ and ‘entertaining’ – according to EG1, these are words used by learners themselves. He was also aware that learners expected him, the lecturer, to be like a television personality, but he would not behave that way. His non-verbal cues reinforced my interpretation of his verbal message – that teaching is not equated with entertaining. However, not all instances of non-verbal messages can be as easily interpreted. As an example, long pauses could be an indication that the informants had heard the question for the first time and because they did not have a ready answer for it, they needed to think about the issue posed. To Piaget (1929, cited in Wellington 2000), this is ‘liberated conception’ (p.143-144); such answers are seen as ‘original products of the interviewee’s mind’ (Wellington 2000, p.144). Long pauses could also signal that the informants know exactly what their answer is and need time for either deeper reflection or for a careful construction of the answer in a way that might be perceived as being more acceptable, either by the interviewer or the interviewees themselves, or both. In instances of doubt regarding the interpretation of non-verbal cues, I relied on examination of the verbal messages, taking into account not only significant words and phrases, but also the contexts in which the utterances were made. This required a reading of larger chunks of text within the transcript for a firm sense of the intended meaning.

3.5.2 Two metaphorical models

This section presents two metaphorical models chosen as the other analytical tool. They are Fox’s (1983) theories of teaching and Kember and Gow’s (1994) orientations to teaching. They both fulfil two criteria: they illustrate conceptions of teaching and they contain metaphors for teaching.

Much of the literature on teaching that I came across describes teaching, including pedagogy with ICT, in terms of teaching styles, approaches, techniques, teachers’ roles (for example, Bonk, et al 2001; Oxford 2001; Spanier 2001; Bergen 1999; Harvey &
Knight 1996; Lander, et al 1995), teacher knowledge and professional learning (Harris, et al 2007; Fisher, et al 2006; Shulman & Shulman 2004; Loveless 2003; Loveless, et al 2001; McCormick & Scrimshaw 2001; Banks, et al 1999; Mortimer 1999). During my preliminary examination of the data that I had collected, I found these aspects were either outside the scope of my investigation, like teaching styles and techniques, or were limited as an analytic tool. For instance, Bonk et al (2001) focussed on four roles of the online instructor, which is only a part of my investigation into teacher thinking. Similarly, the teaching approach presented by Lander et al (1995) is not explicitly a framework that can be easily used as an analytic tool. Even the models of teacher knowledge (Harris, et al 2007; Fisher, et al 2006; Shulman & Shulman 2004; Loveless 2003; Loveless, et al 2001; McCormick & Scrimshaw 2001; Banks, et al 1999) were found to be suitable to a certain extent. These models focus on attributes of good teaching, or on the interaction between the dimensions of teacher knowledge or the interaction of these dimensions and the community, the scope of which exceed the research purpose of this study. For instance, Shulman and Shulman’s (2004) model describes the characteristics of an accomplished teacher (at the individual level of analysis), and of the four categories of teacher knowledge in Banks, et al’s (1999) model, only one, Personal Subject Construct, addresses the question of teacher beliefs. It must be acknowledged that even though none of these models were adopted in their entirety, the dimensions of teacher knowledge that they present are utilized in the discussion in chapters 4 and 5.

One other consideration of my choice of an analytic tool is the use of metaphors to gain insight into teachers’ thinking (see section 3.5.1). For this reason, an appropriate tool would be one that bridges the areas of metaphor and teaching conceptions. Two models that complement each other were found to be suitable. They are Fox’s (1983) theories of teaching and Kember and Gow’s (1994) orientations to teaching. One reason for choosing these models is that they are applicable to current research on conceptions of teaching. Kolari and Savander-Ranne (2002) made use of Fox’s theories to describe how teacher thinking about teaching affects their choice of pedagogical approaches. Similarly, in their study of how university lecturers’ approaches to teaching are related to their conceptions of teaching, Kember and Kwan (2002) found two contrasting approaches to
teaching – ‘content-centred’ and ‘learning centred’ (pp.231-233) – corroborating Kember and Gow’s orientations to teaching. Another reason for using them is that the categories are explicit, making them easy to apply. The third reason is that Fox’s theories of teaching are presented as metaphors.

In discussing the theories and the way their application is reflected in subject disciplines, Fox (1983) maintains that teachers’ theories of teaching affect the teaching strategies they adopt as well as their attitudes to learners. He presents four theories – transfer, shaping, travelling and growing. He also argues that teachers’ theories of teaching influence learners’ approaches to learning. He concludes that recognising differences in perceptions among teachers and learners regarding the teaching and learning process is a step towards reconciling differences among them. To the teacher, in particular, knowing these theories is an advantage as they can then select the most appropriate teaching approaches according to the situation. This suggestion is similar to Alexander’s (2005a, 2005b) idea of ‘fitness of purpose’ of the choices offered by a teaching repertoire. Like Fox, Kember and Gow (1994) state that teachers’ conceptions of teaching affect the quality of learning, that is, the use of surface or deep approaches to learning that learners adopt. Hence, their research examines the relationship between conceptions or orientations to teaching and the way courses are taught. Similar to Fox’s research, their data were collected from academics representing a wide variety of disciplines. They present two basic orientations to teaching, namely, knowledge transmission and learning facilitation. Their research reveals correlations between teaching orientations and student approaches to learning: the knowledge transmission orientation generally leads to a surface approach to learning, while the learning facilitation orientation usually results in a deep approach to learning (Kember & Gow 1994). Surface learning occurs when the learner does not relate new knowledge to existing knowledge, memorises and reproduces facts for assessment and is afraid to fail. Deep learning, on the other hand, occurs when the learner focuses on meaning and understanding, attempts to connect new information to existing knowledge, relates theory to practice, reflects on what they have learnt, and is intrinsically motivated (Atherton 2005; Prosser & Trigwell 1999, cited in Åkerlind 2004).
These two models are similar in that the categories in Kember and Gow’s knowledge transmission orientation match Fox’s description of the ‘simple’ theories, that is the transfer and shaping theories. As for the categories in the learning facilitation orientation, they match the description of the ‘developed’ theories, that is, the travelling and growing theories. These models complement each other, thus providing a more detailed framework for data analysis. In this respect, they are suitable for the current study. The following sub-sections describe these two models of teaching.

3.5.2.1 *Theories of teaching (Fox)*

In wanting to know what teachers understand by the term ‘teaching’, Fox (1983) asked newly appointed academics the question “*What do you mean by teaching?*” Their responses and his personal observations of teaching modes and methods related to the nature of the subject disciplines gave rise to a conceptual model for thinking about teaching. Fox’s model consists of four basic ‘theories of teaching’ – the transfer theory, the shaping theory, the travelling theory and the growing theory. The first two are termed ‘simple theories’ while the last two are known as ‘developed theories’.

In Fox’s model, ‘simple’ theories convey a simple relationship between teaching and learning. As an example, teachers who hold such a theory believe that learners know the topic simply because they have previously been introduced to it. It seems their concern is not about the quality of teaching or the quality of learning; rather, the teacher expects learners to remember the information conveyed earlier. In other words, as long as there has been the activity of teaching, the learners are expected to have learnt. Teaching, in this sense, seems to be viewed as an event independent of learning, and such a view is one held by many inexperienced teachers (Kolari & Savander-Ranne 2002). ‘Simple’ theories do not seem to accord with Harvey and Knight’s (1996) definition of teaching, which states that teaching is considered to have taken place only when there is learning or transformation. This does not mean, however, that there is no place in education for ‘simple’ theories, for teachers do analyse their target audience and the learning situation to make an informed choice of the teaching approaches to use.
Fox’s ‘simple’ theories of teaching include the transfer theory and the shaping theory. In Fox’s description of ‘simple’ theories, the teacher must be in complete control of the commodity being transferred (transfer theory) or of the shape and size of the finished product (shaping theory). These are usually predetermined, and the teacher’s role is to arrange the transfer or mould the product. Fox observes that ‘simple’ theories of teaching are often regarded as encouraging a surface approach to learning.

Unlike ‘simple’ theories, ‘developed’ theories of teaching acknowledge the role of the learner in their own learning. Indeed, this is an essential quality in ‘developed’ theories. Here, learners contribute to the process, pace and direction of their learning. Fox’s (1983) ‘developed’ theories include the travelling theory and the growing theory. The role of the teacher who adopts either or both of these theories is to respond to the needs of the learner, like an expert guide helping a novice traveller to ‘make more sense of their experience and of what lies ahead still to be mastered’ (p.156). Hence, unlike the ‘simple’ theories, ‘developed’ theories do not present the teacher as ‘provider of information or shaper of inert material’ (p.157). In this way, Fox asserts, ‘developed’ theories are regarded as encouraging a deep approach to learning. If teaching is leading learners to transformation, as Harvey and Knight (1996) state, then this could be achieved with deep approaches to learning, as such approaches emphasize the search for meaning and understanding in the learning process, compared to surface approaches to learning, which focus on rote learning and the passing of examinations.

An additional point that Fox makes about these theories is that as the transfer and travelling theories view the teaching of subject matter rather than the learner as important, they are likely to be evident in teachers teaching subjects that are heavy in factual content, like engineering and law. In contrast, as the shaping and growing theories relate to teaching that regards the learner as the object of teaching, they are more probably evident in teachers teaching subjects such as drama and management, where personal attitudes and skills are more crucial than detailed, factual knowledge.

A fuller explanation of each of these theories, that is, the transfer, shaping, travelling and
growing theories, is given below. A hybrid theory, the building theory (see section 3.5.2.1.3), is included as the link between the ‘simple’ and ‘developed’ theories.

3.5.2.1.1 The transfer theory

The transfer theory is one of Fox’s (1983) ‘simple’ theories of teaching. Indeed, it is the most basic of teaching theories. The transfer theory sees knowledge as a commodity which can be transferred from one container to another or from one location to another through the act of teaching. The application of this theory is apparent in such expressions as *imparting knowledge* or *conveying information* or other verbs that denote giving and transferring. Transfer theorists spend much time on material preparation, making sure that the material is accurate and current. They also develop and refine their methods of transfer, such as using elaborate teaching aids. To the transfer theorist, the lecture is the most appropriate platform of knowledge transmission, for the lecture is a one-way street, with students listening and perhaps noting down whatever the lecturer says. Besides the metaphor of the one-way street, the transfer theory is also described by Fox (1983) in two other ways: the baby food manufacturing analogy and the broadcast analogy (p.153). In his baby food manufacturing analogy, the teacher processes tough material into easily digestible form. In other words, the teacher understands that difficult lesson material like complex concepts needs to be simplified for the sake of students, although with simplification, the material is altered in some way. In the broadcast analogy, on the other hand, the teacher scatters seeds rather than transfer them to containers. However, in this variant of the transfer theory, the teacher is not concerned with what learners do with the seed. They see their primary responsibility as ensuring ‘the purity of the seed’ (ibid). In other words, complex concepts are presented as they are, without any modification for easy reception.
### The shaping theory

The shaping theory is another of Fox’s (1983) ‘simple’ theories of teaching. This theory can be explained in two ways. The first variant of the shaping theory sees learners’ brains as raw material to be shaped or moulded. Commonly used expressions that suggest this theory at work are *produce*, *develop*, *showing* and *demonstrating*. Shaping theorists prefer to demonstrate a quality or concept and then set exercises so this quality or concept can be applied and consequently, is formed in learners. This is similar to the notion that learners solve problems through teachers’ demonstrations that they are asked to repeat or through leading questions. In any case, ‘the teacher is both guide and mentor’ (Glassman 2001, p.11). For example, in theoretical subjects like mathematics and engineering, theoretical exercises or ‘problems’ are set, and the usual teaching strategy employed is one in which the teacher demonstrates the way of solving the problem by going through it at the whiteboard or on an overhead transparency. Learners are then set similar ‘problems’ to solve using the same methods. The second variant of the shaping theory sees teaching as a matter of making connections in learners’ minds. This is the ‘electrical’ version of the theory. In other words, shaping theorists seek to help learners make connections between parts of the subject matter as well as connections between aspects of learners’ experience. Advocates of the shaping theory prefer to teach in lecture theatres, workshops and laboratories. The lecture environment, in particular, is favoured as it gives the teacher control over learners to shape their thinking and understanding. Overall, these environments are deemed perfect for the teacher to demonstrate and thus mould thinking. Shaping is accomplished ‘through the sheer force of the spoken word and the authoritative presence of the expert on this controlled, passive raw material’ (Fox 1983, p.154).

### The building theory

A hybrid between the transfer and shaping theories of teaching is the building theory (Fox 1983), which can become a link between the ‘simple’ and ‘developed’ theories. In the building theory, concepts are commonly used with expressions like *build* and *building*. This theory views learners’ brains as building sites. Based on the transfer theory, teaching is seen as delivering raw materials of the subject matter to the site. As ‘a
concept is a complex structure built of many different interrelated elements’ (Fox 1983, p.154), teaching involves both delivering the material as well as building the structure according to a predetermined plan. Furthermore, ‘knowledge and understanding are seen as rigidly structured and acquiring them is done through a rational piece-by-piece process’ (Northedge 1976, cited in Fox 1983, p.155). The teacher, then, is the builder and the learner is the ground on which the builder builds. The house is built with ‘bricks of knowledge and skill… laid on top of each other in a fully planned way’ (ibid.), and the builder follows a plan to arrive at the completed building. The finished product signifies understanding on learners’ part, evident from the passing of criterion-referenced tests. In addition, from the perspective of the shaping theory, the teacher functions as architect and builder. A sign that this theory is at work is when the teacher expresses annoyance at learners’ unwillingness or inability to work with the material that the teacher has so meticulously produced and carefully delivered. That said, this theory acknowledges a possibility for the learner to play a more active role in the learning process – that of building their own concepts and modifying and developing the structural design as the building is in progress. This shift to the learner might seem like a contradiction from what is said earlier about the teacher’s role, but because the building theory acts as a bridge between the ‘simple’ theories and the ‘developed’ theories, one can see how learner agency comes into the picture. According to Fox (1983), when the learner takes an active part, the building theory can become a ‘developed’ theory. In his description, there are two ‘developed’ theories, namely, the travelling theory and the growing theory.

3.5.2.1.4  The travelling theory

The travelling theory is one of the ‘developed’ theories of teaching. In the travelling theory, the common expressions are guide, lead and point the way. Here, the teacher focuses on the subject and/or subject matter. Fox (1983) sees learning as a journey and the subject or module as an interesting landscape to be studied. In a sense, studying a subject is like studying a map. The map shows relationships among the main features of the travel experience (Phillips & Soltis 2004). But according to Fox (1983), the journey is an uphill one, over uneven terrain, and much effort is needed on the traveller’s part to overcome difficulties of the climb, so that they may be rewarded by the view from the
top. Only from the top can the traveller have a bird’s eye view of the landscape. What this refers to is that inter-connections of patterns are made clear and meaningful when the learner reaches higher ground in their pursuit of subject knowledge. Here, the teacher performs various roles. First, the teacher is a local guide (Wright 2000), who has travelled the routes and knows the views, but who is still exploring. The guide knows that there is always something new to learn and enjoys sharing their experience with the novice traveller. Next, the teacher is an equipment provider, who supplies travelling gear and, when needed, accompanies novice travellers on their exploration journey (Fox, 1983). In this sense, the teacher is a fellow traveller, who makes suggestions about the best routes to take and so on, and can help the novice traveller make sense of what they see from the hill-top. Fox (1983) states explicitly that the teacher is not a coach driver on a packaged tour. Learning, according to him, is a journey of exploration, not a direct trip from one point to another. And exploration is viewed as a personal activity. In Fox’s (1983) analogy, therefore, the teacher as guide sees their main responsibility as that of continually monitoring learners’ progress and providing them with detailed feedback so that they can improve.

3.5.2.1.5 The growing theory

The growing theory is the other ‘developed’ theory of teaching described by Fox (1983). The teacher here is a gardener who sees the learner’s mind as a piece of ground. This ground is already covered with plants (concept systems), some of which are worth holding on to and cultivating. There will have been previous gardeners who have worked on this ground, and the current gardener is mindful of how their work can have an effect on the work of others. Although there will have been broad plans for the garden, the gardener does not dictate what the garden will eventually look like, as the gardener recognises that the garden is continually changing as different plants grow. Instead, the gardener’s job is to find ‘ways of acting as a catalyst in bringing out the best he [sic] can from the available ground’ (Northedge 1976, cited in Fox 1983, p. 157). This means that the teacher ‘does not attempt to specify the exact dimensions that each plant (or concept structure) is to achieve’ (Fox 1983, p.157). In other words, rather than emphasising mastery of subject, the teacher focuses on what the learner is becoming as a person, that
is, on their personal growth, for ‘the driving force for growing is internal’ (ibid, p.158).

The above shows, therefore, that Fox’s theories of teaching can be helpful in illuminating teachers’ conceptions of their work and their roles. Fox’s model has empirical value as it has been used in teacher education to help trainee teachers ‘develop their own personal views and styles’ (Kolari & Savander-Ranne 2002) and in faculty development (James 2006). However, what he presents are broad descriptions. For a more concrete description of a model of teaching, we turn our attention to Kember and Gow (1994). Kember and Gow’s (1994) orientations to teaching reinforce Fox’s theories by categorising teaching tasks and purposes. This is explained in the following subsection. Together, Fox’s theories and Kember and Gow’s orientations provide the framework in this study for understanding teachers’ beliefs about teaching and learning.

3.5.2.2 Orientations to teaching (Kember and Gow)

Kember and Gow (1994) describe two orientations to teaching: knowledge transmission and learning facilitation. Unlike Fox’s broad descriptions of his theories of teaching, Kember and Gow’s orientations consist of subscales or specific categories. In the knowledge transmission orientation, the subscales are: training for specific jobs, use of media, imparting information and knowledge of subject. In the learning facilitation orientation, the subscales are: problem solving, interactive teaching, facilitative teaching, pastoral interest and motivator of students (Kember & Gow 1994, p.59). These categories are useful for identifying constructs related to the teaching activity, as shown below.

3.5.2.2.1 Knowledge transmission orientation

The knowledge transmission model consists of four subscales, as Kember and Gow (1994) call them. For this orientation, the teacher must be knowledgeable and learned; this is the primary requirement of a teacher. As the teacher’s role is to impart that knowledge, teaching is ‘a transfer of information from one vessel to another’ (p.64). To aid the teacher in an effective transfer, educational media are used. In fact, overhead transparencies are preferred as learners are expected to copy verbatim from them. Lastly, knowledge transmitters often see themselves as preparing learners for specific job
positions and hence their focus on the subject matter. This orientation is similar to Fox’s (1983) ‘simple’ theories, that is, the transfer and shaping theories, in the way it regards knowledge and the teaching process, the way visual aids are used to effect the transfer of knowledge and the way the learner is expected, at the end of their education, to have been moulded and made ready for specific jobs.

3.5.2.2 Learning facilitation orientation

A learning facilitator sees problem-solving as a high-level aim of education, along with other aims such as critical thinking and independent learning. To help learners achieve these aims, the teacher acts as a guide who is responsible for making sure that learning takes place. Hence, the teacher with the learning facilitation orientation seeks to make their teaching more interactive and to motivate learners so they will be enthusiastic and excited about learning. Last but not least, the learning facilitator has a pastoral interest in their learners, that is, they show care and concern for them. Put simply, these teachers are genuinely interested in the personal growth of their learners. This orientation is similar to Fox’s (1983) ‘developed’ theories, that is, the travelling and growing theories. This is seen in the way the teacher views the importance of high order skills like problem solving and critical thinking. At the same time, they place significance on the learner as a person whose personal growth is important.

Fox’s (1983) and Kember and Gow’s (1994) models of teaching, therefore, are complementary to each other and so provide a possible framework for data analysis. As will be seen in chapter 4 where the findings of the study are presented, these theories fit the purpose of the study in identifying the understandings of teaching and of learning held by both engineering and non-engineering informants.

3.6 Ethical issues

At this point, a word regarding ethical research is necessary. As a researcher, I am aware that ethical issues appear at every turn of the research journey. The key issues I considered include access to informants and information, confidentiality and fairness in reporting (Cohen, et al 2000; Scott 1996; Johnson 1984). For instance, I am aware that
during the interviewing process, I should not lose control of the situation by becoming a ‘confidant’ (Johnson 1984, p.15) to the informant as this might compromise my position as researcher, that is, an objective, neutral party. Also, while the idea of a thorough interview is attractive, I have to be mindful of not overstaying my welcome or imposing on the interviewee’s time longer than is warranted.

An ethical researcher has to protect their informants’ interest, especially as personal views are involved, which may be open to misinterpretation by other parties, like colleagues, supervisors and management, who may have access to the published information. The researcher has to bear in mind the possible consequences for informants and ensure confidentiality, such as the identity of informants, is uncompromised. This has implications for the way that information provided is presented, like the naming of the school subject and description of duties specific to particular informants. Hence, a method such as offering the transcript or summary back to the informant for checking gives reassurance to the informants that their consent is sought for the final version for publication. It is vital that informants feel secure with that shared version of the interview. As an example, two informants in the study exercised that option to present a final version of the information they had earlier given. While one deleted the expression ‘afraid of’ when evaluating student behaviour, the other removed a phrase describing a response to a particular task. In the second instance, the deleted phrase was ‘selling of services to the cheapest bidder’. According to this informant, that was a tongue-in-cheek comment; apparently, this informant had learnt about how a CEO had lost his job because of a similar comment, and hence their request not to include that expression in their interview transcript and summary. I respect the sentiment and decision of these informants, which is the reason the final versions of their transcripts and summaries do not contain these expressions.

Responsible researchers are constantly mindful of the ethical issues that may arise throughout the research process. It is, therefore, important that they make ethical decisions about the way they conduct themselves and to show their concern with ‘the rights and responsibilities of both researcher and researched’ (Scott 1996, p.68). It is
hoped that this awareness of ethics in research is adequately communicated in this thesis.

To conclude, most research situations give one a chance to learn and understand. It is important that in a qualitative study, one is allowed the space to explore and discover. In my study, I recognise the need to be flexible where time and effort are concerned. The qualitative approach may entail a slow and tedious process, but the rewards it promises are attractive. In view of the above discussion covering the criteria of authenticity, generalisability, validity and reliability, the qualitative approach is justified for my study. More importantly, while I acknowledge that not all the criteria can be fully met, I have considered the drawbacks and related ethical issues, so as to maximise the value of such an approach.

In summary, this chapter has described the research approach, the context of the study, the sample, the data collection and analysis methods, and the way ethical issues are handled in the study. The following chapter presents the findings on teachers' use of ICT in their teaching, as well as their understandings of the affordances of ICT and of teaching and learning. It also attempts to show the relationship between these elements.
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CHAPTER 4
TEACHERS’ UNDERSTANDINGS OF TEACHING AND LEARNING
AND ICT AFFORDANCES

4.1 Introduction
As discussed in chapter 2, teachers hold different personal views about teaching and learning, which are reflected in the way they attend to their classroom responsibilities, such as use of textbooks and design of learning tasks (see Woods 1996 for an example of a study on teacher cognition and classroom processes). Similarly, teachers use ICT in ways that match their personal understandings of teaching and learning. Teachers’ responses to ICT indicate and are associated with their understandings of teaching and learning, which are revealed through their orientations to teaching (Kember & Gow 1994) and espoused theories of teaching (Fox 1983).

As stated in chapter 1, the aim of the study is to explore the relationship between teachers’ understandings of teaching and learning and their perceptions and use of ICT affordances. This chapter, therefore, describes informants’ understandings of teaching and learning and their perceptions of ICT as well as explores the relationship between these understandings and the use of ICT in their teaching. The chapter also explores tensions arising from the interaction between understandings and use. The findings presented here seek to provide answers to the following research questions set out at the start of the study:

- What are university engineering and non-engineering teachers’ understandings of teaching and learning?
- What perceptions do these teachers have of the affordances of ICT?
- How do these teachers at the university use ICT in their teaching?

Sections 4.2 and 4.3 describe informants’ beliefs about learning and teaching and their perceptions and use of ICT affordances.
4.2 Faculty beliefs about learning and teaching

Various views regarding teaching and learning are expressed by the engineering and non-engineering teachers in this study. These perceptions and beliefs are grounded in informants’ experiences first as students and later, as teachers. Their views are investigated through their use of lexis and metaphors. For this reason, I have chosen to use metaphors to organise the findings. These metaphors arose from my reading of the data; they also match the category descriptors in Fox’s (1983) theories of teaching and Kember and Gow’s (1994) orientations to teaching. While I acknowledge the argument that metaphor use ‘carries the danger of shaping perceptions rather than clarifying them’ (Katz 1996, p.62), I also find they are an efficient way of pulling together common threads within the data, reflecting the characteristics of each category, as well as presenting the findings, hence my decision to use them. An example of metaphor used to organise findings is found in Katz’s (1996) study of teaching styles characterised by the roles that teachers in the language classroom adopt.

Informants think that there are various ways in which learners learn best. These are, through face-to-face interaction with the teacher, through thinking and understanding, through taking responsibility and through having the right attitude towards learning. As understandings of learning relate to understandings of teaching, the corresponding understandings of teaching are examined here as well. Informants believe that they have various roles and responsibilities to fulfil, namely, that they need to interact with learners, lead them through the process of thinking, encourage learner participation and develop in learners the right attitude towards learning. These beliefs are organised and discussed in terms of the following metaphors: delivery, shaping, travel and growing.

Table 1 shows a summary of informants’ beliefs about learning and teaching. In the table, the corresponding understandings are presented side by side.
The four sub-sections below present each of these beliefs of the engineering and non-engineering informants. Table 2 shows the distribution of beliefs displayed in the responses from the 22 informants.

**Table 1: Faculty Learning and Teaching Beliefs**

<table>
<thead>
<tr>
<th>METAPHORS</th>
<th>LEARNING (Beliefs about how learning takes place)</th>
<th>TEACHING, including TEACHER ROLES AND RESPONSIBILITIES (Beliefs about what teaching is/entails)</th>
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<td>Delivery</td>
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</table>

**Table 2: Distribution of Responses**

The first two beliefs are the leading categories. These are what Fox (1983) calls the ‘simple’ theories, that is, the transfer and shaping theories, and the corresponding knowledge transmission orientation (see section 3.5.2). It is found that out of 22 teachers, 15 (9 engineering, 6 non-engineering) believe that teaching and learning occur through face-to-face interaction (*delivery* metaphor), that is, when the teacher is in the same room as the learners; similarly, 15 teachers (9 engineering, 6 non-engineering) believe that learning happens through thinking and understanding and that the teacher’s role is to lead learners through the thinking process (*shaping* metaphor); 12 teachers (6 engineering, 6
non-engineering) believe that learners should be responsible for their own learning and
the teacher should encourage participation (travel metaphor); and 7 teachers (5
ingineering and 2 non-engineering) believe that learners should have the right attitude
towards learning and that the teachers’ responsibility is to develop the right attitude in
learners (growing metaphor). Informants hold different beliefs simultaneously; these
beliefs are also complementary to each other. It is found that 12 teachers (8 engineering,
4 non-engineering) mention both beliefs 1 and 2; 9 teachers (5 engineering and 4 non-
engineering) mention beliefs 1 and 3; 9 teachers (8 engineering and 1 non-engineering)
mention beliefs 1 and 4; 9 teachers (4 engineering and 5 non-engineering) mention
beliefs 2 and 3; 10 teachers (8 engineering and 2 non-engineering) mention beliefs 2 and
4; 7 teachers (6 engineering and 1 non-engineering) mention beliefs 3 and 4; 7 teachers (4
ingineering, 3 non-engineering) mention beliefs 1, 2 and 3; 9 teachers (8 engineering and
1 non-engineering) mention beliefs 1, 2 and 4; 6 teachers (engineering only) mention
beliefs 1, 3 and 4; 6 teachers (5 engineering and 1 non-engineering) mention beliefs 2, 3
and 4; and 4 teachers (engineering only) mention all four beliefs. The interaction of these
different beliefs may highlight tensions such as the one between teachers’ focus on
providing correct answers and desire to actively engage the students (see section 4.2.3).
However, while it may be informative to examine how multiple conceptions interact to
form a teacher’s knowledge about teaching and learning, a detailed study is beyond the
scope of the present research. In this study, tensions are highlighted in relation to their
effect on teachers’ choice of teaching strategies (see sections 4.2.1 to 4.2.4) and use of
ICT (see section 5.3).

As will be seen in sections 4.2.1 to 4.2.4, the first three categories of beliefs are closely
related to the learning and teaching of subject matter, while the last category is related to
personal growth. This suggests the main concern of informants is with content matter
rather than with learners’ personal growth. The attention to subject matter learning and
teaching demonstrates the least ‘developed’ conception of teaching in Fox’s (1983) terms
(see section 3.5.2.1). Teacher roles and responsibilities are included in the following
discussions as they are closely tied to teacher beliefs and teaching practice.
4.2.1 Belief 1: Learning and Teaching through face-to-face interaction: the delivery metaphor

In making use of the delivery metaphor, both engineering and non-engineering informants express their strong belief that teaching entails a transfer of subject knowledge content and learning entails the reception of such content. (The term delivery expresses the notion of transfer. Both delivery and transfer carry the same meaning of moving an object from one place to another in a one-way conveyance mode.) This conception matches the traditional view of education as ‘the delivery of knowledge’ (Kramsch 1995, p.10). According to 15 informants, to achieve effective transfer, the face-to-face class, be it a lecture or tutorial, is essential. A sample comment is:

*I think [face-to-face teaching] is essential. You cannot excite a person without seeing him.* (EG5)

As the data show, the fundamental quality that teachers value in a face-to-face class is interaction. In fact, the terms ‘interaction’ and ‘interactive’ are used by various informants to refer to the face-to-face mode of instruction. EG2 describes the face-to-face class as ‘the primary platform of interaction’ with learners. It is believed that with interaction comes learning:

*The way learning happens is through interaction.* (EG4)

In informants’ minds, there are two aspects to face-to-face interaction to effect transfer of subject knowledge content: the human element and the opportunity for learners to ask questions of the teacher. These aspects are explained below.

The first aspect of face-to-face interaction as a mode of instruction which informants believe is key to learning is what they call the human element or ‘human touch’ (NE1; NE5). The implication is that a necessary condition for learning to take place is the physical presence of the teacher. Informants believe that because they are physically present with their learners while the lesson is in session, they can judge from learners’ reactions how well they understand the topic being taught. This way, they can respond to their learners accordingly:

*...with human beings standing there, ... you can look at the reactions of your*
...in the delivery, what you get is also the interaction. So you know what problems some students are facing. And also you can gauge how effective your lesson is. (NE7)

When I finish a major concept or an example, then I ask them if they’ve not understood or whether they have any questions. And if I see that it really seems that they have not understood, then I would repeat it. That to me is the way that I judge whether or not they have understood. (EG8)

As the above comments show, informants view an effective lesson as one in which teachers are able to address the problems learners may face in understanding the content of the lesson. Face-to-face sessions, therefore, are viewed as essential for the human touch, which allows the teacher to effectively transfer subject matter to their learners. This is unlike what the online platform offers. While informants acknowledge the online platform is capable of delivering subject matter efficiently, they also see the lack of face-to-face interactions as a limitation of this platform (see section 4.3.1).

The second aspect of face-to-face interaction which informants value is the possibility of engaging learners on the subject matter. To them, in order to attain interactivity, face-to-face lectures and tutorials are a necessary part of the curriculum. EG3, for instance, maintains that the face-to-face classroom provides opportunity for ‘Socratic dialogue, where I ask a question and you answer me.’ In fact, informants like EG1 and EG2 believe that good students prefer face-to-face teaching over online teaching for this reason. The importance of face-to-face lectures, in particular, is highlighted in the following sample comment:

...students are not supposed to miss lectures. ...The lecture is still the most important. (EG10)

Engineering teachers, in particular, insist that it is through face-to-face interaction with the teacher that learners can ask questions when need be, both during and after the lecture. A sample comment is provided by EG8:

I still think that the best way for the student to learn is to listen to me, is to talk to me, is to ask questions and to take it from there.
In other words, these informants believe that with the teacher in the room, learners will find it easier to ask questions, as well as receive ‘immediate feedback’ (EG1) to their questions. This suggests the teachers’ belief that as teachers, they have a central role to play in the learning process, which is, to ensure effective transfer of information. In other words, teachers can immediately respond to questions asked, thus helping to clarify learners’ thinking and understanding. This is illustrated by the comments below:

*The questioning and the interaction are very important for teaching. … So the basic learning is, lecturer is lecturing and you have a question, you interact with him.* (EG4)

*But lectures conducted locally within the same university, you can have real interaction. …The active [students] would have asked the questions after lectures, this face-to-face interaction makes explanation easier and better than via emails.* (EG6)

The consensus among these engineering teachers seems to be that learning of content in lectures takes place effectively with face-to-face interaction as the opportunity provided by the here and now is always there for learners to ask questions and for teachers to answer them. Implied is the notion that it is through this exchange that questions are answered, misunderstandings cleared and learning of the subject matter takes place. The act of questioning and answering by learners and teachers is a form of mental engagement which informants value as important to learning. EG8 testifies to this, citing his own experience as a learner:

*…the lecturer is right there, he’s writing something, he’s telling you something, you can ask him something in return. So it was a thorough learning process. I was learning instantly, more or less.* (EG8)

In a sense, this preference for face-to-face teaching and learning illustrates the learning facilitation orientation described by Kember and Gow (1994) because of its interactive approach (p.63). It is also an instance of the dialogic teaching and learning espoused by Alexander (2005a; 2005b). In other words, when learners interact with others on the content of their learning, they become ‘active learners’ (EG6). In a way, such an engagement in seeking answers is a form of exploration and discovery of the subject
matter, which suggests the travelling theory of teaching at work and which seems to be in line with the constructivist approach to learning. What is clearly apparent, though, is the transfer theory at work. This is evident through some informants’ common use of the word deliver. In the data, the verbal forms deliver and delivers are collocated with lecture (NE2, NE3, NE8, NE10), concepts (EG6), materials (EG5), project (EG6), notes (NE10), subject (EG6) and learning (NE10), and the nominal form delivery is collocated with system (NE10), platform (NE10), and mode (EG9). These verbal and nominal forms are used by informants to emphasise the importance that they attach to subject knowledge content and the role of the teacher:

…a teacher is defined as someone who delivers materials… (EG5)
I think the main thing is how you deliver the lecture… (NE3)
If I hadn’t seen Lecturer A’s style of lecturing, I probably would have done the same thing as Lecturer B. I would have made sure that my lecture was perfect in terms of delivery, but I wouldn’t have been able to use engaging strategies. (NE5)
…as much as I have seen over the last thirteen years, students really like the way that I... ‘teach’ may not be the best word... that I deliver. So I think that has raised my confidence level and I am in a position to tell you that face-to-face teaching is irreplaceable. (EG8)

These sample comments show that some informants, both engineering and non-engineering, see teaching as an act of delivery, which reveals their orientation to teaching as knowledge transmission. To elaborate, although EG8 could be attributing the success of his lecturing to a particular style of delivery, the fact is that he refers to his lecturing as a delivery, as if knowledge is a product to be given and received and the act of lecturing is a transfer of content from one container to another. His comment shows he is aware of the way that he transfers knowledge to his learners. Similarly, to NE3 and NE5, delivery style is an important factor in effective teaching. As stated in Kember and Gow (1994), to knowledge transmitters, ‘teaching …becomes largely a matter of presenting the lecturers’ knowledge as clearly and accurately as possible’ (p.64). The importance of delivery styles is discussed later in section 4.3.3.1.

Another instance of the transfer theory is evident in its variant, the baby food
manufacturing analogy (Fox 1983). The food analogy is held mainly by engineering teachers. Only 1 non-engineering teacher (NE7) used the same analogy to describe how she prepared her learners for the face-to-face lecture. NE7 uses a hybrid mode – online and face-to-face – in her teaching. She uses the online platform to get learners interested about upcoming lectures. She refers to the case studies or questions she posts online as a ‘starter’ (an appetizer) to the lecture (the main course):

Well, when I’m leading a lecture, what I try to do is, generally before they come to the lecture, I give them a lecture outline. And the lecture outline I try to make it more interactive in the sense that I post questions for them to think about before they come for the lecture. So that’s usually my starter in the lecture. (NE7)

Several engineering informants make use of the food analogy to describe how subject content knowledge can and should be conveyed to learners during lectures. For example, both EG9 and EG2 refer to this analogy explicitly and therefore highlight their perception of their role as teachers. For example:

I use a mixed mode of delivery. So there is a 45-minute lecture; you chop it into smaller chunks. (EG9)

This view of lecture material as food and learners as consumers is echoed by EG2, who thinks that lectures are a time to pass knowledge to learners, and that through the lectures, information can be broken down into bite-size pieces for learners to digest. According to EG2, the teacher is like a food provider. Although he reflects that ‘spoon-feeding’ learners is not encouraged at this level of study, he nevertheless believes that teachers should ‘feed’ their learners. Like EG9’s reference to ‘smaller chunks’ of food, this reference to spoon-feeding reminds us of the baby food manufacturing analogy (Fox 1983). This analogy derives from the transfer theory, for the teacher processes ‘very tough material into more easily digestible nutrient for rather simple minds’ (ibid).

To EG2, a good teacher must ‘understand his or her subject well’ and be able to ‘creatively deliver’ knowledge to their learners. In order to do this, teachers must be able to identify their learners’ needs. He also believes that the teacher’s ideas can affect learners and their style of learning, so that the teacher has the responsibility to guide learners to learn how to build on what they already know. This suggests that even as
teachers seek to transfer subject knowledge content, they must also be sensitive to learners’ needs and ability to comprehend and understand the content. Moreover, when the concepts are difficult to understand, the teacher may need to find a way of helping learners arrive at comprehension and understanding. This is through using illustrations and examples. If teaching is intended to bring about learning in others, as Harvey and Knight (1996) define it, then we may surmise that teachers will use whatever means is available at their disposal to ensure that learning happens as a result of their teaching. A simple case to illustrate this is provided by EG3 and EG10, who both emphasize the usefulness of real-life applications and examples to exemplify complex technical concepts:

\[
\text{I try to put in engineering examples to illustrate the concept. The concept may be very dry, so you want to illustrate with actual engineering applications. Sometimes [these applications] can be in day-to-day activities as well, or domestic activities like cooking a chicken or boiling a kettle of water. (EG3)}
\[
\text{I would use diagrams, tables and analogies to illustrate the concepts. \ldots To relate certain concepts so students can appreciate. (EG10)}
\]

EG3’s description of subject content knowledge as dry is metaphorically interesting. It could be the food analogy mentioned earlier. In this case, the term dry could mean parched. Since hard and dry foodstuff is not palatable for consumption, the teacher’s role is to turn this ‘dry’ stuff into something that can be more easily accepted by the digestive system. Or the term dry could be interpreted as arid. Used this way, the term describes a boring and therefore uninteresting quality about complex concepts, which may obstruct understanding. Therefore, the teacher can help learners grasp complex concepts by providing apt illustrations, examples and analogies.

4.2.2 Belief 2: Learning through thinking and understanding; Teaching by leading through the thinking process: the shaping metaphor

Besides face-to-face interaction, thinking and understanding are also viewed by both engineering and non-engineering informants as essential qualities in learning. To 15 informants, learning and thinking are an intertwined activity. Through the shaping metaphor, informants show that learning through thinking is related to teachers leading
learners through the thinking process.

To informants, the act of questioning by learners is evidence of thinking in progress. In the following sample comments, EG4 recounts his experience as a student and how he learnt through asking questions, similarly, NE4 believes that thinking and questioning are related. These sample comments highlight the perceived value of questioning arising from thinking:

After [the lecture] I’ll have a hundred questions I’ll want to ask him. … Why you did this? Why can’t I do it like this? (EG4)

That kind of question also comes from a limited set of students – those who are really interested and those who read, who really think of why you said this, and they are not happy with the reason or they feel there is another approach to that. (NE4)

Both comments suggest that the belief that learners learn through questioning and thinking rather than passively accepting the teacher’s answers. Evidence of their learning would come in the form of their questions and the perspectives they offer on the topic under discussion.

Informants also indicate their belief that thinking goes hand-in-hand with learning. Below are two sample comments:

I always believe that thinking is essential as learning is thinking. …Because they learn the model but they don’t think about it. They expect you to tell them the limitations of the model; through thinking about it they can find out the limitations themselves. (NE10)

Instead of my telling them what it’s about, [they] think through and tell me what [they] think. That way, it’s better. (EG4)

As suggested by NE10 and EG4, thinking is an activity that learners have to do for themselves. EG4 asserts that the ‘better’ way to learn is for learners to be thinking for themselves rather than getting the answer from the teacher. One could infer that by ‘better’, he is referring to a more fruitful and potentially meaningful learning experience for learners when they have worked out an answer for themselves by drawing on
whatever resources they possess and by not being overly concerned about the correctness of their answer. As the process of learning seems to be the focal point in both informants’ comments, it can be assumed there is an inclination towards the constructivist learning approach, for in a constructivist learning environment, when learners are presented with an issue or an engineering problem, they will build on previous knowledge in order to arrive at the solution (see section 2.3.2.3). Hence, new knowledge can be constructed with previous knowledge as the raw material. As suggested by these informants, this is possible when learners engage in the thinking process. This seems to agree with Wankat and Oreovicz’s (1993) view of the goals of engineering education, which are ‘learning to become a good problem-solver and learning how to learn’ (p.6).

If thinking is the responsibility of the learner, what, then, is the teacher’s responsibility in the learning process? According to informants, leading learners through the process of thinking is one of the teacher’s key responsibilities in teaching. This belief is conveyed through the shaping metaphor. The shaping metaphor entails a process and a product, as well as a skilled craftsman and material for crafting. In the process the material undergoes a transformation from a less desirable to a more desirable state. There is also the master craftsman’s vision of how the moulded product should turn out. These entailments are applicable to the activity of teaching. For a start, the curriculum is decided by the teachers or the school, who have in mind what the product (learner knowledge and skills) should turn out to be like. In the case of engineering teachers, they see their responsibility as producing competent engineers (refer Kember & Gow’s (1994) knowledge transmission orientation). Hence, the form of teaching that they eventually select, such as designing assessments or planning learning units, is geared towards this (EG3; EG8; EG10; EG11; NE1; NE3; NE7). In the teaching activities that follow, namely, to lead learners through the thinking process, informants propose a method that encourages the learner to think – specifically, through step-by-step explanations of abstract concepts. This is explained below.

A common belief among the engineering teachers about their teaching responsibility is that ‘the most important thing about teaching is still explaining the concepts’ (EG10). In
teaching technical subjects, clarity of explanation is of utmost importance. Hence, engineering teachers insist that they need to explain the theories or equations step by step. None of the non-engineering informants highlight this. As mentioned in section 4.2.1, it is primarily the engineering teachers who view face-to-face lectures and tutorials as opportunities for learners to ask questions and for teachers to check comprehension and understanding of subject matter. This is evident from the way they emphasise learning of the subject matter. Perhaps this is due to the nature of their discipline, that is, in content-based engineering subjects, factual knowledge and accurate applications are important qualities that learners must eventually acquire. Also, the fact that engineering teachers feel the necessity of providing answers to questions shows their perception of the teacher as the expert. The learner, on the other hand, is like raw material for the expert to transform into a finished product. In this analogy, the expert moulds the raw material into a pre-determined shape, that is, through providing the answers, presumably the correct ones, the expert shapes the learners’ thinking in particular ways. It is significant that teachers value the face-to-face lecture, for there, ‘shaping apparently happens through the sheer force of the spoken word and the authoritative presence of the expert on the controlled, passive raw material’ (Fox 1983, p.154).

Although the traditional way of teaching, that is, chalk and talk in face-to-face instruction, may entail a slow learning process, it is perceived to be effective, as it allows learners time ‘to follow the teacher’ (EG2). It may seem the expression ‘follow the teacher’ suggests tagging along, as if there is a lack of active involvement on learners’ part. This, however, may not be the intended meaning. As EG2 elaborates, to ‘follow the teacher’ is, metaphorically speaking, to ‘follow the teacher’s thinking’, that is, to think along with the teacher in the course of the lecture. At this juncture, it needs to be pointed out that the term follow is usually used in Singapore English to mean accompany or come/go with (Brown 1999, p.85; Tongue 1979, p.74). In the scenario described, the teacher writes and learners listen and ‘copy’ what they see, for instance the way a solution to a problem is worked out. EG2 believes that the process of manual copying demands from learners a certain degree of concentration and attentiveness, a mental engagement, which he thinks is necessary in order for them to understand the teacher’s
explanations. He also believes that the act of copying allows learners ‘to form an impression’ of the projected image that is on the board or screen. In this sense, to ‘follow the teacher’ indicates an act of mentally going with the teacher and thus implies action and participation on the learner’s part, specifically, watching and reflecting. This teacher’s assumption is that learners think about what they see. However, this does not mean that the ability to ‘follow’ the teacher’s thinking definitely leads to the construction of new knowledge. Still, in response to this conception about how the learning of complex concepts and technical information can take place, engineering informants, in particular, believe that seeing (and thinking about) the sequential progression in problem-solving is a way to learn, and therefore, showing learners the steps to working out the solution is the way they should teach. The sample comments below illustrate this:

[I] do the complete working and show how the solution comes. ... That’s how I teach. (EG4)

... you can show a series of sequence, it is easier for students to understand. (EG6)

You can’t just say this is the definition of this, the definition of that. The whole thing will not go into their mind… They have to see the sequence, see the symbols, see the equations, see the diagrams. (EG10)

Evident from the comments above is the learning facilitation orientation described by Kember and Gow (1994), which includes the development of problem-solving and critical thinking skills, and where the teacher sees their role as ‘a guiding process’ and themselves as having ‘a responsibility to ensure that learning took place’ (p.63). The comments also highlight the shaping theory being applied in the thinking of engineering informants. In particular, teachers who hold the shaping theory claim they show and demonstrate the way to doing something and then set exercises to reinforce the shaping of the product (Fox 1983). For instance:

I have to show…the steps then let them practice – this is efficient. (EG6)

But as you work them out, especially for Math, then they have the opportunity to follow your thinking process. So, this is what I do – I tend to work out on the spot. I don’t remember the steps. Sometimes I fumble. But I think this is a good
educational experience for them, that they pick up your thinking process – how to solve problems. (EG9)

Perhaps the clearest illustration of the shaping metaphor at work is provided by EG9 when he declares how learners see him ‘fumble’ in the problem-solving process and see him work out the solution eventually. In this way, they can ‘follow your thinking process’. In other words, showing the steps as he explains is a ‘splendid opportunity for the demonstrator to demonstrate’ (Fox 1983, p.154). Thus, the belief is that learners learn through modelling the teacher’s thinking process.

4.2.3 Belief 3: Learning by taking responsibility; Teaching through encouraging learner participation: the travel metaphor

The data reveal that 12 informants believe that learners should take responsibility for their own learning. In particular, they construct learners as having to take part in discussions and doing work assigned to them. As for the teacher, their responsibility is to encourage learner participation in activities (which are prescribed by the teacher). This belief is conveyed through the travel metaphor, which portrays the learner as a traveller and the teacher as the expert guide.

These informants believe that learning is a journey, which begins when learners play a part in their own learning. One way that they can do this is to engage in thinking (mentioned in section 4.2.2). Another way is to participate in discussions, by which informants refer to the acts of questioning and responding. But as EG4 comments, learners should first ask questions:

They don’t ask questions, and I find it’s terrible for learning. (EG4)

Apparently, learners need stimulation, which is what the teacher can provide so as to encourage participation. Stimulation can come in the form of difficult questions that challenge learners and ‘stir them to think’ (EG2). Or it could come in the form of the teacher playing the devil’s advocate, like NE10 does. NE10 responds to learners’ ‘shallow’ discussions by ‘instigating’ them, prompting with comments that might ‘hurt’ their ego, as he acknowledges. But he believes that in this way, he is helping his learners think about an issue from different perspectives. Like EG4, EG2 believes that learners...
should participate in discussions, for that is the ‘real way to learn, to think’. Similarly, EG7 asserts that the desire to exercise the thinking faculty and to try ‘challenging questions’ are characteristics of ‘good students’, that is, successful learners.

Yet another way in which learners can participate in their own learning is through doing work that is assigned to them. An example of assigned work is the task of reviewing lesson material before the tutorial. Informants expect learners to at least read up or think about the topics covered; better yet, they should attempt the tutorial questions before class. As an example, NE5 recounted those times when her students did what was expected of them, that is, being prepared for the tutorials. She recalled how the tutorials became ‘interactive’ as, ‘rather than it being a mini-lecture, it turned out to be more of a discussion because the students had already done their homework’. From this experience, she believes that ‘doing things together, applying concepts in the tutorial sessions is more meaningful to learners than just a lecture’. This is indicative of the building analogy. Like NE5, NE8 sees the value in applying concepts. To her, ‘effective learning is, once you have the knowledge, you need to apply’. This suggests the notion that knowledge gained can, and should, be reinforced through doing, that is, through application. Again, the idea is of the learner taking part in the learning process. NE5 further asserts that when learners learn to apply concepts taught in the lectures, they learn better as they could then engage in ‘hands-on, practical activities in the tutorial’. From here, we see an active conception of learning, suggested by the metaphor of learners using their ‘hands’ to build understanding, in the sense of being involved in the discussions and tutorial activities. At the same time, implied is the belief that the teacher should set questions and activities that are meaningful and useful – ‘practical’ – to learners so that they will want to learn to apply the concepts taught. This is a suggestion of how teachers can encourage learner participation leading to a deep approach to learning (see section 3.5.2).

Most engineering informants expect their learners to attempt tutorial questions before going to class. This expectation stems from their belief that learners have to ‘be responsible for their own learning’ (EG6). As EG6 puts it, learners ‘have to come to lectures and do the tutorial questions and not sleeping at home and does last minute work
by watching the videos few days before exam [sic’]. Similarly, EG10 believes that good students will ‘attend lectures and tutorials because they want to learn’. The inference in both comments is that attending lectures and tutorials help learning (discussed in section 4.2.1). Other than attending lessons and working out tutorial questions, informants believe that students should complete course assignments, that is, assignments for marking and/or grading. Sample comments include:

So handing in assignments, that’s where the learning happens. (EG10)

They come to class, and there’s no submission of assignments, right? That’s one of the weaknesses of the system. For every course, every subject, especially Mathematics, assignments have to be compulsory. (EG4)

Submitting assignments is seen to be essential to learning. The argument seems to be that when learners are required to hand in work for grading, they will spend time on the subject, which leads to learning. Therefore, doing assigned work is regarded as a valued activity because of what is entailed in the process of doing. It is interesting that both EG10 and EG4 focus on handing in assignments rather than doing them. Perhaps, the doing of assignments is implicit in their comments, for the doing precedes the handing in. So, they could be referring to the doing of assignments as well. Alternatively, they could be referring to the possibility that learners do not do assigned work unless they have to hand them in for the teacher to mark and/or grade them, and hence their emphasis on the submission of assignments. Both EG4 and EG10 believe that assignment submission should be made compulsory, as their comments show:

...if you want to make them learn, the submission of assignments is very important. (EG4)

It would be nice to have students submit assignments. I think it’s a better system. Here we don’t force them to submit assignments. ...Or there are very few assignments, not like in the US where every week there is an assignment. So every week they do a few questions and submit. (EG10)

Perhaps, the idea of making assignment submission compulsory comes from shaping and building theories. There are two explanations for this. Firstly, it may be that as engineering teachers, informants feel their responsibility is to produce (shape) future
engineers. Therefore, it may be their thinking that when learners are forced to submit assignments, they will learn and eventually become the kind of engineers their teachers hope to produce. Secondly, it may be that the teacher as the builder works to complete the structure according to a pre-determined plan. In this analogy, the building plan is the curriculum and the completed structure signals learners’ understanding of lesson material, expressed through their passing criterion-referenced tests. Of course, when assignments are not done in a controlled environment, some learners may not do their own work or may copy from their peers. But requiring learners to submit assignments may ensure that they are in touch with the subject matter, that is, where some amount of learner action is involved, as the comment below shows:

…even if the fella [sic] copies, he’s looking at the materials once. (EG10)

As discussed (e.g. section 4.2.1), informants prefer their learners to be active participants in the learning process rather than passive recipients of information. Especially in the case of engineering teachers, there appears to be a tension between the focus on the teacher to provide correct answers and the desire to promote active engagement of the learner.

In the conception of learning as an activity that learners have to participate in, informants also see learning as a journey and, by implication, the learner as a traveller. The travel metaphor entails a path (planned or unplanned), a starting point, a destination, a schedule, mode(s) of transportation, travel necessities or equipment, and potential risks and dangers. Occasionally, there may also be travelling companions in one’s travel. And if the goal of the travel is exploration, there may be changes to travel plans, which will demand a willingness to adapt to new situations. Below are sample comments illustrating this conception:

So every week they do a few questions and submit. Learning has to be done progressively, so asking to submit weekly is better. (EG10)

…they should go to explore the opportunities beyond the small local market. (NE10)

If learning is a journey, it is one of exploration and not a direct trip between two points. Doing progressive work and exploring are notions that reinforce this metaphor of the
learning journey. EG10 believes that weekly submission of assignments allows the novice traveller (learner) to know the terrain (subject matter) better and the teacher to monitor learners’ progress, like a guide, and give detailed feedback so that learners may continuously improve (see section 3.5.2.1.4). As for NE10, his conception of learning is that of the learner as a traveller who explores opportunities beyond what is offered in the ‘small local market’. Another informant, EG1, reports on what his students are expected to do for their laboratory sessions. The exercises involve problem-solving and analytical skills, as well as logical thinking. His students are expected, before these sessions, to have thought about the work to be done and to have ‘planned’ how to work out the solution. His expectation is based on his belief that learning involves ‘hard thinking and struggling’, especially in learning technical subjects. By ‘struggling’, he refers to the effort learners have to put in to ‘find out’ where they have gone wrong in their search for the answer and to ‘discover’ how to identify the logical error. He believes the onus is on learners to do the work and not to passively wait for the teacher’s answer. This is expressed in his lexical choices, such as ‘planned’, ‘struggling’, ‘find out’, and ‘discover’, all of which suggest action. Again, this is suggestive of learning as a journey to be undertaken with persistence, for there are hardships along the way and the traveller has to make an effort to find their own way to complete the journey, for according to Fox (1983), ‘exploration is a personal activity (p.156). Although there is no indication here of the teacher as companion traveller who explores and discovers new terrain with the novice traveller, it does seem that the teacher is in the background providing necessary help to the learner. For instance, in the act of setting tasks, the teacher could tell the learner where to go or what to look out for. Specifically, in providing feedback on their work, the teacher’s role is to encourage the novice traveller not to give up the sometimes arduous journey. Moreover, the teacher’s feedback is like essential travel gear, such as maps and compasses, so that at the same time, the teacher is an equipment supplier to help the novice traveller along their way. It may seem that engineering teachers wanting learners to do and submit assignments experience tension between what they perceive their responsibility to be and what they would like to do. As Fox (1983) states, ‘developed’ theories view the learner as a ‘contributing partner’ (p.156) in their own learning. In the travelling theory, the teaching of subject matter is deemed important and
is evident in teachers of a content subject like engineering (see section 3.5.2.1). From what they say, some informants show that on the one hand they are task-setters, and on the other hand, they are like a guide providing equipment and sharing experiences to help a novice traveller make sense of their own learning experience. In other words, while these informants recognise that their primary responsibility at this level of education is to produce engineers who are equipped with knowledge of engineering, they also acknowledge that learners themselves have to want to seek understanding and to want to keep learning. The responsibility for learning lies with the learners while the teacher’s responsibility is to encourage learner participation.

4.2.4 Belief 4: Learning by having the right attitude; Teaching through developing the right attitude: the growing metaphor

The final way that informants believe that learners learn, as 7 informants show, has to do with the learner’s attitude. From informants’ descriptions, attitude appears to be a part of one’s character affecting one’s behaviour. Informants see their role as helping to develop learners’ personal growth. This may be different from the general view about higher education – that it ‘focuses on the transmission of knowledge (and) has relatively little concern for building character or shaping society’s leaders through personal interaction between students and mentors’ (Margolis 2001, p.13). To some informants in this study, however, learners should develop good character, specifically, have the right attitude towards learning. The idea of growth, when applied to human beings, suggests personal development or improvement and an increase in knowledge and/or character. The growing metaphor, therefore, suggests preparing a youngster for adulthood, for living and working among others in society and for continuous learning (Ireson, et al 1999).

It seems that whatever the mode of instruction, having the right attitude is necessary for learning. As an example, EG3 comments:

*When the student is ready, the teacher will appear. That’s a Confucius saying, right? Basically, it means that for a teacher to teach, the student has to be ready and willing to learn. I mean, you have to want to learn before someone can teach, or before the teaching is effective.*
A similar point is made by EG4 through the following analogy:

*It’s like a horse. You can bring it to water but how do you make it drink?*

However, as much as the teacher may want to help learners succeed in their learning, they feel that they are limited in their ability to do so. This could be due to poor learner attitude. For example, EG3 laments that many learners do not care for the learning process but are concerned only about passing the examinations. As a result:

*…you don’t get much enthusiasm from the students.* (EG3)

The thinking here is clear – that the lack of enthusiasm becomes a barrier to real learning. In spite of this, informants seem to want to encourage active learning, as the following comment shows:

*I am a believer of learning happens in you [sic], not through me, that I teach you to do this or that. You need to go interpret the knowledge and then form your own knowledge.* (EG9)

Here, EG9 shows how his learners are encouraged to develop a ‘deep’ approach to learning by reflecting and drawing on existing knowledge so that they form their own interpretation of knowledge and, in this way, acquire new knowledge. But this can happen only when learners take charge of their learning and are not satisfied merely to receive the teacher’s input. This conception of teaching is, therefore, an active one for the focus that it places on the learner as an active participant in the learning process. A similar sentiment is expressed by NE10, who is unhappy that his students ‘are so fearful to “fly”’. His comment is in reference to learners’ unwillingness to ask questions in class for fear of making a fool of themselves in front of their peers. Here is the belief again of questioning as a part of learning (see section 4.2.2) and a means of exploring ideas. (‘Fly’, interestingly, is metaphorically a way of travelling, as in the natural ability of airborne creatures to move about.) NE10 expresses his desire to see his students ‘have the courage and determination to fly like an eagle’ rather than behaving like timid ‘chickens’. He attributes their behaviour to poor attitude:

*…they have very poor attitudes for the world out there. If one is not prepared to learn then he is not in the learning mode at all.* (NE10)

NE 10, in fact, is the only informant who shows very strong opinions about learners’ poor
attitude. On learners who would only look at others’ postings in the online discussion forum without sharing their own ideas, he calls them ‘thieves’ who ‘sample on the food and sneak away’, thereby showing themselves to have ‘no future’. He disallows anonymity of posts as a way of teaching learners to be responsible and accountable for their views.

Some informants perceive the need for teachers to try to understand learners’ difficulties. One way of doing so is to adopt the role of a friend to their learners so as to relate to them and better understand them as human beings. Sample comments are:

…the youngsters do not like to be lectured, so I should not act like a father but a friend. … You have to make an effort – to keeping in contact with them and responding to their needs in a timely manner. Also looking for what they need, thinking ahead of time what they will need. Given time, I think the students will be able to feel that you are making an effort to make a contact with them. (EG5)

Some of them feel that they can trust you like a friend, they can ask you anything, they can approach you anytime. So you give them a sense of belonging, of caring. … They won’t want the lecturer just to be knowledgeable; … he has to be somebody who has empathy with them. And he should be approachable and should be able to relate to them. … In fact, I make many friends over the years with the students for this simple reason. (EG8)

These comments highlight the teachers’ pastoral interest in their learners. The view about the teacher’s role as a friend and as someone who cares about their learners is evidence of the learning facilitation orientation to teaching. In other words, caring for the learner as a person suggests caring for the growth of the individual. Perhaps, informants feel that this is a way to help learners develop the right attitude towards learning.

One common complaint among informants about learners’ attitude is concerned with learners’ lack of participation. Informants assess their learners to be examination-oriented. To them, learners’ focus seems to be on passing the examinations and not on the value of learning. Hence, they think that their learners generally adopt surface o learning:
… most of them feel they have to learn because they have to pass an exam to get that piece of paper. (EG3)

So the focus should be on learning concepts and ideas. When I said ‘thorough learning’, I mean they should not see something as being important that will come out in the exam. No, I want them to learn; when they work as an engineer, I tell them sometimes, you will be asked to do something, and no amount of getting 90% or 80% or 70% will help them at that point in time. It would be something that they have grasped that will put them in good stead. That’s why the focus is on thorough learning. (EG8)

…if a student doesn’t bother about anything, it’s very difficult to teach them... (EG10)

The argument seems to be that without learners’ co-operation and participation, teachers are constrained in their ability to help learners achieve meaningful learning, which is, studying not just for passing examinations. Informants suggest that whatever the mode of instruction, the necessary ingredient to learning is positive learner attitude.

Hence, informants believe that effort and participation in learning are closely related to attitude. Informants perceive that where there is learner participation, there is learning, as there is active construction of knowledge and understanding. To them, this participation is evidence of the attitude learners have towards assigned work. Informants seem to think that it is with a positive learning attitude that there can be some assurance of learning taking place.

Good attitude and effort are, therefore, seen to be closely related to learning. These comments on the lack of enthusiasm and poor learner attitude reflect informants’ belief that motivation to learn and to excel must come from within the learner (this notion is similar to Kember & Gow’s (1994) learning facilitation orientation). It is believed that this force from within leads to the learner growing as a person ‘for the world out there’ (NE10), that is, in anticipation of the world beyond the classroom. If, as informants attest,
being prepared for learning is what learners need, then the teacher’s responsibility, it would seem, is to provide opportunities to enable learners to break out of their comfort zone and to build confidence in themselves so that they will take responsibility for their own learning and thus be prepared for life’s journey. This is succinctly expressed by NE10:

*And to teach them about life – they are very shallow of the understanding of what life is about.*

The belief in the value of intrinsic motivation shows an inclination towards the ‘growing’ theory of teaching, with the emphasis on the learner as a person. Here, the teacher is as a gardener who acts as a ‘catalyst’ (Fox 1983, p.157) to bring out the best that they can from the learner, for ‘the driving factor for growing is internal’ (ibid, p.158) (refer also the TEACHING IS PLANT GROWTH AND CULTIVATION metaphor in Cortazzi & Jin 1999). Unlike the transfer and shaping theories, the growing theory acknowledges the learner not as passive material but as a living organism capable of responding to the right stimulations in the environment.

To summarise, this section on teachers’ understandings about learning and teaching has explored four beliefs through the *transfer, shaping, travel* and *growing* metaphors. It has shown, firstly, how the data match the category descriptions of Fox (1983) and Kember and Gow (1994), that is, how the knowledge transmission and learning facilitation orientations to teaching and the transfer, shaping, travelling and growing theories of teaching are related to these understandings. It has also shown how informants’ conceptions of teaching match their conceptions of learning. For instance, informants feel that learners should attend lectures and do assigned work to accumulate knowledge, while at the same time, engage in face-to-face interaction with the teacher and in thinking, as well as adopt the right attitude towards learning so that they will take responsibility for their own learning. Correspondingly, they believe that teachers should interact with their learners, lead them through the thinking process, encourage learner participation and build positive learner attitude towards learning. The study has shown, lastly, that on the whole, informants’ views about learning and teaching exist simultaneously and are complementary to each other. The main concern among both the
engineering and non-engineering groups seems to be with knowledge transmission rather than with learners’ personal growth, even though the two groups differ in their idea of how teachers should take learners through the thinking process. In this regard, engineering informants are particular about learners being given visual representations of the workings to a solution, whereas non-engineering informants do not insist on this. This difference could be due to the nature of the subjects they teach. When verbalisations of informants’ beliefs are matched with those of their teaching practice, tensions are found to exist under certain contextual conditions. One tension is apparent in informants’ reasons for preferring face-to-face teaching. On the one hand, informants believe that this mode of teaching allows them to interact with and engage learners in a constructivist environment, one that allows exploration and exchange of ideas (specifically, through learners asking questions and participating in set activities); on the other hand, they insist that this mode is good for the teacher because they believe that the teacher is responsible for leading students to thinking and understanding, as they do when working through a problem with the students and providing step-by-step explanations to the solution. Another tension relates to the role of the learner in an environment that encourages surface learning and the teacher’s desire to guide learners to explore subject matter more deeply. The particular reference is to the presence of large classes and an examination-oriented system in a highly competitive learning environment so that getting good grades seems to be learners’ main goal in learning. The teaching strategies the teacher adopts ultimately are those that help them meet curriculum demands. In most cases, the lower-order transfer and shaping theories are adopted. Related to this tension is yet another tension – that of the role of the teacher. Engineering informants, especially, see themselves in a dual role – as task-setter and travel guide. Again, the role they choose to adopt at any time seems to depend on conditions in the environment, such as time demands and learners’ attitude. But both groups of informants strongly agree that the teacher is essential in the learning process and that positive learner attitude is vital to the success of learning and teaching, where learners display a willingness to play an active part in their own learning.

In the following section, we turn our attention to informants’ perceptions of the
affordances of ICT, the way they use ICT in their teaching and their perceived roles and responsibilities when they teach with ICT. The next section will also relate the understandings of learning and teaching to informants’ teaching practice with ICT.

4.3 Faculty perceptions and use of ICT affordances illustrated through metaphors

In this study, on the question of how the engineering and non-engineering informants use ICT, both groups report that they use Power point slides during lectures, although with varying levels of preference. In other instances, informants use Blackboard although here certain features are used more frequently and extensively than others. The level of use seems to be in accordance with the way the affordances are perceived by the informants and by their understandings of learning and of teaching, like their knowledge of the nature of the subject they teach, their assumptions of learners’ needs or their previous experiences as learners. (It should be clarified here that the categories of ICT perceptions offered by individual informants may not be the only categories they actually hold. There is no evidence that informants hold only those categories which they chose to focus on during the interview.)

Informants show that their use of ICT in particular ways is related to their understandings of learning and of teaching. Their views are expressed through specific lexical choices and metaphors. Three metaphors surface as the predominant categories illustrating informants’ perceptions and use of ICT affordances, namely Power point and Blackboard. The metaphors of ICT revealed from the data are: a container to store information and subject knowledge content, a place that offers opportunity for exploration and discovery, and a tool to achieve effectiveness in teaching and learning. The latter includes two key functions to differentiate its use according to purpose: one, as a presentation tool for visual impact and two, as a facilitation tool for communication. These conceptions are depicted in Table 3.
The following sub-sections present findings on informants’ perceptions and use of ICT in these three primary ways. Within each category of findings is a discussion of the relationship between informants’ understandings of teaching and learning and their perceptions and use of ICT affordances. (Table 4 shows the correspondences between teaching metaphors and ICT metaphors.) The tensions arising from the interaction between understandings and use are also explored.

Table 3: Faculty Perceptions and Use of ICT

<table>
<thead>
<tr>
<th>Perception of ICT</th>
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<tr>
<td>as a container</td>
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<td>- presentation tool</td>
<td>- for visual impact</td>
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<td>- facilitation tool</td>
<td>- for communication</td>
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Table 4: Correspondences between Teaching Metaphors and ICT Metaphors
4.3.1 Perception 1: ICT as a container to store information and subject knowledge content

The data reveal that 20 informants (11 engineering, 9 non-engineering) perceive ICT, particularly *Blackboard* with its various features, as a container offering the main affordances of convenience, easy access and opportunity for self-paced learning. It will be seen in this section how the *ICT-container* metaphor relates to the transfer theory of teaching. Specifically, this transfer is a one-way transmission of subject matter as a product from the teacher to the student’s mind (Fox 1983). Informants feel that the main task of the teacher in higher education is to impart content information. At the fundamental level, the teacher is a ‘provider of information’ (NE8), ‘an instructor imparting knowledge’ (EG10). This understanding of teaching as a transfer of information is evident from the way informants describe ICT, particularly *Blackboard* with its various features, as a container offering the main affordances of convenience, easy access and opportunity for learners to study at their own pace.

A physical container is three-dimensional, with an inside area and an outside area. Every container has a boundary, whether natural or imposed, and can be measured and quantified (Lakoff & Johnson 1980). The key function of a container is to hold objects; as such, it could be viewed as a storage device where something can be put into it and something can be taken out of it. This quality is credited to the various aspects of ICT, specifically, the Internet, computer hardware and software and various features in Blackboard. Table 5 summarises informants’ understanding of ICT as a container and their perception of its affordances.
First, both engineering and non-engineering informants conceive of the Internet (ICT, in its broadest sense) as a container. For those teachers who use the Internet in their teaching, the web allows them to conveniently store broadband videos (NE2), for instance, or access information on available resources (EG5; EG6; NE1; NE8). Almost synonymous with the Internet is ‘web space’ (EG6; NE2) where one could ‘embed’ software such as Flash ‘within a web page’ (NE6). A further use of the Internet in the

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<td>Computer hardware and software</td>
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<tr>
<td>Blackboard: Announcements Course Documents Course Information</td>
<td>store for announcements, course information, links to resources, lecture material and tutorial questions</td>
<td>convenience for updating information; easy access; repeated access; self-paced learning; broadcast of students’ work</td>
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Table 5: Perception of ICT as Container
classroom is as a store for students’ work:

*Ya, like take this thing about writing samples. ... if you use Internet, so you ask the students to type something and post it on the Net. And then it’s available to everyone. And you can ask other people to comment on it.* (NE2)

As NE2 explains, students’ work can be stored in a designated web page for retrieval later. Hence, the Internet as a container illustrates the affordances of convenience and easy access.

Next is the perception of the computer, or hardware, as a container that aids teaching and learning. The computer stores data through various devices, such as the thumb drive and compact disk. The computer is a container for specific teaching purposes, so that when necessary, the teacher has to ‘install software’ (EG6) into it. Without this software addition, the teacher would not be able to use the computer to fulfil their teaching purposes. Furthermore, this software within the computer (container) is itself a container. Informants view computer software, like Power point, as a storage device to facilitate transmission of subject knowledge content, as explained by EG3, who ‘put a bit of animation into the slides’, ‘ask questions in the (sic) Power point’ and ‘put in engineering examples’. Similarly, EG6 ‘put everything in Power point; it is easier to retrieve a figure or information from Power point’, and EG5 engages a ‘video that is embedded in the (sic) Power point’.

Along with the Internet and computer, the learning management system, *Blackboard*, or *Edventure*, used by all informants is described most frequently in terms of a container. *Edventure* is viewed as a ‘repository of information’ (EG3; EG8) and a ‘store’ (NE7; NE8). As a repository of information and storage place for subject knowledge content, the features *Announcements*, *Course Information* and *Course Documents* in Blackboard are most frequently used. In fact all informants use these features in the Blackboard domain. (Three of them – two from the engineering strand and one from the non-engineering – use their own web pages, mentioned earlier in this section, in addition to Blackboard as another way for students to gain easy access to course material.)
Two commonly used features in Blackboard are *Announcements* and *Course Documents*. The *Announcements* feature functions as a container as it is used to store the latest announcements and course information, as well as lecture material and tutorial questions:

*I use it to post announcements and lecture notes, tutorial questions. Sometimes we use it to post additional questions for students to download and to try for themselves. Equation list and the list of formulae that the students will be given in the exam – to show them in advance what it will look like.* (EG7)

This feature is perceived as a convenient storage place that allows teachers to revise and update stored information and lesson material. Dated information can be considered useless information, but with ICT, stored information can be revised or updated as often as is necessary for it to remain current and relevant. The same idea applies to lesson material, which is stored in *Course Documents*. For online material to remain relevant to the audience for whom it is intended, the teacher may need to update it from time to time. In this way, the latest, and by implication the most accurate, version can be presented to its target audience. The desire to ensure accurate and updated information is, according to Fox (1983), a sign of the transfer theory in operation, as the product becomes the teacher’s primary focus. What this implies is that teachers assume students will and do learn when they retrieve the content from the container, and that in the case of knowledge transfer through ICT as a container, a key responsibility of the teacher as provider of knowledge is to ensure the information for transfer is accurate and updated. All this, of course, begs the question that students will actually pick up the content that is in the container.

Similarly, storing video-taped lectures on *Course Documents* is generally acknowledged to be useful for review and revision purposes. According to NE4, international students and students who absent themselves from lectures can study the online lecture material at their own pace or to view it as often as they need to – ‘Because I think they find it difficult, especially the foreign students, to follow what we say.’ (NE4). The issue here is one of linguistic ability; international students who are not proficient in the English language are deemed to benefit from studying at their own pace, which happens as a result of the availability of lecture material stored in *edventure*. The material stored in
Blackboard allows constant access, that is, repeated viewing, which informants deem to be helpful for information retention. Informants seem to think this is one way for knowledge to be effectively transferred to learners. As an example, NE1 thinks that learners are like sponges and so will benefit from a second or third viewing of lecture material. Similarly, NE3 thinks that constant review of material will likely enhance comprehension and understanding.

From the above, it can be seen that informants use ICT as a container of information and subject knowledge content according to their perception of its affordances and their understandings of teaching and learning. This seems to concur with Zhao and Frank’s (2003) finding that ‘teachers use computers in ways that address their most direct needs, bring them maximal benefits, … and do not require them to reorganize their current teaching practices’ (p.821). To summarise, informants hold the theory of teaching as a one-way transmission mode to transfer information and subject knowledge content from the teacher to the student via ICT. This corresponds with Kember and Gow’s (1994) knowledge transmission orientation and Fox’s (1983) transfer theory.

Yet, the data show also that in spite of the perceived advantages of convenience, accessibility and availability offered by ICT as a container, there is no one-to-one correspondence between informants’ use of ICT and their beliefs about teaching and learning. Generally, informants generally believe that as an aid to learning, the ICT-container is limited in its function. For instance, even though ICT provides the auto marking function, which can help lessen marking load and give learners immediate feedback on their answers, the feedback facility is useful only when learners make the effort to do assigned work. Also, to informants, ICT is not the answer to classroom problems such as poor attendance and learner inertia, problems which are, again, concerned chiefly with learner attitude.

Informants see the lack of face-to-face interaction as a limitation of ICT. They insist that face-to-face interaction and learner effort are necessary in the teaching and learning process. For instance, the subject knowledge content is deposited in the course site and
there is no guarantee that learners will access it. Hence, the intended transfer from teacher to learner may not happen. Even when learners do access the content material, that action alone is not an indication that they have read or understood the material. Also, although ICT allows constant reviewing of material, this is not helpful to learners who need to clear any confusion about what they read, compared to the immediate help they could receive from the teacher (or their peers) in a face-to-face class. Therefore, simply storing content material online prevents the teacher from knowing how (and if) their learners are learning. This is apparent in their comparison of the two modes of teaching:

*The only thing lacking in ICT is that you don’t have the presence of your students, so you don’t get immediate feedback. So if they’re confused or they’re not sure about what you’re saying you can’t read the signals, these cues, and make up for things that they haven’t understood. Whereas in a one-to-one kind of situation you would read their body language and if you feel that certain students are looking confused you would give them more information, repeat the same information in a different way and give them more examples, whereas you don’t have the advantage of that via ICT.* (NE5)

*I mean, [in face-to-face] you can see whether students understand or not. If students cannot understand, you got to repeat. But in computer-based training, it’s very difficult to repeat certain things. … Many times I had to repeat the concepts, keep repeating to force something into the students.* (EG10)

NE5’s reference to saying ‘the same information in a different way’ illustrates how the teacher can connect with their learners by responding to what they need. This is unlike the online mode, which cannot detect learner confusion or lack of understanding. Similarly, EG10 comments on how the teacher can ‘force something into the students’. This ‘something’ refers to subject knowledge content, the product of the teacher’s delivery. In the transfer model of teaching, the teacher uses various strategies to ensure information is conveyed to the learners. Repetition of content is one such strategy, especially where the content is necessary for comprehension and understanding. In this example, repeating information suggests drilling information into the learners until the information is received. The above examples show informants’ belief that the teacher
with their pedagogical content knowledge is a more important (and essential) variable in learning than the ICT-container. Hence, compared to ICT-based lessons, face-to-face sessions are seen to be more beneficial to learners. This suggests that the tension between ICT use and beliefs about teaching and learning arises from the beliefs that informants hold strongly to satisfy the conditions that, to them, lead to effective teaching and learning. This concurs with McCormick and Scrimshaw’s (2001) finding that ICT is used primarily as efficiency tools rather than ‘transformative devices’ (p.54), and with Czerniewicz, et al (2007) and Loveless, et al (2001), who stress that ICT does not transform practice, but people do (Loveless, et al 2001), specifically, through a change in their focus and mindset (Czerniewicz, et al 2007). But as discussed in chapter 2, this change might not be easy to achieve.

Another limitation with the online storage medium is that it becomes ineffective when overloaded with written text. For this reason, although lecture notes are posted online, they often do not include support material like examples and stories used in face-to-face lectures to exemplify concepts (see section 4.3.3.1). As NE3 explains, there are two reasons for not including such material:

First of all, the notes will be too cluttered, too many things. And secondly, once you do, they start reading, so no point.

By ‘they start reading, so no point’, NE3 refers to the face-to-face lectures being pointless then if clarifying materials are included in the online notes. Instead, these support materials are presented in the face-to-face lectures. Also, the amount of explanation required to help students arrive at an understanding may exceed what can be put online.

We see, then, that this tension between ICT use and beliefs about teaching and learning arises from certain beliefs that informants hold strongly and from the perceived limitations of ICT to satisfy the conditions that, to them, lead to effective teaching and learning. Among these is the belief that learners are an important element in the process of learning. Informants refer to how learners have to be active participants in their own learning. In particular, they think learners must exhibit two basic behaviours as an indication of being active learners: one, they must attend face-to-face lectures and
tutorials, and two, they must do work assigned by the teacher. These issues were discussed previously in section 4.2.

4.3.2 Perception 2: ICT as a place that offers opportunity for exploration and discovery

Another perception that 9 informants (4 engineering, 5 non-engineering) hold of ICT is that of a place that offers opportunity for exploration and discovery. The *ICT-place* metaphor is linked to the *ICT-container* metaphor in the affordances of availability and convenience of access. However, unlike the *container* metaphor where the learner can choose to be passive, that is, not pick up the material, the *place* metaphor is dynamic as learners’ visit to the online platform is itself learner action. As illustrated below, the learning management system and course sites as well as the *Discussion Board* feature in Blackboard exemplify the *ICT-place* metaphor. Table 6 summarises informants’ understanding of ICT as a place and their perception of its affordances.

<table>
<thead>
<tr>
<th>Aspects of ICT</th>
<th>ICT as place</th>
<th>ICT affordances</th>
<th>Link to teaching orientations/ beliefs</th>
<th>Correspondence with informants’ beliefs</th>
</tr>
</thead>
<tbody>
<tr>
<td>learning management system and course sites</td>
<td>organised space; resource room</td>
<td>smooth navigation sequence; tracking ability; access to current information; links to other resources for exploration; easy access for repeated viewing and learning at learners’ own pace</td>
<td>Learning facilitation/ travelling theory</td>
<td>Teaching by leading through the thinking process; Learning through thinking and understanding</td>
</tr>
<tr>
<td>Blackboard: <em>Discussion Board</em></td>
<td>dialogue platform</td>
<td>discussion of ideas to stimulate and encourage thinking</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 6: Perception of ICT as Place**

Firstly, just as they were seen as containers, the learning management system and the course sites on it could be thought of as places for users to visit. This is clear from
informants’ lexical choices like ‘visit’ and ‘navigate’. As a learning management system, Blackboard is seen as an organised space. For example, according to NE2, Blackboard is ‘not like a web site which you just visit and cursorily go through’. The reasons offered for Blackboard’s appeal include smooth navigation sequence and tracking ability. Also, compared to a personal web space, which is individualised and ‘arbitrary’ (NE2), Blackboard is more organised, so that ‘somehow… you continuously keep on visiting it’ (NE2). Furthermore, teachers can get students to visit the course site on Blackboard by updating information on the site. The updating of information ensures the site stays current; in this way, the site attracts learners to it. Similarly, providing useful information on the site, such as additional links, attracts learners to it. Updated information could include:

... change in lecture schedule or any mistakes in the lecture notes or tutorial questions or any information that we need to provide them – uploaded some new materials which we need to inform them. That is the first thing the students read when they log on. New postings are there. (EG7).

Furthermore, as NE2 explains:

... once they go there they realise, oh lots of useful things are there, but initially we have to direct them to the web site.

In other words, when learners log on, that signifies a step in the journey of learning. Details about the course are posted in Course Information, such as start and end dates, course requirements, course outline, weekly schedule and text and reference books, as well as the names and contact details of the teachers responsible for the course. Providing this information is the teacher’s responsibility. Furthermore, this information is necessary to facilitate learning. With this information stored in Blackboard, students can conveniently revisit it whenever they want. In the case of teachers who try out a strictly online lesson, the learner who goes through such a lesson via edventure is taken on a journey as they explore the material that is there. For instance, the links provided by the teacher are part of ‘web navigation’ design, which allows them to ‘go to outside resources’ (NE2). Similarly, when learners (re)visit a recorded lecture, they have time to study the material at their own pace. In short, the online platform is another ‘avenue’ (EG3) in the learning process. Informants’ perception of ICT in this way is in line with
their belief that learning is a journey and the learner is a traveller (see section 4.2.3).

Next, ICT as a place for exploration and discovery functions as a resource room. This is a reference to the course site and/or tutorial site, which learners can continuously visit (NE2). This room is described as having a ‘serious look’ (NE2) about it, because it has ‘sections’ (NE2). In this ICT-place metaphor, the teacher’s role is seen to be that of a housekeeper who ensures that everything that is intended to be posted online is done so in a timely fashion; at the same time, the housekeeper makes sure that visitors to the resource room can have easy access to the material and can navigate themselves around the room (EG7). For these reasons, informants generally express the wish that users would frequently visit the online space (NE2; EG4; EG7). This room is accessible to anyone who is registered as a user. This easy access that ICT affords appears to teachers to be an attractive feature, especially as it allows learners to pace themselves in their study. Moreover, easy access allows for review and revision of subject knowledge, a characteristic that informants seem to appreciate as being beneficial to learners. In a technical field like engineering, the concepts and theories may be difficult to grasp. Hence, learners may require repetitions before they grasp the meaning of a concept, as EG8 and EG10 assert:

*When I finish a major concept or an example, then I ask them if they’ve not understood or whether they have any questions. And if I see that it really seems that they have not understood, then I would repeat it.* (EG8)

*If students cannot understand, you got to repeat. … Many times I had to repeat the concepts, keep repeating to force something into the students.* (EG10)

Informants like NE1 and NE3 also believe that with the use of ICT, repeated access to information helps learners to grasp subject knowledge content. The idea of learners retrieving content from Blackboard suggests learner action:

*But they are able to learn it more because they retrieve it a few times and the information just sinks in… So yes, they could retrieve content, they could remember that, I would think, because they do it a few times.* (NE1)

*[ICT] enhances learning, because if I don’t understand I can view it again.* (NE3)
Finally, the *Discussion Board* on *edventure* is seen as a dialogue platform that allows discussion of ideas. To informants, the act of discussing an idea stimulates and encourages thinking. In a discussion forum, therefore, learners share and explore ideas with each other:

*The discussion board is more to share information. More for them to read about how people perceive that topic.* (NE1)

In a way, learners engaged in discussions could be viewed as embarking on an exploration of ideas. Blackboard also allows files to be attached on the *Discussion Board*, so there could be additional material for learners to cover. Once learners enter the forum, they may find a number of sub-topics arising from the discussions among fellow learners and they may ‘add (sic) the tracks’ (NE10).

To informants, the value of the *Discussion Board* lies in its function as a dialogue platform offering the opportunity for exploration of ideas to stimulate and encourage thinking. This is line with faculty’s belief that learning comes through thinking (see section 4.2.2). Here, informants believe that on the learners’ part, exercising the thinking faculty is one way to attain learning; they also believe that the teacher is in part responsible for learners achieving comprehension and understanding of what is being taught. Therefore, the belief is that learners need stimulation for thinking. Hence, informants usually provide a topic on the *Discussion Board* to ‘start off the discussion’ (NE10). According to EG9, to encourage learners to ‘go into the forum’, the teacher has to initiate the discussion:

*Because if you don’t plant the question, then there won’t be discussion.* (EG9)

*I tried to throw questions [in the discussion forum].* (NE9)

The expression ‘throw questions’ (NE9) is an interesting one. Presumably, there is a purpose to the teacher posing a question in the *Discussion Board*. Perhaps they want their learners to attempt answering the question, or at least to think about it. On the one hand, these sample comments by EG9 and NE9 tell of the teacher’s part in encouraging the use of the *Discussion Board* to engage thinking and persuade learners to express their ideas. On the other hand, the implication seems to be that the onus is on learners to participate in this thinking game in order that learning can happen. Asking questions is also a way
for informants to get a sense of where their learners are in terms of understanding lecture topics (EG2; EG4; EG7; EG8; EG10; NE1; NE7; NE9; NE10). Asking difficult questions, some informants believe, will challenge learners and ‘stir them to think’ (EG2). Similarly, EG3 states:

… when you ask questions, you make people think.

Informants believe, too, that when learners are faced with difficult questions, they will be challenged to explore and discover new knowledge:

We also have good students who are … very enthusiastic about the subject and like discussion and challenging questions. They like to think and if a challenging question has been posted up, they like to try although they may not get the right answer. (EG7)

Here, the focus is on the learners arriving at a destination (answer) that may not be the pre-determined one (‘right answer’). This suggests the travelling theory at work again. However, there is a ‘right answer’ to contend with, which suggests that learners will ultimately want to get to that place (right answer), perhaps via the teacher, that is, the expert traveller and guide.

Thus far, we have seen that the ICT-place metaphor is related to the beliefs that learning happens through thinking and that learning is a journey. The teacher’s role, therefore, is as an expert to help learners along this process at arriving at understanding and at exploration and discovery (discussed in sections 4.2.2 and 4.2.3). EG9 offers a strategy that the expert could use to allow learners the opportunity to explore:

You need to steer your students to the Discussion Board and say, Discuss…and then you should leave it there for three days. And students will respond. And if there are various differences …and they can answer to questions that weaker students ask, or that other students ask. You shouldn’t come in right from the start and silence all the opinions. So you just let them be involved and only when it is necessary, like they go off track or the concept that has been propagated and discussed for a few weeks is completely wrong, then you just bring them back to the track.

Clearly, EG9 sees learning as a journey of exploration. The strategy adopted by this
informant in the facilitation of learning is to stay away from the discussion for a while, so as to allow students to participate and contribute to the forum. EG9 compares himself to a guide whose job is to ‘steer’ learners to the forum and ‘back to the track’ when they ‘go off track’. When the discussion is allowed to develop, the purpose is to allow learners to explore the terrain, that is, the topic of discussion. In this way, the teacher hopes that learners may discover new ideas for themselves. But when they head in the wrong direction, the teacher, as the guide, steps in to direct them to the right path. However, unlike the travelling theory put forward by Fox (1983), the teacher here seems to be in control of the destination of the travel. In a sense, then, the journey metaphor here is not developed like Fox’s travelling theory, as the learner does not have the final say – unless the answers they provide are the right ones. Moreover, the teacher is not the fellow explorer described by Fox but one who directs the learner to the destination via a pre-determined path. Here, informants’ version of the travelling theory seems to be like the shaping theory, for it holds the teacher as the expert who knows the way to the pre-determined destination and leads the way when the time is right, like entering the discussion forum when they see learners getting off track or getting the wrong answers.

As NE4 states, the teacher’s responsibility is monitoring discussions in the discussion forum. Allowing students the space to talk to each other is also advocated. EG4 offers more advice on how discussions should be managed so as to facilitate student learning:

*My role is very important. I do not interact right away. …I don’t want to do that. You see, a discussion is like a stew. I want it to simmer. If you’re cooking a stew, you put in a lot of things and allow it to heat for some time. Then you add the right thing and finish it, right? My feeling is like that. … So I don’t interact right away. I wait for four or five fellas to answer them in their own words when they write. Then their thinking also is cleared. Then I come in and clear them.* (EG4)

To EG4, the process of developing an idea is akin to the process of cooking. EG4 compares himself to a cook preparing a stew and allowing it ‘to simmer’. Here we see the baby food manufacturing analogy version of the transfer theory (Fox 1983) at work, for the teacher as the cook has a dish (product) in mind and works towards that. Allowing the stew to simmer is simply allowing the ideas in the pot to develop as learners take on the
discussion. The dish, however, is cooked only when the teacher sees fit to ‘add the right thing and finish it’. Furthermore, the teacher is the expert who knows best – ‘And of course, some questions they cannot answer at all, then I come and correct it. In that way, I’m like a teacher who always points out the errors and makes it correct’ (EG4). It is in this way that the product (knowledge and information) gets transferred to the container, that is, the learners.

Informants report, however, two possible barriers to this learning. The first barrier is system breakdown and slow downloading of big files. When these hamper the efforts of learners, they may leave the discussion. Hence, the journey may be disrupted and learning affected. The second barrier is the presence of non-contributing members to the Discussion Board. This is seen in the following sample comment:

*The problem is that though the tools are there, tools requires response, we assume the students are interactive – our students are not interactive. Very few are interactive, I go into the statistics, and students will go spend a lot of time in blackboard without a single posting.* (NE10)

Here, the informants’ conception of the travelling and exploration process places the teacher in the position of an expert guide who leads the learner to the destination. As mentioned, this conception is not the same as Kember and Gow’s (1994) learning facilitation orientation and Fox’s (1983) travelling theory. In particular, EG3, EG4, EG9, NE1 and NE3 simultaneously perceive ICT as a container and believe in the necessity of face-to-face sessions. This highlights again the tension between ICT use and informants’ beliefs. Nevertheless, in this conception of ICT as a place there is, on the whole, an element of facilitative teaching involved, which suggests some indications of a ‘developed’ theory of teaching. Informants’ perception and use of ICT as a place for exploration and discovery corresponds with their belief that teaching is leading learners through the thinking process and that learning happens through thinking and understanding.
4.3.3 Perception 3: ICT as a tool to achieve effectiveness in teaching and learning

To the question about what they think ICT is, in all of the 22 informants’ replies (11 engineering, 11 non-engineering) is the image of ICT as a tool, although they differ in their evaluation of its functions or performance levels. In the literal sense, a tool is a device, implement or piece of equipment, usually one used with one’s hands, that is used to help one do a job. Metaphorically, a tool is associated with the ideas of necessity and efficiency, and perhaps, convenience. Informants report that ICT as a tool for teaching and learning is ‘useful’ (EG8; NE5; NE6; NE10), ‘convenient’ (EG4; NE5), ‘efficient’ (NE3; EG6) and ‘powerful’ (EG4; EG6; NE1; NE2). ICT is also an ‘additional helping tool’ (EG4) and a ‘productivity tool’ (EG10). For instance:

So it’s a great tool, ICTs. It’s nothing different, but it’s like any other tool, slightly more powerful because it’s computer-based. And day by day it’s getting more powerful, so you can do more and more things. (NE2)

These are the fundamental means of ICT, demonstration or through emails which involves computers, Internet and can help students learn. Make learning more interesting, efficient and effective. (EG6)

Informants also state that as a tool, ICT occupies only a complementary or supplementary position in their teaching. Below is a sample comment:

It is complementary to my own teaching; I can streamline it into what I want to emphasise... It is very flexible to update anything I want. The accessibility is there. For those students who are more ‘on’ – they can ask you questions. (NE9)

Although they perceive ICT to be complementary to teaching, informants nevertheless acknowledge its possibilities for both learners and teachers. To them, ICT is a ‘powerful’ tool (NE2; EG4) that learners could, and should, use to develop questioning and thinking skills. Next is ICT viewed as an efficient and effective tool. Blackboard is described as a useful e-learning platform, mainly because it is ‘systematic’ (NE2), that is, it is orderly and efficient, so that students can easily pace their learning. Another example is electronic mail for communication, where questions and answers can easily pass from one party to another. Time-wise, too, the advantage is evident – there is no need for the parties concerned to be physically present at the same place or even at the same time.
(NE8). However, ICT may turn out to be a ‘two-edged sword’ (NE3; EG9), particularly with regard to time and lecture attendance. While ICT users may not be bound by time constraints, they may spend much time on the Internet. Similarly, while learners may review lecture material anytime and anywhere, they may lack the discipline to do so. In spite of that, ICT is considered a flexible and accessible tool to teachers, as it offers them the ease of adding and updating information, the convenience of locating their students and the effectiveness of reaching all course participants through the Discussion Board (EG3; EG10; NE9; NE10). Last but not least, ICT is seen as a ‘productivity’ tool (EG10) as it ‘takes off pressure from the teacher’ (NE2). For instance, Power point presentations aid communication (EG11) and lecture and tutorial material can be downloaded and printed as needed. For all these reasons, ICT is seen as a tool to make teaching easier and the teacher more effective (NE2; EG10).

On the whole, ICT affordances are portrayed in a positive light; in some respects, ICT seems almost indispensable. As NE4 puts it, one can easily become familiar with ICT use, like ‘if you know that [the computer] is not there, I think you’ll find it pretty difficult to do your job’. As a tool to achieve effectiveness in teaching and learning, ICT is deemed to function primarily as a visual presentation tool and a communication facilitation tool. These functions are elaborated on in the following sub-sections and discussed in relation to informants’ understandings of teaching and learning. Table 7 shows the different aspects in which ICT is perceived as a tool and its accompanying affordances.

<table>
<thead>
<tr>
<th>Aspects of ICT</th>
<th>ICT as tool</th>
<th>ICT affordances</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Power point</em> slides, animation, video</td>
<td>presentation tool for visual impact</td>
<td>to gain audience attention; provide clear and interesting lecture material; exemplify abstract concepts for understanding</td>
</tr>
<tr>
<td>email, <em>Discussion Board</em></td>
<td>facilitation tool for communication</td>
<td>to provide feedback; share class responses; link students as a community of learners</td>
</tr>
</tbody>
</table>

**Table 7: Perception of ICT as Tool**
4.3.3.1 **ICT as presentation tool for visual impact**

Through use of the *ICT-presentation tool* metaphor, 14 informants (7 engineering, 7 non-engineering) report their use of ICT as a presentation tool, which is related to the transfer and shaping theories of teaching. As a presentation tool, ICT provides visual impact. This impact is achieved through *Power point* slides, graphic illustrations, animation and video. This seems to work well for the transfer of information and subject knowledge content. Table 8 summarises informants’ understanding of ICT as a presentation tool and their perception of its affordances.

<table>
<thead>
<tr>
<th>Aspects of ICT</th>
<th>ICT affordances</th>
<th>Link to teaching orientations/beliefs</th>
<th>Correspondence with informants’ beliefs</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Power point</em> slides, graphic illustrations, animation, video</td>
<td>transfer of information and subject knowledge content; attract audience attention; provide clear and interesting lecture material; exemplify abstract concepts for understanding</td>
<td>Knowledge transmission/transfer theory, shaping theory</td>
<td>• Teaching as a transfer of subject knowledge content; learning as a reception of such content • Teaching by leading through the thinking process; Learning through thinking and understanding</td>
</tr>
</tbody>
</table>

**Table 8: ICT as Presentation Tool**

An interesting observation is that both groups of informants believe that their students learn visually (see section 4.2.2), as shown in the comments below:

…*it’s easier for them to see words than to hear us talking.* (NE1)

*You can’t just say this is the definition of this, the definition of that. The whole thing will not go into their mind… They have to see the sequence, see the symbols, see the equations, see the diagrams.* (EG10)

Hence, they prefer visual presentation through animations, pictures and video clips:

…*there were pictures as well. In order to make the slides more interesting and not*
to have wall-to-wall words, I try and put relevant pictures into the slides as well. (NE5)

We should be able to explore the simulation aspect as well as the use of animation, video clips to illustrate etc. It can be something very comprehensive that even the weaker students can appreciate what we are teaching. (EG7)

Presentation as a basic function of ICT is acknowledged by all the informants, who introduce their lecture and tutorial material through either Power point slides or a web page to facilitate transfer of information and subject knowledge content. This is linked to the belief that teaching is a transfer of subject knowledge content and that learning entails a reception of such content (see section 4.2.1). Although one common complaint among informants about the use of ICT for preparation of lesson material is that it is time-consuming (EG3; EG4; EG5; EG7; EG8; EG10; NE2; NE5; NE6; NE8; NE9; NE10; NE11), informants agree that ICT is a useful tool to make their lesson presentations clear and interesting. They believe that in this way, material presented through ICT attracts the attention of their audience. Graphic illustrations, for instance, are used for this purpose:

…to look attractive with visual…nice colours and titles. (NE9)

I can make my presentation clear to the students by showing them graphics – like if the fluid starts to take shape – that is rotational. (EG5)

Moreover, for engineering subjects in particular, teachers can easily exemplify abstract concepts through animation and video for better understanding, as the comments below show:

…to illustrate some concepts, like using animation and sound. (EG3)

And animation also helps students to understand better. (EG11)

Because… this is about the motion of fluid, it will be much better if there is animation and videos to illustrate the motion itself. …The animation does add to the illustration of the assumption I am making. … video is very useful as well. I am using video throughout all my lectures – from introduction to the illustration of the results, application and results. (EG5)

Although the use of animation is generally seen to be helpful, not all informants think the same about it. EG8 and EG10, in particular, feel that animations are ‘fancy things’ (EG8)
which might be more appropriate for ‘lower levels’ (EG10). To them, teaching in higher education ought to focus on concepts, principles and theories.

In general, informants reiterate that even as visual aids help learning, the teacher must decide on the appropriateness of their use. Appropriateness of ICT use is related to beliefs about teaching and learning. The data show that providing visual impact is only one way informants transmit information and knowledge. More importantly, informants believe that the teacher’s responsibility is to help learners understand the subject knowledge content (NE1; NE3; EG6; EG7). The teachers’ focus, then, is on leading learners to understanding, which is closely related to thinking. Engineering faculty, in particular, demonstrate this in their teaching. They provide step-by-step explanations in the belief that this will lead learners through the thinking process (see section 4.2.2). This is the shaping theory (Fox 1983) in operation. Like the transfer theory, the shaping theory suggests the teacher is the authority with total control to shape thinking and understanding, while the learner is passive and controlled. Informants also believe that the teacher’s delivery style could affect how learners learn (EG1; EG2; NE3; NE11). Each of these aspects is discussed below.

As mentioned in section 4.2.2, in teaching technical subjects, clarity of explanation is of utmost importance. One option for engineering teachers is to explain the theories or equations step by step. This can be achieved through ICT, in particular, Power point presentations, as EG5 explains:

> All the materials are in a proper sequence and they are presented in a predictable way. For example – derivation, if I want to show the students how a certain ‘governing’ equation is derived, I can start with a picture of the problems with the axes in their proper manner and I can also post up the assumptions, and then the boundary conditions then presentation can be carried out in a step by step manner until a solution is arrived at.

However, he later states that the transparency is a better option than Power point slides:

> I think the students do not quite grasp the concepts using the Power point. In Power point it is difficult to pause and cater to their needs – easier to use
transparency. So with that I can jump the steps and link the steps. ...There is more on the spot response to the students’ needs. (EG5)

The data show that generally, informants share that ICT plays a limited role in helping the teacher explain concepts or illustrate problem-solving sequences. Unlike the use of graphics and animation, the use of PowerPoint slides to show a sequence of steps is, according to engineering informants, not ideal. This appears to stem from informants’ belief that learners learn by watching and reflecting, like seeing how the teacher works out a technical solution step by step; they believe that in this way, learners can follow the teacher’s thought processes. To them, seeing the sequential progression in problem-solving is a way to learn (see section 4.2.2). Another explanation for their conception about the limitation of ICT in teaching is their belief that face-to-face interaction is the way to learn and teach (see section 4.2.1). In this view, the teacher is irreplaceable in the face-to-face session. This is also an instance of the knowledge transmission orientation, for ‘the use of media consisted of students copying verbatim from overhead transparencies’ (Kember & Gow 1994, p.64).

Hence, when the teacher needs to explain the steps in a problem-solving sequence, the white board or a blank overhead transparency is usually used to show the steps rather than PowerPoint slides which can ‘flash’ (EG10) the entire sequence all at once. Similarly, a tablet PC with the writing feature allows on-the-spot writing, which works for EG1, who prefers it to using PowerPoint slides, as he is able to engage his students, to help them focus attention rather than just look at the slides while listening to him.

Below are sample comments:

>You start with a clean board and do the complete working and show how the solution comes. (EG4)

>Lecture notes are always on the edventure. I go to transparency partly because to disrupt this process [of viewing lecture slides on edventure]. I don’t want them [learners] to fall back to a passive way of learning without much thinking. (EG5)

>Because our engineering work involves a lot of concepts and equations and diagrams. So I can just take one of the overhead projectors, take a fresh transparency, draw a diagram or write an equation on it and try to explain using
Whatever tools I have. Whereas with edventure it would be just one show ... So I prefer two OHPs where one of my transparencies is already there and if I want to reinforce the idea, I use the other projector with a blank transparency and then I try to explain. So to me, that works very well. (EG8)

Therefore, all this suggests that the presentation of sequences during the face-to-face lecture is not done as well via ICT, namely Power point slides, as via transparencies or the whiteboard. Hence, because of this perceived limitation, ICT is not used as much during lectures when step-by-step explanations are required.

Informants report that another limitation on learners understanding technical information is the way in which the information is delivered. As mentioned in Chapter 3, face-to-face instruction remains very much a part of the curriculum. Delivery in this context refers to the manner or the technique employed in teaching. In the transmission model (espoused by many informants; see section 4.2.1), the teacher is the delivery person and the product delivered is the lesson or lesson material. The teacher’s responsibility is to ensure the product gets to the intended recipient. Informants use the term ‘traditional’ to describe this mode of teaching; a ‘traditional teacher’ may be defined as ‘someone who delivers materials’ (EG5) or as ‘somebody who gives a lot of information to her students and it could be like a one-way kind of traffic’ (NE5), which could then make teaching and learning ‘boring’ (NE1).

Therefore, informants recommend employing new strategies or new modes of teaching. Following is a discussion of the strategies teachers can employ in both face-to-face as well as online delivery modes.

Informants suggest that the teacher should think of a host of activities to engage learners’ attention. Hence, the teacher should not simply follow the traditional way of teaching but should have his or her own idea about teaching (EG2). To EG2, the teacher can be compared to a music conductor and teaching to playing music; musicians do creative work and, he believes, so do teachers. In his opinion, fundamental knowledge has been in existence for a few hundred years, yet the ‘old’ can be made ‘new’ (EG2). As he
explains, just as a piece of classical music can sound different each time the orchestra plays it, ‘fundamental (i.e. ‘old’) knowledge’ can be made interesting and fresh (i.e. ‘new’) each time the teacher communicates it. He refers to how the teacher has first to know their subject very well so as to turn the information into something that learners will find appealing and thus pay attention to. The belief is that when learners are attracted to the information, they will be open to the learning experience. For engineering informants, making the theories meaningful is the main concern in their lesson preparations. Hence, their materials and activities are designed with this goal in mind. The topmost consideration for EG1, for example, is how to present concepts in ‘the best way’, by which he means presenting real life examples to illustrate concepts (see section 4.3.1). For EG3, ‘it’s more of application of a concept in an engineering situation.’ Again, he would illustrate with examples from daily life; to him, this leads to a ‘more complete understanding’ of concepts. Similarly, in non-engineering subjects, making the content accessible to learners can be achieved by way of illustrations that they can relate to, such as stories from history or from their own experiences, or issues understood ‘from a layman’s point of view’ (NE3). This point is further exemplified by NE11:

For instance, I’ll ask, why was it important for Raffles to speak Malay at that time? … I’ll relate it to modern Singapore, as to why the government insists on us all to have a second language, and even a third language, if we can manage it.

This conception of the teacher’s responsibility to engage learner attention concurs with the general view that ‘academic learning is enhanced when it is perceived as relating to real life’ (Ireson, et al 1999, p.223).

Furthermore, in this delivery process, both verbal and non-verbal communication skills play an important role. To illustrate, NE3 realises that lecturers must be interesting to get learners’ attention, and that to achieve this, the manner of delivery is crucial. He finds that learners dislike the lecturer to merely read lecture material during the lecture. Instead, they seem to prefer the story-telling technique. In fact, EG5 thinks that the teacher is like a story-teller who narrates the story in an interesting and engaging manner. It is perhaps in this way that the teacher can ‘excite’ (EG5) the learners. EG1 agrees with this, as evident from the stories he tells to illustrate concepts. However, he firmly
believes that he is not an ‘entertainer’ (EG1) (compare the TEACHING IS ENTERTAINMENT metaphor in Cortazzi & Jin 1999); as a teacher, he sees himself as someone who tries to deliver material, that is, someone who tries to help learners understand the material.

In an effective delivery, non-verbal communication skills are as important as verbal communication, if not more so. As NE2 puts it, he is mindful about ‘whether students understand my accent, my pronunciation, my pace’. As long as the teacher is visual (i.e. whether face-to-face or online via video-recording or the talking head), learners can see the teacher’s facial expressions and body language (NE1; NE3) and hear the tone of voice. Through this, the audience get a sense of the teacher’s presence:

So by and large, it’s just the clarity and the loudness and the fact that you want to relate to them… (EG8)

Furthermore, in such a delivery, the teacher does not assume the position of expert or authority on the subject and talk down to learners. Instead, they give learners the sense that they are in a dialogue with them and that they have equal ownership of the lesson; for instance:

It’s …standing there talking to a huge big group and knowing that they are listening to you, and being in a position of advantage, and yet not taking advantage of them, wanting them to learn. … Some of them feel that they can trust you like a friend, they can ask you anything, they can approach you anytime. So you give them a sense of belonging, of caring. (EG8)

Therefore, to informants, the manner in which the teacher delivers the message is a key feature of teaching.

On the use of ICT to deliver lectures, informants stress that their role as online teachers is to facilitate understanding. They refer to the teacher adjusting to learners’ pace of learning and level of understanding, to ensure teachers ‘have the whole class with you’, that ‘you are taking them all along with you’ (NE3). The implication is that the teacher is responsible for ensuring learners understand what is being taught. For this reason, the ability of the teacher to convey messages effectively to their target audience is important
Unlike engineering teachers who are concerned with the completeness and accuracy of information that they provide, non-engineering teachers place emphasis on the way that online lectures are presented. They advocate the use of appropriate strategies to deliver a ‘better product’ (NE5). These are, basically, ‘interactive strategies’ that the teacher may already be using in the classroom (NE5). These strategies help to encourage learner involvement. Also, whether the lecture is a sound or video recording, these strategies will help the teacher ‘appear as a visual instructor’ (NE7). Again, this highlights the belief that their audience are visual learners (see section 4.2.2). NE5 and NE7 suggest using the following:

... a lot of personal pronouns, making it very you-oriented, so students feel they are actually part of the learning circle as opposed to outside it... repetition, but not overly so because the medium itself allows them to repeat bits of the lecture if they want to... dramatization in the sense of role-play... rhetorical questions, because you can’t have responses to questions immediately, but at least when you ask rhetorical questions, you’re getting them to think along the lines that you want them to think on... (NE5)

... make my tone more conversational, as though I was speaking to them rather than just setting up notes on the platform... add motivational words and markers inside... incorporate graphics and pictures, so that they can visualise the words rather than just see words... dramatise it, so it will be more exciting... synchronising the slides and what we are speaking. (NE7)

To NE5 and NE7, these strategies are useful for lecture delivery via ICT in two ways: to attract learners to the online lecture (NE7) and to involve them in the learning process (NE5).

We see, therefore, that the *ICT-presentation tool* metaphor corresponds with Fox’s (1983) less developed theories of teaching and with Kember and Gow’s (1994) knowledge transmission orientation. It corresponds with informants’ beliefs that teaching is transferring subject knowledge content and leading learners to thinking and that learning is receiving subject knowledge content and understanding by going through the
thinking process.

4.3.3.2 *ICT as facilitation tool for communication*

Besides being viewed as a presentation tool, ICT is also perceived and used as a facilitation tool by 16 informants (9 engineering, 7 non-engineering) to encourage open communication between the parties involved in the teaching and learning situation. This is related to the shaping and growing theories. The use of the *ICT-facilitation tool* metaphor suggests that with communication, teachers and learners are able to share responses and get feedback. Computer-mediated communication also encourages students to come together as a community of learners. Table 9 summarises informants’ understanding of ICT as a communication facilitation tool and their perception of its affordances.

<table>
<thead>
<tr>
<th>Aspects of ICT</th>
<th>ICT affordances</th>
<th>Link to teaching orientations/beliefs</th>
<th>Correspondence with informants’ beliefs</th>
</tr>
</thead>
</table>
| email          | provide feedback; share class responses; link students as a community of learners | • Knowledge transmission / shaping theory  
• Learning facilitation / growing theory | • Teaching and learning and through face-to-face interaction  
• Teaching through encouraging learner participation and developing the right attitude; Learning by taking responsibility and having the right attitude |
| Blackboard: *Discussion Board* | | | |

Table 9: ICT as Communication Facilitation Tool

Blackboard’s *Communication* feature is most frequently referred to when informants talk about ICT-based communication with their learners. Communication is a two-way process that entails participation and interaction. It is ‘the simultaneous sharing and
creating of meaning through human symbolic interaction’ (Seiler & Beall 2005, p.3). A simple model of communication includes the following elements: sender, receiver, message, channel, feedback and noise. The sender and receiver are the teacher and learners, who provide the message and feedback, the channel is ICT, and noise is any barrier (physical and psychological) that affects communication. This model applies to computer-mediated communication. To NE4, ICT is simply ‘a tool to facilitate your interaction with students’. This interaction could happen from communication between the teacher and one learner, the teacher and a group of learners or the teacher and the entire class of learners. It could also be communication among learners. Learning through communication with others is similar to Vygotsky’s idea of social interactivity between learners to promote learning (see section 2.3.2.4).

Blackboard offers both synchronous and asynchronous communication. Synchronous communication is possible through the software programme that the university has named iNTUition or through video conferencing. For example, a lesson conducted with synchronous communication ability allows the teacher to answer students ‘in real time’ (EG6). Asynchronous communication, on the other hand, is possible through electronic mail and the Discussion Board. These are also the features most commonly used by informants in their communication with learners.

Informants generally agree that ICT is a good medium for shy learners to express themselves. Sample responses include:

And some students actually feedback to me that they are very shy in class but this will allow them to…they can share, you know, in the online medium. They like that. (NE1)

I think emailing is really good, because there are students in your class who are really too shy to ask you questions, to ask for clarification and so on. But they are more willing to do that via email. So I find that I’m able to keep in touch with my students and get to know the quieter ones better. (NE5)

Email is a basic communication feature in any ICT-based teaching and learning environment. Email allows learners easy access to their teachers:
I think basically it facilitates in allowing students to have better access to me by email. (EG9)

Similarly, EG8 asserts:

I know some of my colleagues don’t respond to email queries; they think it’s a waste of time. To me, it is absolutely essential.

Email is used by learners mainly to ask questions of their teachers. In fact, informants report that learners seem more comfortable communicating via email rather than sharing their questions on the Discussion Board. One reason for this is provided by EG3:

It looks like they want personal attention. They want exclusive answers.

Another possible reason is that learners feel more certain that the teacher will respond when they write to the teacher directly rather than post their question on the Discussion Board:

Or students who wish to ask questions but do not wish to post it on edventure – may be more secured to write directly to me. Like if I were to see the questions directly, I am likely to respond to them. (EG7)

Similarly, EG8 reports on learners’ preference for use of email over the Discussion Board when they need clarification of concepts:

In fact, they [students] still prefer to send me a personal email rather than use the Discussion Board. … It could be just that when the students write to me they receive a reply… within twenty-four hours, unless it’s over the weekend. So once they receive a reply within twenty-four hours they’re probably very happy with it and then they don’t think of using the Discussion Board. That could be one possibility. The other could be that sometimes the questions lies there in the Discussion Board and the idea is for students to discuss among themselves. … But what invariably happens is that nobody replies. They wait for the lecturer to reply. … So that may be one of the reasons why the students think it is not working, that it’s taking a bit of time. And so they directly write to the lecturer.

However, with email, time is an important consideration. For email to be useful in the teaching and learning situation, quick response on the teacher’s part is deemed essential to sustain online communication efforts. The teacher has to be ready to give a reply to
every question that he or she gets, as soon as it is received:

_Some students are not willing to share with others as well. … Wheneve..._ [students] really want quick results. They want things quickly, sometimes with minimal effort. (NE7).

The _Discussion Board_ is the other feature in the _Communication_ feature in Blackboard. Unlike learners who prefer to use email, most informants prefer the _Discussion Board_ for the accessibility (for public viewing) and convenience that it offers. Below are sample responses:

_When I reply to their questions, I reminded them to post their questions on the edventure site in the future – it will benefit to other students. If I spend 20 minutes to reply, the effort is not wasted as others can see the reply. (EG7)

[Students] can send you an email and they expect an answer within 24 hours. Especially during the peak period. That is why I try to steer students towards the Discussion Board. Otherwise you will die. (EG9)

_In the past, students’ email means questions. So you can only answer to that particular student even if those questions might be interesting to other students. But with Discussion Board you just have to answer once and everybody can read it. So it’s convenient to use. (EG10)_

The discussion forum also allows teachers to focus their energy and time on learners who need their attention, as in the case of NE4:

_...there are some students who take the lead to answer. So if they know, they will take the lead to answer, so that gives you time to answer other students._

Informants report on the way they use the _Discussion Board_ and the opportunities that it offers teachers and learners. As a way of engaging its users in open communication, the _Discussion Board_ creates the possibility of forming a community of learners.
The questions on the Discussion Board are posted not only by the teachers but also by the learners. When this happens, not only do teachers answer learners’ queries, but learners also answer each other, which is what teachers like to see, as they believe that communication and interaction of this nature leads to learning. In this way, ICT facilitates peer-to-peer interaction as well as teacher-learner interaction. At the same time, as informants report, this exchange of views and ideas among learners allows them to know how much learners have understood the topic of discussion:

Open forum for students to post questions and we monitor their questions – ascertain then what are some of the concepts students do not understand. Then we respond accordingly. (EG7)

we had a discussion forum where students post questions in there. You see, I don’t answer them right away. So if a fellow posts a question, the other fellows answer, so it goes like a threaded discussion. …So if a fella posts a question, the other fellas explain, so that way it helps me a lot because I know if they are understanding this. See, nobody has the perfect answer, so it’s somewhere in between. So to what level they are clear and what level they are not clear, this discussion board helps a lot. (EG4)

However, starting and maintaining the discussion forum is not an easy task, as some informants report:

One time I tried to start a discussion forum but nobody responded, so that was the end of that. (EG5)

But I have problem with the discussion forum. I couldn’t get them to contribute much. (NE1)

But my sorrow is, again, that not many are using it [Discussion Board]. So if you can somehow make them use that, I think… You see, once they use it and they realise the benefit, then nobody will have to sell them this; it will be automatic. But somehow this is not happening. (EG4)

However, when discussion forums take off, teachers are often happy to let students take the lead. For instance:
...usually one of the students or somebody will take the lead to answer somebody’s question… So it’s more like students interacting with one another. So only if I see the person is answering wrongly then only I come in. But most times the students seem to be happy talking among one another. (NE4)

Yet another effect of computer-mediated communication is the creation of a community of learners through interaction and networking. Networking is a way of sharing and supporting; in this sense, it serves to link parties to each another. As NE2 reports:

...e-learning is basically for sharing, and sharing in two aspects, that is, teachers need to network with each other… The other networking is students.

The implication here is that knowledge is not confined to the classroom, and ICT can be used to put people in contact with each other ‘because e-learning has destroyed the boundaries’ so that ‘if you don’t network and you are using e-learning, then it’s not very useful’ (NE2). However, as shown, building such a community can be a challenging task for the teacher.

The data show, therefore, that informants use the Discussion Board mainly to facilitate communication between themselves and their learners, as well as between learners and their peers. The purpose of this communication is to stimulate thinking and encourage sharing of ideas among learners. This, informants believe, is when learning takes place. Communication also makes it possible for learners to interact and network among themselves, so that a community of learners can be formed. However, informants also experience difficulty in keeping students interested in the Discussion Board. The data show that the strategy adopted by some informants to keep discussions going stem from the shaping theory of teaching. Often, each discussion ends with a final word from the teacher.

From the discussion thus far, it can be seen that informants believe that communication and interaction are an integral part of teaching and learning. Where ICT is concerned, while they acknowledge the potential of the Discussion Board to facilitate communication with and among its participants, they also recognise its limitations.
question one might ask is, how can communication in teaching and learning be facilitated? The following examines two ways of facilitating communication that are significant to informants: through face-to-face interaction and through learner participation.

Here, as before (see sections 4.2.1 and 4.3.1), informants maintain that they prefer face-to-face interaction with their learners. Various reasons are offered for their preference for this mode to achieve communication, as shown below.

Teachers’ background, such as their previous experiences as learners, can affect their understanding of teaching. EG8, for example, recalls his experience when as a learner the way that he learnt best was through ‘irreplaceable’ face-to-face interaction. As discussed earlier, this idea that informants have about face-to-face interaction comes from their belief that the human touch and human connection are necessary in the teaching and learning situation:

*I have this impression that you have to teach, and face-to-face teaching is irreplaceable. So I think that has probably stayed with me in a very strong way.*  
(EG8)

An explicit reference is made by NE6 and EG3 to the human element that is thought to be present with face-to-face interaction. In particular, EG3 laments that the current communication features in Blackboard, that is, email and Discussion Board, do not allow for dynamic interactions that are possible with face-to-face group interactions. Neither are these features conducive for developing desirable qualities like a quick thinking mind – unlike what face-to-face interactions are deemed to be able to train:

*I’m a people’s teacher at heart, in the end. I do like going into a classroom and teaching students. I don’t think I want to sit in front of my desk waiting for emails to come in...* (NE6)

[ICT] is a good supplement. But by itself it’s not good, because it doesn’t train the aspects I was talking about, like being able to think on your feet, being able to discuss with your classmates, to have that kind of three- or four-way discussion, not just two-way. Right now, e-learning is only two-way, at the most. Interactive
two-way. But the group dynamics, the group discussion, is not present. (EG3)

One other reason informants give for preferring the face-to-face mode as a question-and-answer platform is that the written medium is a less efficient means of delivering concepts. It appears from the data that engineering teachers, in particular, are not comfortable writing replies to queries. This could be because the online medium is heavily dependent on the written word, which may not be the preferred choice for some users. Moreover, when the same questions are asked by different learners, it is ‘clearer and efficient’ (EG6) for the teacher to give the answers in class. Furthermore, not all learners may get the answer via the discussion forum, especially when they are not interested in learning or sharing ideas with others:

I don’t like to type. I want to deliver the concepts in an efficient way and typing is not an efficient way. If I use the discussion board – I will look at their questions and then discuss in the lessons. I don’t want to type to answer one question unless to reply to all, otherwise some may not get it. Furthermore, if I send to all, it may become a junk mail to some students. Sometimes, same question is being asked repeatedly, and then it is clearer and efficient to answer in class. …They can help each other but how effective is this? Are they keen on their part? If their focus is not there, they may just attend lecture and read the lecture notes. Some students are not willing to share with others as well. (EG6)

Facilitating communication among the learners also entails encouraging learner participation. Participation in online discussions refers to ‘the process where learners and educators are actively engaged in on-line text-based communication with each other’ (Ho 2002). Lack of learner participation is a common complaint among informants. The lack of participation in the Discussion Board is attributed to learners’ less than positive attitude. For instance:

…it’s just that they are keeping away from participating. Which could be just pure indifference or the fact that they want to know what the other students are asking. And they have learnt something but they don’t have anything to say. (EG8)
Such behaviour on discussion forums is viewed as ‘selfish’ (NE10). Interestingly, this contrasts with what might be thought of as selfish behaviour in a real-time class when a learner who asks questions or makes constructive comments and in this way takes up the time of other learners. It is because ICT allows participation anytime and anywhere that learners are expected to join in the discussions.

With participation, however, communication is facilitated, helping learners to work through lesson material via the sharing of ideas. Informants believe that when learners participate in online discussions, the demands of this text-based communication help them to clarify their thinking as they write, thus leading them to understanding. Moreover, informants believe that thinking takes place when learners are engaged in questioning and responding, that discussion is the ‘real way to learn, to think’ (EG2). In the first place, learners should learn to ask questions, as EG4 observes:

‘[students] don’t ask questions, and I find it’s terrible for learning’

The next step is that learners should attempt to respond to questions even if they do not have the correct answer:

_They are very enthusiastic about the subject and like discussion and challenging questions. They like to think and if a challenging question has been posted up, they like to try although they may not get the right answer._ (EG7)

Informants believe that there are ways of encouraging learner participation in _Discussion Board_. In NE1’s view, learner participation can be ‘created’, that is, caused to happen. One way of encouraging participation is to provide the right motivation. One suggested way of motivating learners is to set uncompleted class work as homework:

_I say, okay task four we are not able to do today, you have to do it as homework and your answer you have to post in Blackboard discussion board. … for the students there is some goal, so they’ll always do it. In the past also I would say, oh we don’t have time to do this task, so go home and do it, and I’m sure nobody did that because once you leave the class, then that’s it. But then it puts a pressure on them when you say, you have to post it there._ (NE2)

Completing this piece of work becomes a ‘goal’ (NE2) that students will want to
accomplish. Perhaps this belief draws on this informant’s knowledge of learners in this examination-oriented system, which is, that learners view written work seriously and respond to the ‘pressure’ (NE2) if they think it will be evaluated:

_Because they somehow think that everything... that it’s for evaluation, it’s being recorded. And I also tell them that you can track it, whether they have visited. You can actually see whether a certain student has visited or not. Of course I don’t do it, but once the fear or pressure is there, the student is more serious._ (NE2)

Another way of motivating learners is to pose questions that require personal opinion or that are outside the scope of the lecture topic:

_I put up my 7 or 8 lecture topics, or 10, under every topic you will find a ‘kick-off’ question, like leadership – are leaders made or born? Motivation – how to motivate people? So that would start off the discussion._ (NE10)

_That subject where I had 400-plus postings, that subject that time was very interesting. So all the postings had to do with Internet problems. So actually nothing to do with the subject itself. They were talking about 3-G; students were all talking about this. So it’s not really discussing the subject content. Some time ago there was WAP, about five years ago. Very hot topic; everybody was so interested. A lot of discussion was on these topics. Let’s put it this way, the discussions were not to do with the exams. They were related to the subject but not on examination material. I used the Discussion Board to broaden their perspective. I joined in the discussion, because those things were very new and sometimes the students knew more than me._ (EG10)

The result described by EG10 is an encouraging sign, especially as learners seem to thrive on information in areas that interest them or that touch them on a personal level, like the topic of new technology to engineering students.

Another suggestion to increase the rate of participation is to make forum contributions compulsory and/or assign bonus marks to contributors. At the same time, informants highlight two other issues: the role of the school management in empowering teachers to assess learners in the way they deem appropriate and the demands on time and heavy
workload of both teachers and learners so that participating in the Discussion Board is often perceived as additional, and by implication, unnecessary, work. The following comments illustrate this:

*But I have problem with the discussion forum. I couldn’t get them to contribute much. … unless the top, like the dean, says, Look you must get them to do online forum and marks will be given. But I can’t do that because it’s not within my jurisdiction. Unless you can give them, say, you post a comment online, then we’ll give you marks for that. I dare not do it because I don’t know whether the school allows us to assess them in this way.* (NE1)

*So this is why I think we need to make it (discussion board) compulsory if not we will not get the response.* (NE9)

*But I haven’t had much success with Discussion Board, because it just takes too much time, from my point of view, and the students. Unless you make it…as graded, so unless you’re forcing students to do it, you’ll find that students themselves don’t have the time to do it.* (NE6)

*…But of course most of them do not participate anyway, I told them I give bonus points to those who participate.* (NE10)

These recommendations, however, are disagreeable to other informants, particularly engineering teachers. For example:

*I don’t like this [giving marks for forum participation]. This is not like a business, you know. It’s not like if you don’t like it we will refund your money. That’s nonsense. They’ll use it [Discussion Board] provided they know it’s beneficial for them.* (EG4)

*One extreme way is to force them to post. I’ve heard that some lecturers in the […] school grade students by their discussions. … I don’t force my students.* (EG10)

Strong feelings about this form of extrinsic motivation are expressed here. One is that education should not be treated like a business and learners looked upon as customers.
Giving bonus marks for forum participation is likened to giving a guarantee of satisfaction for the product purchased. The other strong feeling is that assigning grades for participation is a way of compelling learners to do what they would not normally do. This is viewed as an ‘extreme’ form of motivation. However, these views contrast other research findings on the relationship between increased online participation and mark allocation. For instance, learners’ desire to obtain good grades has been found to be a factor for participation in online discussions (Vrasidas & McIsaac 1999a). Increased contribution has also been attributed to motivation from both the allocation of marks and other learners’ contributions (Hughes 2003). This could be due to one or two of the following reasons: learners participate because they know their effort and time spent in contributing to the discussions are acknowledged, and online discussions allow them to pace their learning (CFLTOM, date unknown). The latter is especially useful to learners who require more time to consider their answer than would be available in a face-to-face situation (Baird, date unknown).

Time constraints and large class size are two difficulties cited by informants as factors affecting asynchronous online communication facilitation. With regard to the time factor, unlike a face-to-face class where the teacher is physically there with the learners to answer their questions immediately, the online discussion forum succeeds when there is timely response. Here, the focus is on the teacher. The teacher’s commitment to online communication is crucial, as attested by NE11, who cites time constraints as a reason for the difficulty in keeping up the effort:

*...if you set up a discussion forum and if you cannot attend to the questions there, I think it defeats the purpose. They will try once, second time they do it and they find the answers are not forthcoming quickly enough, they will just forget about it. So you must be there to answer their questions or students will be kept waiting.*

One other difficulty for teachers to maintain online discussions is large class size. EG7, for example, finds having to deal with questions on the Discussion Board time-consuming because of the large student numbers. In addition, when only one lecturer is involved in the online communication effort, it becomes taxing on that person. The ideal situation is to have more tutors involved in the activity. However, the fact is that it does
not work that way, as EG7 explains:

... for the discussion forum – much time is needed as I have a big class of about 1000 students. ...So even if you have a few percent of students out of the entire cohort asking questions – this is tens of questions. Imagine how much time is needed to reply all the questions – time consuming. ...In our subject – it is because I am the coordinator; the rest [of the tutors] will not be interested. Since they are not in-charge they tend not to be interested. ... Other tutors are not interested, although we did mention that if there are too many questions, they will have to step in – taking turns. But it doesn’t work.

On the other hand, a small group for online discussions is also not necessarily a workable idea. Vrasidas and McIsaac (1999a) have found that a very small group of participants will likely not lead to productive discussions. This view is echoed by informants in the study. NE4 and EG4, for instance, comment on how it is the same small sample of discussants in their Discussion Board forums that seem to benefit from the activity:

You see, you go and give a lecture, right? And you want to get a feel whether they’ve understood. What level is the understanding? Where is it not clear? That feel I don’t have with a big class. Through this [Discussion Board] I have it. But the sample I have is a very small sample. And normally these guys who interact are the bright fellas. So it’s not really helping the average fella. The bright guy is expanding his horizon, that’s what I think. And that way, it’s good. ... But the weaker ones are not coming to look at it. (EG4)

As Vrasidas and McIsaac (1999a) conclude, it appears that a critical mass is needed for more interactions. This is an area that merits more research.

It is for the above reasons that some teachers regard too much effort spent on getting students to contribute to the Discussion Board as a distraction to the main goal of teaching. According to EG10, for example, while teachers can try to get more learners to participate in online discussions, they should not be side-tracked by that attempt. Their main task, he maintains, is to lead learners to understanding (of concepts):

To get them in, you got to try. I post something there first to open up the discussion. ... A lot of effort on the teacher’s part is needed. I believe this kind of
effort is not the mainstream; it’s a side track. So if you spend 80% of effort trying to get students to discuss, you won’t achieve much in terms of your teaching. I mean, the objective of teaching is for them to understand, not for them to just come in and say something. For technical subjects it’s a little difficult. It’s not the [...] school; there the lecturer can post a scenario and students will have different perspectives. But with technical subject usually there is only one answer.

Hence, although the teacher’s effort to encourage learner participation is acknowledged, informants’ view is that teaching should be geared towards understanding.

Generally, it is thought that the benefits offered by ICT will not materialize if learners themselves do not appreciate them. As EG4 states, learner participation will follow with realisation of the benefits of the activity. For instance:

...you can’t force learning, you can’t force a person to be passionate about certain things, so it has to come from the student himself. (EG3)

This suggests that informants adopt an approach which place learners in the centre of the learning experience; in other words, learners are believed to benefit more from the learning experience when they contribute to it. This may seem to be a deviation from the transfer model, but it could be viewed as being complementary to the model. A possible explanation for this is that communication, simply defined, involves two or more people engaged in sending and receiving the intended meaning of a message, so that where one party is not thus engaged, communication breaks down. In other words, for online communication and interaction to take place, two parties (at least) must be involved in the process. Perhaps, the question in regard to the use of the Discussion Board is not whether or not to make learners participate in online discussion forums, but how to encourage participation. Some suggestions are offered here. Just as with face-to-face activities, for the online activity to succeed, clear objectives and instructions must be given; this applies whether the online activity is to be graded or not. Interestingly, in the study, only one informant (NE1) has commented on the need for clear rubrics to reflect a fair and valid way of assessing online discussions. Research has also shown that learning is linked to the quality and quantity of online discussions and the value that teachers place on it (Swan 2004) and that learners’ perceived relevance of online discussions
motivates them to contribute (Frazee 2003). Like learners, teachers can be introduced to ways of using the Discussion Board more effectively. They could take various actions to improve learner participation, just as they would in the face-to-face class. They could, for example, start the forum with easy questions or tasks to help learners become comfortable with the idea of posting messages, and they could provide frequent feedback. Whether the teacher’s feedback is to the individual or to the class, it is an important element in asynchronous communication. Teachers can also encourage online communication by modelling ‘expert behaviour and appropriate etiquette’ (Vrasidas & McIsaac 1999b, p.7). These include responding positively to good posts and creating an online environment that is safe and free of flaming and abuse.

Here, we see informants’ use of the shaping and growing metaphors in their conceptions of ICT as a facilitation tool. Through email and the Discussion Board, the teacher shapes learners’ thinking and understanding when they answer their queries individually or when they enter the discussion forum to correct misconceptions and provide the right answers. Learners who are shy to speak up in a face-to-face class may grow in confidence when they communicate with their teachers via email or when they voice their opinions on the Discussion Board. Here, as before, informants insist on learners’ participation and a right attitude for successful learning through these online communication channels.

In summary, this section on informants’ categories of ICT perceptions shows how ICT is perceived and used as a container, a place, a presentation tool and a communication facilitation tool. Firstly, as a container, ICT is used to store information and subject knowledge content, which reflects the transmission theory of teaching. However, informants see also various limitations with ICT that do not aid teaching and learning. The ICT-container metaphor highlights informants’ perception of the extent of help that ICT offers as well as its limitation. Informants’ main concern relates to learners’ behaviours in the learning process. Secondly, as a place, ICT functions as an organised space, resource room and dialogue platform for exploration and learning. The ICT-place metaphor is related to the beliefs in the importance of engaging learners in the thinking process and in discovery and exploration, all of which suggest learner action. Learners
visiting this place are deemed to have taken the first active step towards learning. In matching learners in this step, teachers take on various roles, namely as housekeeper, expert traveller and guide, and cook. However, the effectiveness of ICT as a platform for learning depends on the smooth functioning of the hardware. It also depends on the willingness of learners to contribute to the conversations that teachers hope will take place among them. Thirdly, ICT is seen as a presentation tool. The *ICT-presentation tool* metaphor relates to informants’ understanding of teaching as a transfer of information and as leading learners through the thinking process. As a presentation tool, ICT is used to achieve visual impact to aid understanding. However, informants feel that *Power point* presentations alone are insufficient to ensure effective communication of subject content. To them, providing step-by-step explanations to lead students through the thinking process and using an appropriate delivery style are more important in teaching. Finally, ICT is seen as a facilitation tool. The *ICT-facilitation tool* metaphor illustrates how ICT is used to shape thinking and aid communication and interaction between teachers and learners or among the community of learners. Email and the Discussion Board are acknowledged to be useful platforms to facilitate discussion and communication. In spite of this, there are problems with the use of these communication features. In line with their beliefs about face-to-face interaction and learner participation for learning to take place, informants maintain their preference for face-to-face interaction over online communication. In the case of the Discussion Board, they reiterate that learner participation is essential to successful online discussions. On the other hand, they acknowledge that teachers themselves should be committed to online communication if they want a similar level of involvement from learners. In addition, teachers can help learners, and themselves, have positive experiences with the Discussion Board by adopting best practices, so that learners feel comfortable and secure about sharing on this platform.

To conclude, this chapter has discussed informants’ beliefs about teaching and learning as well as shown how their perceptions and use of ICT in their teaching, and their view of their roles and responsibilities are closely related to their understandings of teaching and learning. It has also highlighted apparent tensions reflected in informants’ verbalisations.
of their beliefs and their teaching practice. Teachers’ understandings are but one aspect of the question of ICT uptake among informants in this study. Contextual conditions and the interaction of these with teacher beliefs also play a part in affecting teachers’ decisions to teach using ICT. This is dealt with in the next chapter.
CHAPTER 5
CONTEXTUAL VARIABLES AFFECTING USE OF ICT IN TEACHING

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CHAPTER 5
CONTEXTUAL VARIABLES AFFECTING USE OF ICT IN TEACHING

5.1 Introduction
As stated in chapter 1, teachers’ understandings are a contextual variable, among others, in studying teachers’ use of ICT. In this study, context is broadly defined to include aspects of the teaching environment, including the teacher, the learner, management, facilities, time constraints and workload.

Following the discussion in chapter 4 on teachers’ beliefs of teaching and learning and their perceptions and use of ICT affordances, this chapter examines how teachers’ uptake of ICT in their teaching is related to other variables in the instructional environment. The chapter, then, seeks to answer the final research question in the study:

- What factors influence these teachers’ use of ICT in teaching?

5.2 Contextual variables
The interview data show the other contextual variables affecting informants’ use of ICT to be time, institutional support, teacher attitude and learner attitude (Figure 2 from chapter 1). Each of these variables is discussed below.

![Diagram of Contextual Variables](image)

Figure 2: Contextual variables
5.2.1 Time

One common response among informants on support for ICT integration in teaching and learning concerns the availability of time for developing online work.

For a start, the online system may pose a challenge to teachers in terms of time spent waiting for the server to respond (NE6; NE8). For instance:

... sometimes the Internet connection is not that good. And that’s when you can get really frustrated when you’re trying to upload a document and after half an hour it still hasn’t gone up. It’s half an hour wasted. You don’t want to waste time with simple things. (NE6)

The attractions of online work include easy access and convenience. If teachers do not enjoy the benefit of time saved because of slow server response or other technical glitches, they are not likely to want to use the technology (Zhao & Frank 2003).

In addition, informants find that much time is needed to search for material on the Internet or to produce visually appealing material:

This is the very first thing I need to do – see the resources currently available. ... not very much in Internet because usually I have something in mind and it is quite hard to find something that matches my exact need. So this is time consuming. (EG5)

... you spend more time trying to embellish your materials, so I have given up doing that. (EG3)

I think the fundamental thing is not to use the same material that you use for your handout.... So I had to spend a lot of time in converting material. So for example in designing there is a rule that no scrolling. And I try to follow that rule very seriously. That means students shouldn’t have to scroll a document. (NE2)

A similar finding on conversion is reported in Selwood and Pilkington (2005), where ‘teachers identified the time involved in ICT take-up and systems conversion from paper to e-media as a cause of excessive workload’ (p.165). As seen in chapter 4, ICT is a store
of resources to teachers (section 4.3.1). However, it takes time to search for appropriate material through this huge store (EG1; EG6; NE6) or to learn to use specific software or programmes to create animations or technical drawings. This latter point could be related to the teacher’s technical expertise or technological knowledge in using ICT (EG2; NE3; NE9; NE8; NE11). For instance:

... when you have to do animation or Power point or dynamic type of animations, then that takes a lot of time. I tried but I find it is so time-consuming to learn the package myself. So if I have to rely on some multi-media expert to do it, I still have to convey my idea to him or her to help me. And that again takes time. So I find it very difficult. ...I, for one, will not want to spend so much time developing it. Because it’s so time-consuming and I can’t afford the time. (NE11)

Sometimes, too, the teacher’s desire to ‘perfect’ the delivery of the lesson is what makes the use of ICT time-consuming (EG3; NE2; NE3; NE5). This happens especially during pre-recordings of lectures:

...trying to record lectures is so artificial. And then you always feel that you’re not saying the right things and then you start repeating again and again. It’s really time-consuming. (EG3)

I was seated all the time, and I kept trying to use different voices, different pitches, different expressions. And the good thing is that you can erase it and you can re-do the whole thing if you don’t like it, whereas in real life, you can’t. ...But I know that it takes a lot of time and that one has to set aside a whole day or two in order to record just one lecture. (NE5)

Teachers need time to prepare for each lesson, like sourcing for materials, and to manage classroom communication, like monitoring contributions on the Discussion Board. However, as reported by informants, time constraints may prevent them from doing any, or more, online work. Several reasons are given for time constraints, namely, heavy workload, big class size and curriculum changes. Below are sample comments illustrating this:

For me, my load is so much I can’t spend the time on edventure, you know. So if one fella is teaching only one subject, maybe he can. But I don’t have the time.
Handling heavy teaching and administrative loads, monitoring a big class of learners on the Discussion Board and coping with curriculum changes, therefore, make demands on the teacher’s time. For ICT integration to succeed, faculty concerns about lack of time arising from these demands need to be addressed.

Another reason for teachers’ unwillingness to give up their time to ICT could be that they are not sufficiently convinced of the benefits in time saved after the initial work (Mehra & Mital 2007; Selwood & Pilkington 2005). Again, this could be due to frequent curriculum changes (as mentioned) or to staff movement across subjects, as EG4 describes below:

And here you teach two or three times and they move you. That’s not good. So if a person teaches for at least five or six times, then it’s okay. … Here they arbitrarily, within three years, they say, You change. (EG4)

In this case, perhaps, when teachers are given the time to respond to change and to explore technology (Turkmen 2006; Gillespie & Barr 2002), they will be more receptive to the idea of using ICT to manage curriculum changes and staff movement. ICT integration may also become more extensive.

There is, therefore, a relationship between time saved and preference of instructional pedagogy (Mehra & Mital 2007). However, a limitation in my study is that no information is available on how much time informants generally spend on the computer for the teaching functions mentioned above or how much time they save due to ICT, or what time management strategies they adopt (Lynch 2002). A longitudinal study might
show if there is a change in teachers’ perceptions of ICT use in their teaching and the reasons for the change. Neither is there data in my study on how ICT use might reduce teachers’ administrative load and paperwork and so save them time. If available, the information would supplement the finding in chapter 4 on ICT as a productivity tool (section 4.3.3).

5.2.2 Institutional support
The term institutional support used here refers to technical, management and pedagogical support.

5.2.2.1 Technical support
The first aspect of institutional support is technical support, a pre-determined category derived from the literature as an important contextual variable cited by teachers, which includes access to equipment (Dale, et al 2004) and ‘issues like installation, operation, maintenance, network administration and security’ (Sife, et al 2007, online).

Informants report that there are adequate facilities and technical help to support their ICT-based teaching. Below are sample comments:

I think technical assistance is there; that’s good. And another thing is the facilities. I mean, take for example these wonderful labs and the [university’s name] system of wireless networking. (NE2)

We have computer lab – they have technicians to help us. Whatever I need any help to upgrade or install software, I can seek their help. (EG6)

However, the potential problem with server breakdowns is a source of concern for informants who conduct online quizzes with large classes. This is voiced by EG1 and EG6.

Generally, informants’ level of satisfaction in this regard reinforces research findings that having the necessary equipment and ready access to technical resources is an important element in encouraging teachers’ use of ICT (Turkmen 2006; Gillespie & Barr 2002; Lynch 2002).
5.2.2.2 Management support

Informants also mention management attitude towards ICT adoption as a factor affecting their use of the technology. Management attitude is perceived as the kind and level of support it gives to faculty.

Interestingly, informants disagree on the nature and extent of management support they need. For instance, some informants feel that management should acknowledge teachers’ effort and use of ICT when they evaluate their performance; this, they believe, will encourage faculty uptake of ICT (similar findings are reported in Turkmen 2006 and Lynch 2002). For example:

*If more time is given and if the effort (in using ICT) is recognised, then yes. I think the only thing they recognise is the teaching feedback, not these things.* (EG7)

At the same time, other informants feel that ICT adoption should not be used as a criterion in teacher evaluation, as the following sample comment shows:

*I begin to see there is such a pressure. I always remind the CED [Centre for Educational Development] director – …you promised that such things will not happen, because your philosophy was not to use ICT as a carrot or a stick to influence teaching. As I mentioned, this is a very human business, with different styles (of learning and teaching). It doesn’t mean that if you use ICT you will be better than if you don’t use it. …We shouldn’t include the use of ICT as part of the evaluation criteria, because what that is saying is that if you use, that is good, and if you don’t use, that is not good. That is not correct. It must be appropriate to the style and the situation.* (EG9)

Both comments reflect the need for appropriate teacher evaluation criteria (Lynch 2002). Perhaps, they reflect also the view that ‘the effective use of technology requires a revolution in thinking about teaching and learning’ (Sife, et al 2007, online). For instance, informants believe that the examination-oriented system and large classes at the university are not conducive for learning (see sections 4.2.4 and 4.3.3.2). Moreover, these conditions are not within the teachers’ control to change. From this, I infer that these are partly the reasons for the limited way in which informants use ICT in their teaching.
Indeed, ICT use will be limited when, as Ehrmann says, ‘institutions fail to integrate ICTs into teaching and learning because they are using ICTs to replicate their traditional practices, content and control. Their plans appear to be driven by ICTs and not by pedagogical rationale and focus’ (Ehrmann 1995, cited in Sife, et al 2007, online).

This is echoed in EG9’s comment (above) about the nature of teaching and learning and about technology’s place in the classroom.

Another aspect of management attitude concerns the approach taken to encourage faculty uptake (see section 3.2). It is felt that management should allow teachers the space to use ICT as they wish, particularly in relation to curriculum practice. NE10, for example, comments on management’s insistence that teachers conduct face-to-face lectures and thus its ‘control’ over faculty use of lecture recordings:

The mindset of the management is not there to receive e-learning and allowing it to grow. If recording of lectures is to take place, it means I can play the video for repeated lectures but this is not allowed. ... I think the management approach to control has to change. (NE10)

As expressed explicitly by NE10, management has first to be convinced of the benefits that ICT offers teachers and learners so that it will give teachers the support they need to use the technology:

...the organisation [university] has not ‘bought in’ to the Blackboard; not that I expect more reward. They should give me time to do these things. Encourage the use of these things... Just like if I go into the class and don’t teach – does the university bother? Of course. But for e-learning Blackboard, they are not bothered by it. (NE10)

It seems from the above that informants think differently about the extent that they need management support. But they do indicate that unfavourable teaching conditions like large classes and emphasis on examinations as well as conventional staff evaluation criteria that do not acknowledge ICT adoption are matters that require management action before faculty would be encouraged to use ICT to a greater extent. Perhaps in this
regard management perspectives need to be investigated as well.

At the research site, although management initiated the use of ICT in teaching, it did not dictate to faculty that they have to use the technology. It would, therefore, be interesting to find out what management perceives to be the place of ICT in teaching and learning. This study has no information on this, unfortunately. Research has suggested that when management acknowledges barriers to ICT integration that faculty faces (see section 5.2.1) and addresses the issues, faculty uptake of ICT might increase (Dennis 2001). Hence, the question of management perception warrants further study.

5.2.2.3 Pedagogical support

On the matter of pedagogical support – the last aspect of institutional support – informants generally feel that they do need such support but also that it is currently inadequate. Research on successful online teaching suggests that faculty development is necessary, as the ‘human dimension’ (Dennis 2001, p.217) matters more than the technical aspect of online teaching. Faculty need to know how to ‘translate principles into action steps’ (ibid). In this process, demonstrations of Web-based courses and discussion of quality indicators (Dennis 2001) could be introduced.

Several informants think that CED should be the place they can go to for help on technological pedagogical matters, because it is equipped with a team of instructional designers whose main responsibility is to help teachers and learners enhance their teaching and learning experiences through ICT. To them, instructional designers should do more than introduce new software programmes (NE1; NE2; NE6). Specifically, it is thought they should be able to explain pedagogical principles behind each ICT application, such as use of the Discussion Board, as well as apply these principles to specific online teaching situations. Moreover, as peer support can be a positive force in encouraging ICT adoption (Dale, et al 2004), it is thought that CED could act as an intermediary to connect teachers who are facing the same difficulties and/or who have found a solution to similar problems. Hence, teachers may be more willing to explore ICT use because of the ‘impact of positive testimonial’ (Dennis 2001, p.213). NE2
suggests a broadening of CED’s role to include providing this contact point for faculty to network and share resources:

*This is CED’s role. There are lots of people who are working on their islands in (university’s name) and somebody has to bring them together. So CED’s role has to be perceived in a different way: they have to facilitate these things. They're doing it to some extent …but it has to be done more, rather than think, oh CED and CED’s trainers, they will teach everything to all at [university’s name]; it’s not going to work.* (NE2)

The sharing of resources and best practices among users is seen as a way to encourage faculty uptake (Turkmen 2006; Lynch 2002). The idea is to generate dialogue among faculty, to foster a community of practice (Dale, et al 2004) among them. This could also contribute to professional development.

However, informants generally agree that they do not have adequate support from CED. One reason for the lack of support could be that the team of instructional designers is under-staffed and overworked:

*And they’re very busy, so sometimes it’s very hard to meet up with them. ... I think they’re also overworked. There are only three or four of them.* (NE1)

As a result, teachers are left to themselves to work out the pedagogy for ICT use. Issues like classroom management, learning styles, learner autonomy and assessment reliability are also not raised for discussion and sharing of best practices:

*I don’t think [CED] can provide any other kind of assistance. It’s only the technical assistance, you know. The rest is up to the lecturer.* (NE3)

Without the necessary pedagogical support, teachers find it difficult to sustain their effort (NE1; NE6). This sample comment illustrates their problem:

*I feel that CED could be more personal, to give more help. I find that I’m searching within myself, you know, and I don’t know where to go to, and more could be done. ...But right now I feel there is a gap. ...Whatever thing they propose or give to us, it’s not customised to our needs. It’s there, you just use it. But how to use it, how effective is this, how to cater this to our students’ needs, that aspect is lost.* (NE1)
However, other informants (EG3; EG10; NE5; NE10) disagree that instructional designers are in a position to advise on pedagogy. To them, faculty are ‘supposed to be the experts in …teaching pedagogy’ (EG3). Similar comments include:

On the instructional design issue, I don’t think they can help much. Because these are high level technical subjects. The lecturer has to think what to do. (EG10)
CED is a support; it has no control over teachers. They do not know how a particular class is taught. Pedagogical aspect. No one has taught us the strategy of e-learning. (NE10)

If teaching with ICT is seen as a ‘new’ mode of teaching, then perhaps e-learning teaching strategies, as NE10 calls it, should be included in staff training programmes. This illustrates the need for teachers to develop their technological pedagogical knowledge (see section 2.4.2). As for the seminars and workshops given by CED as part of their staff development programme, informants have mixed reactions about them. While some acknowledge CED’s efforts to keep teachers informed and updated on the latest software that it has acquired for teaching and learning purposes, others feel that they don’t need such training sessions and that attending these sessions is wasting time. Below is a sample comment:

I’ve never attended CED’s courses and I don’t like to attend. I don’t see them as being a great advantage. I mean, if we have to use anything, I’m sure we have the ability; they can just give us some steps or some general guidelines and we’ll be able to do it ourselves. (EG8)

Informants who do regard CED’s courses as helpful also think that these seminars and workshops could be more effective with sustained training. One informant suggests that there should not be too long an interval between workshops that take the teacher from one level of a training course to the next:

[CED has] a basic Dreamweaver course, but you wait for twelve months before the intermediate one comes along. And in twelve months, you have forgotten what you learnt in the basic. You go to the intermediate class and it turns into a basic
course because no one remembers what they've been taught before. So I've told them they need to run more courses for the same people. (NE6)

Sustained training is an area that deserves consideration, especially when teachers are motivated to attend courses that they find relevant. In this way, staff training can become more effective (Gillespie & Barr 2002).

On the whole, informants think that there is good technical support in the institution. However, they think differently about the extent that they require management and pedagogical support in their efforts to integrate ICT in their teaching. The findings suggest that the university can do more in terms of institutional support to motivate faculty uptake of ICT.

5.2.3 Teacher attitude

The teacher’s attitude towards ICT may affect their readiness to use the technology (Selwood & Pilkington 2005). Teachers are likely to adopt ICT when they realise the benefits it brings to teaching and learning (Gillespie & Barr 2002). Teacher attitude includes elements like teachers’ technological knowledge, skills and confidence (Dale, et al 2004; Watson 2001). This section discusses informants’ attitude towards ICT in terms of their willingness to integrate new technology.

As seen in sections 5.2.1 and 5.2.2, time constraints and level of institutional support affect informants’ choice and extent of ICT integration in their teaching. However, informants NE1, NE2 and EG9 feel that openness towards new technology is a motivation for ICT integration. For instance, the teacher’s interest in computers and technology can itself become a push to use the technology:

*I suppose I want to do this because I’m interested in it. I take it as a hobby to create such things. ...I try to marry the two. This is my interest, this is my hobby; I need to prepare these lectures, so I had this idea, why don’t I create these little things and they can be used? (EG9)*

*... I like computer, you see ... it’s all this, the fun of it, learning new things, learning how to write instructions, how to create links. (NE1)*
To NE2, teachers’ commitment to integrate technology will eventually show result, so that it is not the teachers’ technical know-how that helps the teacher to use ICT but the teacher’s belief in ICT:

But because of the conviction you still stay with technology. So I think, have faith in technology, and loyalty … I don’t think I have lots of technical know-how. Many of my colleagues know Java and whatever programme, which I don’t know at all. But in terms of e-learning I have more materials on the web than them, because it’s about either they don’t have the direction, how they can use Java, or some of them are not convinced that it’s better; they still believe in the conventional method of teaching. So I think it’s their attitudes, perception and beliefs that’s more than technical know-how.

NE2 further suggests that with respect to ICT, a change in mindset is essential. He advises potential users to think of the web differently from the paper mode, in order to make use of its potential:

I think that’s the key, that is, if you want to exploit the power of the web then you have to get rid of the paper domain, come out of that mindset, so should not think of the A4 page but think of the screen size, and don’t think of the number of pages but think of bytes and bits. And it changes everything.

Like NE2, NE5 advocates an open mind towards ICT, so as to discover technology’s potential offerings:

I think the most important thing is to be open-minded, because when it comes to any kind of machine-related thing, you could have barriers. … I think it’s just a mental block. I think once you by-pass that, once you overcome that, and you are in the world of technology, it’s really like you are let loose in a toy shop and there’s so much you can do. (NE5)

NE5 enjoys trying out video-recording and watching herself on tape – ‘for fun’. Her use of the toy shop image is an interesting one. She compares her experiences at pre-recording lectures to ‘playing with a toy’ and her exploring the potentials of technology as being ‘let loose in a toy shop’. One might think that she does not have a serious view of technology; but this interpretation is not consistent with what she has shared about her views and use of ICT. I believe that she sees play as a way to discover and so learn about
the world of technology. The point is, this is how her open-mindedness towards technology has changed her attitude.

Informants like EG5, NE1 and NE2 also suggest that a positive attitude towards ICT will help teachers become more skilful and confident at ICT integration. NE1 provides an example of how the teacher is also a learner. When CED could not offer the help he needed to resolve problems on the use of the Discussion Board, he did not give up. Instead, he sought help from his colleagues and found that in ‘the process of doing’ (NE1), he had grown in knowledge of ICT use:

*I learn in the process of doing. And at the end of the day, you feel satisfied that from a non-specialist on online learning, you become someone who knows something about online learning…* (NE1)

NE1 further asserts that he does not feel ‘marginalised’ anymore, compared to when he was not using ICT while his engineering colleagues were, but he now has a sense of achievement gained from personally engaging in online work. Now, he finds the experience to be ‘very exciting, very rewarding’ as ‘it also enhance [sic] your own teaching experience’. This positive attitude comes, perhaps, from his perception of ICT affordances and the benefits he can derive from using the technology (see section 4.3). Getting support from one’s peers also helps (Dale, et al 2004; Gillespie & Barr 2002; Lynch 2002).

It is interesting that the majority of non-engineering faculty, who admit to not being technically minded, are more willing than their engineering counterparts to want to explore the new technology. On the other hand, engineering teachers, who are more comfortable around technology, use ICT for practical reasons:

*So I think the principle should be use it when it is necessary. If it is not necessary, it is good to avoid it.* (EG11)

*I don’t want to type to answer one question unless to reply to all, otherwise some may not get it. Furthermore, if I send to all, it may become a junk mail to some students. Sometimes, same question is being asked repeatedly, and then it is clearer and efficient to answer in class.* (EG6)
I do not see the need to do it [lecture recording]; but if I am asked to do it – I will think about it in terms of the extent of it. But if it becomes a policy then I have no choice but to do it. (EG5)

This could be due to engineering faculty’s perception that the learning of engineering subjects is done best in a particular way (see sections 4.2 and 4.3). It could also be due to workload, class size and time constraints (see section 5.2.1). However, this does not mean that the non-engineering teachers do not face the same time and workload constraints. In their case, they seem to be motivated by the need to be in the mainstream and to ‘keep up with the times’ (NE5):

I felt that as a language teacher I would be marginalised if I don’t use this kind of technology... (NE1)

Actually, I felt I just had to keep up with the times. There was no choice, really. NTU became a paper-less kind of office, and all circulars and notices were being sent via email. (NE5)

But not all non-engineering informants feel positively about ICT although they also acknowledge the benefits of using the technology. The fear of being replaced by the computer is an obstacle to faculty integration of ICT (Li 2007). NE11 expresses this thought:

There is a lot of reluctance among colleagues to do a good set of ICT-based instructional material... if you do it so well, people do not need your service as lecturers. ... At the moment, all of us are probably still unsure. Am I going to put myself out of a job? (NE11)

On this matter of teachers becoming redundant, other informants offer a different view. As seen in chapter 4, informants generally believe that the teacher and face-to-face teaching are irreplaceable. They feel, therefore, that the teacher has nothing to fear from adopting technology:

I remember when the computer entered language learning, the first time people got so worried it’s going to take jobs away. It still hasn’t happened. It’s impossible. I mean, you can help, you can give them more tools, you can give them lots of reference material, you can give more exercises online, but no one’s
really replaced the teacher yet, not as far as I know. No teacher has yet lost his or her job because of computers. (NE6)

I think the teacher can add value to the learning. It doesn’t mean we can be replaced by the computer. (EG11)

To assure faculty that the computer is not a threat, an alternative view could be taken – that technology supports, and not replaces, the teacher (Means, et al 2003). For faculty to want to develop effective ICT-based teaching skills, they need to see that delivering quality ICT-based lessons is a marketable quality. They need to see that online materials, particularly when they are pre-packaged, do not replace the teacher but the lecture and the textbook. As importantly, they need to realise that when they adopt ICT, their role, and that of their learners, may change, as research has shown – from lead actor to director, from knowledge-transmitter to feedback-giver, interaction-facilitator and moderator (Liu, et al 2005; Lynch 2002; McDonald & Reushle 2002; Paris 2001; Noss & Pachler 1999).

5.2.4 Learner attitude

Faculty’s perceptions of learner attitude towards learning in general and online learning in particular also affect the pedagogical choices they make. This discussion of learner attitude rests entirely on informants’ perceptions of their learners as no data was gathered from learners. Although the issue of learner attitude has been discussed in chapter 4, it is included here to emphasise its effect on teachers’ choice.

Informants seem to think that learner attitude towards online learning reflects their attitude towards learning in general. This has implications regarding the teaching strategies and approaches teachers think will work with their learners. A common learner attitude reported by informants is the examination-oriented mentality (see sections 4.2.4 and 4.3.3.2), where learners focus on good grades rather than the learning process or where they wait for the teacher’s answers rather than work out the solution for themselves. Such learner behaviour, however, could be a sign of strategic learning (Stansfield, et al 2004), but none of the informants acknowledged it as such. The belief that the learner must want to learn before the teacher can do their part is evident in
several engineering informants’ comments on it, like EG3’s reference to the Confucian saying that the teacher will appear only when the student is ready and EG4’s remark about wasted effort if the horse brought to water would not drink (see section 4.2.3). The two sample comments below illustrate teachers’ thinking about poor learner attitude adversely affecting learning:

Once students know they can view later, they’ll say, I’ll view later. And then they never view. (NE3)

For the good students, they attend lectures and tutorials because they want to learn. I think the easiest way is to attend lectures and understand the information. But for the not-so-good students – I’m talking about attitude – probably they would prefer to have material posted online. They may think they can access anytime they want but I don’t know whether they do that or not. (EG10)

Informants also associate learner attitude with the calibre of the learners, which in turn seems to predict if ICT use in teaching will be successful, as NE3’s comment shows:

You see, in MIT and all that, they [teach online]. And because they do that, universities like Singapore want to follow. I think they forget the students there are top quality. They choose the best students from the whole world. And we don’t. Our students, I would say, maybe are one-third good and two-thirds, actually average or even below average. So in that sense, [online teaching] may not work very well. (NE3)

Research on online learning has shown that for learners to be successful, they need ‘to be highly motivated and self-disciplined with great persistence and commitment’ (Li & Atkins 2005, p.55). What this suggests is that online learning is not for everyone (just as face-to-face instruction is not for everyone). Hence, teachers should be aware of learners’ needs and adapt online pedagogy to suit their learners’ learning styles.

The following section examines the impact of ICT use on pedagogy in the context of the current teaching environment at the university. This is done through looking at the interactions of ICT use and the variables discussed – time, institutional support, teacher
5.3 Impact on pedagogy

Knowing what we know about informants’ beliefs about teaching and learning, their perceptions of ICT affordances and the context in which teaching and learning take place, the next step is to consider how these variables relate to each other to affect teaching so that the teacher is ready, willing, able to teach and learn, and is a member of the professional community (Fisher, et al. 2006; Shulman & Shulman 2004; Banks, et al 1999).

Firstly, on the dimensions of teachers’ ability to teach and learn and their readiness to integrate ICT in teaching, we consider teacher knowledge and learning, as these affect teachers’ thinking about teaching approaches (McCormick & Scrimshaw 2001). Here, we examine how the various aspects of informants’ knowledge and learning interact to influence their practice. Informants’ content knowledge is not considered in this discussion as I do not consider myself qualified to evaluate my colleagues’ knowledge of the specialised areas that they teach. But from informants’ answers, we may deduce their technological knowledge, pedagogical knowledge and technological pedagogical knowledge. Informants’ technological knowledge and pedagogical knowledge appear to correspond to some extent with each other (see section 4.3). In addition to this are two other elements: their strong belief that the teacher is essential and irreplaceable in the learning process and their experience (and hence knowledge) of their students as apathetic, surface learners. Together, these combine to render a possible reason for informants, especially engineering faculty, adopting lower-order approaches to teaching (Watkins & Mortimore 1999). In other words, ICT is used mainly to replicate traditional methods; it is also used as an efficiency aid and an extension device (McCormick & Scrimshaw 2001). This suggests that informants have limited technological pedagogical knowledge for them to use ICT in more creative ways. It also suggests that teachers’ technological pedagogical knowledge is affected by context. Teachers’ readiness and ability to integrate ICT more fully in their teaching are thus limited. Since teachers are learners too, when their technological pedagogical knowledge is developed in the process...
of their learning, they could be better prepared as ICT adopters. This form of help toward teacher learning could be offered by CED, which currently is perceived as lacking in this function.

Next, on the dimension of willingness, we consider teaching purposes, goals and expectations as well as contextual variables. The findings show that informants’ reasons for using ICT are varied: from compliance to a top-down directive, that is, using ICT with big classes (especially lectures), to the desire, especially in non-engineering teachers, to keep up with their peers, to a continuation of current practice of using ICT. Different kinds of motivation influence teachers’ efforts to engage ICT in pedagogy (Mouza 2005). Their goals, seen from their beliefs about their responsibilities as teachers, are also varied. The closer the match between purpose and goal, the less resistant the teacher is to using technology and the stronger the sense of control and ‘ownership’ (Sikes 1992, p.49). It would seem, then, that the challenge for teachers is to find that fit between teaching purposes and goals for using ICT. At the same time, management should make clear to teachers its goals and expectations in introducing ICT into the curriculum, just as it needs to understand teachers’ reasons for using ICT (Sikes 1992). In other words, both parties need to be clear about their goals and expectations with regard to using ICT in teaching. Again, the closer the match between the two, the more willing teachers will be to adopt technology. Besides considering the fit between purposes, goals and expectations, we examine how conditions in the teaching and learning environment could bring about change in practice, as contextual factors ‘influence the purpose, pattern and pace of activities’ (Loveless, et al 2001, p.71). These variables affect each other in various ways; furthermore, when there is competition for the same item (Zhao & Frank 2003) or when variables clash with teaching goals, tensions arise. For instance, a big challenge for informants is time demands. Since time is a resource and management is the provider of resources, the implication is that management support is needed to ease this tension. Allowing teachers time to explore the technology could motivate them to engage with ICT more frequently and in more ways than currently practised without feeling that ICT use is additional workload. It is possible that informants adopt lower-order approaches to teaching as a coping strategy in view of contextual constraints. Also,
teachers’ technological pedagogical knowledge needs to be developed, as mentioned, so that teachers would feel more confident about exploring and using ICT meaningfully in large classes and when confronted with learner apathy. My findings show that ICT is not used in informants’ practice to a large extent, not because teachers are not willing to try something new (informants’ years of experience with ICT use range from three to eight years), but most likely because of their perceptions about learners’ attitude, their own limited technological pedagogical knowledge and other contextual conditions. For change in ICT use to take place, teachers’ views of knowledge and their personal constructs, of which their beliefs and prior teaching experience are a part, must be considered (McCormick & Scrimshaw 2001). As mentioned, poor learner attitude is perceived as another major contextual variable (see section 5.2.4). In addition, the assessment system, which in this case is the examination, is not ICT-related; in fact, it is very much a paper-based activity. If we accept that learning performance increases when there is a close match between learning conditions and assessment conditions (Demetriadis, et al 2005), then it would not be reasonable to expect learners to be responsive to ICT in their study if they do not see how that may translate into assessment of their learning. When the institution implements large class teaching and paper-based examinations, it is inevitable that learners adopt a surface approach to learning. Hence, at the same time that teachers’ technological pedagogical knowledge needs to be developed, the curriculum needs to re-direct focus on learning (rather than good grades) – which would correspond with informants’ travelling and growing theories of teaching – and to take into account how learning and assessment conditions can be made more similar. Again, as teachers are generally not empowered to make such changes, management (at policy level) will have to initiate change.

Lastly, on the dimension of teachers as members of the professional community, we consider educational change in terms of technology in practice and the kinds of policy changes that may be needed. One marker of successful technology use may be the degree and types of computer use (Zhao & Frank 2003). However, it is ineffective to simply introduce technology as a solution (Barnett & Hallam 1999). Hence, the first thing to review is perhaps the training of teachers to use ICT for the tool’s sake. To ensure
success in their efforts to facilitate teacher learning with regard to technology, CED might need to re-think its approach, that is, to focus on pedagogy, not technology, and develop teachers’ technological pedagogical knowledge specific to the content areas that they teach (Harris, et al 2007). This way, their approach would be in line with the idea that ‘change must engage with fundamental views of learning, knowledge and pedagogy’ (McCormick & Scrimshaw 2001, p.54). ICT at the current level of use among informants cannot claim to be transformative in McCormick and Scrimshaw’s (2001) understanding of the term, as there is no evidence that informants conceive of their learners entering into a community of practice as ‘central’ (p.51) to their learning. We have seen that informants make decisions about how ICT can be used to help them fulfil teaching functions based on their conceptions of teaching and learning (see section 4.3). We have also seen that they adopt the ‘simple’ transfer and shaping theories of teaching most of the time. Enhancing teacher learning would help teachers harness the ‘developed’ travelling and growing theories of teaching (Fox 1983) to a greater extent. To further help teachers, CED could, as one informant suggests, form a network among faculty for sharing resources and knowledge about using technology. This way, teachers, too, could learn in a community of practice. The chances of the innovation being diffused among teachers are also greater with such interactions, as suggested by Zhao and Frank’s (2003) ecological metaphor. The next thing to consider is the changes that may be needed at policy level. Two aspects are considered here. The first relates to the learning environment. As Barnett and Hallam (1999) assert, for a pedagogical innovation to be effective, ‘the innovation will have to be aimed at raising awareness of and probably transforming the students’ learning environment’ (p.150). My findings show that this is what engineering informants think, too – that big classes make it impossible for the teacher to cater to individual students and that the examination-oriented system is not conducive to learning. Changes to student-teacher ratios and the assessment system, as mentioned, may need to be considered. The next aspect concerns staff evaluation. Acknowledging ICT integration efforts in staff’s teaching evaluation would be a clear indicate to teachers that there is value in spending time on ICT adoption. This entails management being clear about the nature of change that they envisage with the introduction of ICT into the curriculum (McCormick & Scrimshaw 2001) and
recognising the impact this introduction will have on teachers. One such impact is how teachers perceive their role being challenged by technology. Teachers who fear being replaced by the computer would resist ICT use. But if management could assure them that ICT plays a potentially complementary and not competitive role in the curriculum (Zhao & Frank 2003), then teachers may be more receptive to ICT as pedagogical innovation. It would help, too, that within the institution there be ‘a perspective that emphasises understanding teaching and learning’ (McCormick & Scrimshaw 2001, p.55). Also, if management would promote ‘an open-ended professional environment’ (Barnett & Hallam 1999, p.151), that is, to ‘reward staff for demonstrable interest and involvement in pedagogical innovation’ (ibid), and at the same time provide opportunities to explore and reflect on challenges with technology use, teachers may be more open to the idea of change. This has implications for the successful integration of ICT in pedagogy. One implication is that conditions in the environment are critical to the survival of the ‘invader’ (Zhao & Frank 2003, p.824). Another implication is that teachers as change agents must be prepared to accommodate change, with support from effective change management at policy level.

The interaction of variables discussed above highlights their influence on teaching practice – that teachers become not only knowledge builders, but also collaborators and reflexive practitioners (Fisher, et al 2006), aspects that are in line with the concept of ‘pedagogy’ (Banks, et al 1999).

In conclusion, this chapter has looked at four other variables besides understandings that influence informants’ decision to use ICT in their teaching: time, institutional support, teacher attitude and learner attitude. It has also discussed how teachers’ understandings of teaching and learning, their perceptions of ICT affordances and these variables all interact to affect teachers’ use of ICT in teaching. The research questions to this study have, to some extent, been answered. However, the study also raises questions of its own. For instance, what conclusions can be drawn from the discussions, what limitations are there in the study, what lessons can be drawn from the study and what can future studies in this area focus on? The next chapter attempts to answer these questions.
CHAPTER 6
CONCLUSION

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CHAPTER 6
CONCLUSION

This final chapter reviews the research purpose and design, and summarizes the key findings presented in the previous chapters. It also discusses implications of the findings and the contributions and limitations of the study before ending with suggestions for future research.

6.1 Review of research objective and research design

The research was undertaken in recognition of the potential of ICT for learning and teaching purposes and, at the same time, the different responses to ICT among engineering and non-engineering faculty at the university where I work. This was what motivated me to investigate my colleagues’ views of ICT and how they use ICT in their teaching.

The study examined teachers’ beliefs about teaching and learning and their understanding of ICT affordances. Also considered were the effects of contextual variables on teachers’ response to ICT. The objective was to explore the relationship between teachers’ use of ICT in their teaching, their understandings of ICT affordances and their understandings of teaching and learning. The research questions were:

- What are engineering and non-engineering teachers’ understandings of teaching and learning?
- What perceptions do these teachers have of the affordances of ICT?
- How do these teachers at the university use ICT in their teaching?
- What factors influence these teachers’ use of ICT in teaching?

The answers to these questions were sought through interviews and interview summaries, and through data analysis based on two complementary models of teaching and the theory of affordances. The two models of teaching were the theories of teaching by Fox (1983) and the orientations to teaching by Kember and Gow (1994). The informants’ lexical choices, including metaphors, were examined to derive meaning.
The data collection and analysis tools were found to be useful in getting informants’
views first-hand and in illustrating what the potential benefits and limitations of ICT are
and how my engineering and non-engineering colleagues view and use ICT in their
teaching. The research questions, too, prove to be appropriate questions for this study on
the teacher’s perspective, as the answers show how informants’ verbalisations of their
beliefs are related to their verbalisations of their teaching practice, including the use of
ICT. They also show that besides teacher beliefs, environmental and cultural factors need
to be examined too, for a more complete picture of teachers’ use of ICT. The findings are
potentially useful to the university to maximise the use of the learning management
system by both faculty and students.

6.2 Summary of findings
Several key findings emerge in answer to the research questions on teachers’ beliefs
about teaching and learning, their conceptions and use of ICT affordances, and the factors
influencing their use of ICT in their teaching. Also revealed are tensions arising from the
interaction between informants’ understandings and the use of ICT in their teaching.

6.2.1 Engineering and non-engineering teachers’ understandings of teaching and
learning
Informants’ understandings of teaching and learning at tertiary level can be understood in
terms of the delivery, shaping, travel and growing metaphors. It is found that the primary
theories of teaching espoused by the informants appear to be the transfer and shaping
theories (Fox’s (1983) ‘simple’ theories and correspondingly, Kember & Gow’s (1994)
knowledge transmission orientation). It is also found that both groups of informants hold
different beliefs simultaneously and that these beliefs are complementary to each other.
The first three categories of beliefs are found to be closely related to subject matter
teaching and learning, while the last category is found to be related to personal growth.
This suggests that informants’ main concern is with content matter rather than with
learners’ personal growth.
Firstly, both engineering and non-engineering informants stress face-to-face interaction in the delivery of subject content knowledge and information, which illustrates the transfer theory. Engineering teachers, in particular, claim that in face-to-face interaction, the physical presence of the teacher (the human element) allows for questions and answers and thus content learning takes place. To them, this kind of interaction between learners and teachers is a form of mental engagement. This may indicate the travelling theory of teaching and the constructivist approach to learning, but clearly at work is the transfer theory, evident through informants’ use of the word *deliver* to emphasise the importance of subject knowledge content and the role of the teacher as delivery person and knowledge provider. Informants also show they recognise the need for effective transfer through use of examples and illustrations, seen through their use of the baby food manufacturing analogy, a variant of the transfer theory.

Secondly, informants value thinking because it enables shaping of learners’ knowledge and skills at the hands of the expert; this highlights the shaping theory. Engineering informants maintain that a step-by-step explanation of abstract concepts leads to thinking, while none of the non-engineering informants verbalise this. This could be due to their different perceptions of the nature of their subject disciplines. Engineering teachers demonstrate the way to doing something, followed by setting exercises to reinforce the shaping of learners’ thinking. They also seem to view the teacher as the expert providing answers to questions. The learner, on the other hand, is like raw material for the expert to shape into a final product. However, these informants also value the right attitude towards learning, referring to how learners need to engage in thinking rather than simply wait for teachers’ answers. To them, learners (as travellers) must find their own way in the journey of learning. This emphasis on learner engagement suggests, again, the ‘developed’ travelling theory being adopted. However, it is found that the teacher remains in control of the learning path, thus showing the shaping theory at work and the role of the teacher as the expert.

Thirdly, informants believe that learning is a journey and that learners as novice travellers should be responsible for their own learning – through engaging in thinking, asking
questions, participating in discussions and doing assigned work. For example, both
groups of informants expect their learners to attempt tutorial questions before class.
Engineering informants expect learners to also complete course assignments. Clearly,
informants prefer their learners to be active participants than passive recipients of
information. However, among engineering teachers, especially, there appears to be a
tension between providing correct answers and promoting learner engagement.
Nevertheless, informants believe the responsibility for learning lies with the learners
while the teacher’s responsibility is to encourage learner participation, like a guide
prompting the novice traveller to explore the terrain.

Lastly, informants believe that learners should adopt the right attitude towards learning
and that their role is to help develop this attitude in learners. To them, poor learner
attitude, such as lack of participation or a strong focus on passing examinations, inhibits
the teachers’ efforts to prepare learners for life beyond the university. Through their
verbalisations, informants indicate a pastoral interest in their learners, which shows the
learning facilitation orientation to teaching. Informants believe that learner effort and
participation in learning are closely related to attitude, both of which must come from the
learner, while the teacher can provide opportunities to help the learner gain confidence
and grow as a person. The teacher, then, is like a supportive and caring friend as well as a
gardener tending to the needs of the garden (in this case, of human beings).

6.2.2 Teachers’ perceptions of ICT affordances
Next, in answer to the question about teachers’ perceptions of ICT affordances, the data
show that informants perceive ICT, which are mainly Power point and Blackboard,
primarily as a container, a place and a tool. These perceptions are derived from analyses
of the way they describe their use of ICT and their understandings of its affordances.
There is, however, no evidence to show these are the only conceptions informants have of
ICT affordances.

As a container, ICT functions as a storage space to facilitate such affordances as easy
access, transfer of subject knowledge content, interaction and self-paced learning. The
**ICT-container** metaphor loosely corresponds with the *delivery* metaphor of teaching as informants see the absence of face-to-face interaction as the key limitation of ICT in this case. The basic *Blackboard* features used by informants include *Announcements*, *Course Documents* and *Course Information*.

As a place, ICT allows self-paced learning and easy access to materials, and serves to engage learners in discussions to stimulate their thinking. The *ICT-place* metaphor corresponds with the *travel* metaphor of teaching although it also seems like the *shaping* metaphor in operation, for informants see the teacher as the expert who knows the way to the pre-determined destination. The course site and *Discussion Board* on *Blackboard* are the basic features perceived and used in this way. Here, the barriers to learning through ICT are system breakdown and the presence of non-contributing members.

Finally, as a tool, ICT functions in two main ways: to present information and to facilitate communication. As a presentation tool, ICT provides visual impact to gain audience attention and aid clarification of abstract concepts. The *ICT-presentation tool* metaphor corresponds with the *delivery* and *shaping* metaphors of teaching. The most common means of visual presentation include *Power point* slides, animation and video. However, smooth transfer of information seems to be the teachers’ responsibility, as informants stress the use of appropriate teaching strategies and delivery styles. Next, as a communication facilitation tool, ICT functions to link teachers and learners as a community where responses and feedback are shared. The *ICT-facilitation tool* metaphor corresponds with the *shaping* and *growing* metaphors of teaching. The *Blackboard* features for this aspect include electronic mail and *Discussion Board*. Here again, informants cite potential barriers to their use of online communication, such as reliance on the written medium, students’ demand for speedy replies from the teacher and lack of learner participation in discussion forums. A contentious issue among informants is the question of whether external motivation for learner participating in discussion forums should be provided.

Linked to informants’ understandings of teaching and learning as well as the perceived
ICT affordances is the matter of roles and responsibilities informants perceive they have when they use ICT in their teaching. The data show that informants see themselves as *knowledge provider*, *builder*, *architect*, *housekeeper*, *cook*, *expert traveller*, *guide*, *music conductor* and *story-teller*.

### 6.2.3 Use of ICT by engineering and non-engineering faculty

From the way informants verbalise their understandings of teaching and learning, it is apparent that they view ICT as playing a complementary role in their teaching. To them, face-to-face interaction and learner attitude are more important issues than what ICT can do for them. While informants recognise the ICT affordances of convenience, accessibility and availability to benefit learning and teaching, they maintain that the teacher cannot, and should not, be replaced by ICT and that ICT is but a tool for the teacher’s use. At the same time, while they espouse the transfer and shaping theories of teaching, which position the teacher as the authority on information and subject knowledge content, they also insist on the role of the learner in the learning experience. Specifically, they believe learners have to play an active part in their learning, particularly through reflecting on what they have heard and read, asking questions and participating in online discussions. To informants, these actions lead to learning, which they feel is the destination that they as teachers are responsible to lead learners to.

There appears to be a tension between informants’ beliefs of teaching and learning and their use of ICT affordances. On the one hand, informants seem to espouse the ‘simple’ theories of teaching as a one-way transfer of knowledge and a shaping of a product; on the other hand, they seem to hold the ‘developed’ theories of teaching that position the learner in the centre of the learning experience. However, from their verbalisations alone, we cannot conclude that they hold either only one or the other of teaching conceptions, or if they hold more than one conception. There is evidence, however, that contextual variables, such as the presence of face-to-face lectures and an examination-oriented education system, also affect informants’ use of ICT.
6.2.4 Factors influencing faculty’s use of ICT in teaching

Various factors are found to affect informants’ use of ICT. These are time, technical, management and pedagogical support, and teacher and learner attitudes.

First, time given to teachers to experiment and integrate technology into their classrooms is deemed necessary for successful use of ICT (Turkmen 2006; Watson 2001; Noss & Pachler 1999) but it is also one resource informants find they do not have.

Next, informants generally are satisfied with the technical support they get but they desire stronger management and pedagogical support. This highlights the point that ‘the power is not in the tool but in the community that can be brought together and the collective vision that they share for redefining classroom learning’ (Riel 1990, cited in Turkmen 2006, p.79). I see a necessity here for faculty, management and CED to collaborate to enhance online teaching and learning.

On the question of teacher attitude, non-engineering teachers show themselves to be more willing than their engineering counterparts to explore the new technology. It seems that motivation plays a big part in taking teachers into the world of technology. Firstly, a positive stance is helpful, followed by institutional support, specifically, management giving teachers time to explore opportunities offered by the technology, acknowledging staff involvement in ICT-based teaching, developing staff through sustained training, as well as allaying their fear of being replaced by the computer (see section 5.2.3). Research has suggested that teachers should be encouraged to see their role differently and to view ICT as a tool and not a competitor for their job (Sife, et al 2007, online; Meskill, et al 2002; Selinger 2001), as ‘there is no evidence to suggest that the introduction of technology will decrease the teacher’s role’ (Noss & Pachler 1999, p.206). This sense of job insecurity highlights, perhaps, ‘the need to focus on educators’ needs and situations’ (King 2002, p.284). I believe this is an area which management could address to encourage more extensive use of ICT among current adopters in this study. I also think that management should consider teacher attitude among non-adopters (although this group was not included in the current study) to understand and address their concerns.
Finally, on the matter of learner attitude (discussed more fully in chapter 4), the discussion rests solely on engineering and non-engineering informants’ perceptions of their learners. Both groups of informants generally do not have a favourable view of their learners’ attitude towards learning, which shows in learners’ emphasis on getting good grades and passing examinations and their relatively poor responses to discussion forums. Poor learner attitude is found to affect teachers’ ICT use.

The impact of ICT on teaching can be examined from the dimensions of pedagogy (Fisher, et al 2006; Banks, et al 1999), which reflect the extent to which a teacher is ready, willing, able to teach and learn, and is a member of the professional community. This is approached through examining the interactions of variables, that is, teachers’ understandings of teaching and learning, their perceptions of ICT affordances and the context in which teaching and learning take place. First, to enable readiness and ability to integrate ICT in teaching, teacher knowledge and learning must be considered. In particular, teachers’ technological pedagogical knowledge must be developed as this aspect of knowledge influences thinking about teaching approaches. Next, teachers will be less resistant to using ICT when they find a close match between their reason and goals for using ICT. To encourage willingness among teachers to use ICT in their teaching, management, too, needs to clarify its goals and expectations with regard to ICT in pedagogy. The closer the match between purpose, goals and expectations, the more willing teachers will be to use ICT. Contextual variables must also be considered, as conditions can affect change in practice. For example, management could support faculty in the use of ICT by giving them time to explore the challenges of technology and by acknowledging the value of their ICT integration efforts. It could also consider changes in the learning environment by making learning and assessment conditions more similar. Lastly, for teachers to function as members of the professional community, especially with the introduction of pedagogical innovations, they need to be prepared for educational change. Here, again, policy changes may need to be considered. These would be policies with regard to the curriculum, such as class sizes and the assessment system, as well as acknowledgment of staff’s technology integration efforts. When conditions in
the environment are conducive, ICT as an innovation is more likely to succeed.

6.3 Implications of findings
There are several implications arising from the findings.

Firstly, research into teacher understandings is potentially instructive in any attempt to understand teaching practice. Teacher beliefs, in particular, influence teaching practice (see, for example, Loveless 2003; Hativa & Goodyear 2002; Murphy 2000; Hannafin & Freeman 1995). And understanding teaching practice is helpful where implementing educational change is concerned (Fullan 2001; Watson 2001). The usefulness of the current study lies in its showcasing how teacher understandings are related to teaching practice. For instance, we see from the way informants in this study verbalise their use of ICT that they espouse primarily the transfer and shaping theories of teaching, that is, as a container and as a presentation tool. Moreover, as Wilson (2005) argues, ‘our methods, models, and theories are themselves carriers of value and perspectives’ (p.544). He questions if stakeholders in the use of ICT are using these tools appropriately. Informants’ responses indicate that they hold the same view.

Secondly, the findings indicate the appropriateness of Fox’s (1983) theories of teaching and Kember and Gow’s (1994) teaching orientations as well as the use of cognitive metaphors for studies on conceptions of teaching as they are applicable in delineating teaching beliefs among the informants. However, neither Fox’s nor Kember and Gow’s model discusses the possibility of a teacher holding dichotomizing views of teaching, which would have been helpful to explain the apparent tension between the informants’ teaching beliefs and their use of ICT.

Thirdly, the findings show the relevance of the theory of affordances in examining teacher knowledge of ICT benefits and limitations, identifying perceived ICT affordances among the informants, and illustrating that the mere presence of an ICT affordance does not mean teachers will make effective use of it (see chapter 4). Let’s take the Discussion Board in Blackboard as an example. This function is generally recognised as a
communication tool. In the case of discussion forums that are graded (which is possible in *Blackboard*), the teacher may want to know the number of contributions a student has made. However, the system is unable to provide this information. As a result, the teacher would have to manually track the threaded postings for this piece of information. When the teacher has many groups or large groups to track, this becomes potentially demanding work. Teachers who are unaware of this before using the forum for this purpose might become frustrated by the limitation. Hence, knowing the limitations could help teachers decide how they will use this platform. Perhaps, making an affordance explicit is needed, as this ‘will allow practitioners to make informed choices’ (Conole & Dyke 2004, cited in Fisher, et al 2006, p.20) about how they might use ICT. This has implications for staff development programmes in providing pedagogical support for online teaching. It seems, too, that teachers’ knowledge of ICT affordances is an area that merits more research.

Lastly, the study shows there are implications for practice and policy in the context of the university where the study was conducted and that of higher education in Singapore. As mentioned (see section 3.4), the study is relevant to anyone who sees the value of using ICT in their teaching. At the teacher’s level of change, teachers as change agents need to be adequately prepared for ICT as pedagogical innovation, especially in terms of their technological pedagogical knowledge. This knowledge interacts with their conceptions about teaching and learning, their perceptions of ICT affordances and other contextual variables to affect their practice (see section 5.3). At policy level, management, involvement with technology integration among faculty is deemed necessary. Management has the responsibility of ensuring a conducive teaching and learning environment. In relation to teaching, contextual variables have been found to influence teacher thinking and practice (for example, Loveless 2007; Borg 2006). Imposing change on teachers will not work, and neither will simply supplying necessary resources such as computer laboratories and technical help or implementing staff development programmes that are focussed on technology rather than pedagogy, and to expect the innovation to take effect from there on. In some cases, policies may have to change to create favourable teaching and learning conditions for successful ICT integration. The study shows, for instance, that poor learner attitude towards learning is a concern among informants. This
perhaps relates to the culture of learning (especially among Singaporean learners) in Singapore. Most institutions of learning in this country emphasize the pursuit of excellent academic results; the school ranking system by academic performance is testament to this. Another example is the strategy schools here adopt to improve their academic standing – they advise their students to give up English Literature as it is more difficult to achieve distinctions in this subject (Koh 2000). An explanation for the same pursuit at the university where my study took place may be the presence of large classes, an examination system and therefore keen competition for top positions in class. Moreover, overseas students, the majority of whom come from other parts of Asia, are quickly inducted into the system. It is not surprising, therefore, that learners are generally perceived to be concerned mainly about getting good grades and lacking the desire to know more than what is needed for passing examinations or to seek meaning and understanding. An implication for educators in higher education in Singapore would be to re-visit conceptions of teaching and learning. In particular, institutions should place more emphasis on promoting understanding, developing critical minds and, on the social aspect of learning, educating individuals for living and working with others in society. For now, with regard to the use of ICT in teaching and learning, both faculty and management in higher education should be aware of the culture of learning and manage their expectations of learners accordingly. This may also help management to understand some of the challenges faculty faces when teaching with ICT. Other examples of how management could more effectively support teachers’ ICT integration efforts include developing teacher knowledge and learning and introducing curriculum changes (see section 5.3). Management might also have more success with change implementation when they know teachers’ values and perspectives and understand the impact on teachers when new approaches or technology is introduced into their classrooms, ‘to see what is replaced, what is changed, and what is maintained’ (Zhao & Frank 2003, p.831). The study suggests, therefore, that management’s decision-making can be informed by considering teacher beliefs. The result may be a better chance at maximising the investment in pedagogical innovation, thereby closing the gap between the change management hopes to accomplish with the innovation and the reality reflected in teaching practice (Sikes 1992; see also section 1.2).
6.4 Contributions of study

The current study is significant in the following ways.

Firstly, although the study is situated in the college of engineering, it reveals not just engineering teachers’ perspectives but non-engineering teachers’ as well. In this respect, research into teacher understandings could be extended to faculty in other disciplines within the university. Further research could look at whether faculty from different disciplines hold different understandings of pedagogy using ICT (for an example, see John & Baggott la Velle 2004), and if they do, the extent that teaching practice is influenced by the nature of the knowledge of different disciplines.

Secondly, in showing teachers’ understandings regarding teaching and learning with ICT, this study has shown the influence teacher understandings can have on teaching practice and, in the context of educational change, the need to be aware of teacher understandings. On teaching with ICT, the study could help the education community better understand teachers’ perceptions of ICT and the challenges they face when using this technology. The study can also help management at the university in its efforts to encourage faculty use of ICT. For instance, the findings show that the impact of contextual factors on teaching practice should not be ignored. The environment and culture, such as expectations regarding teacher and learner roles, influence the decisions a teacher makes.

Thirdly, the study shows that reflecting (through verbalising thoughts) helps teachers become more aware of their own beliefs and practices and may lead to a change in thinking. As noted in chapter 2, reflection can be a tool for change. For example, NE3 realised from talking about face-to-face lectures in big lecture groups that students sitting at the back of a big lecture theatre will not be able to see the teacher’s facial expressions. This, to him, defeats the purpose of a face-to-face session (see chapter 4). He then assessed the value of online lectures more positively as the lecture recordings can show the teacher’s expressions and gestures, which, he thought, might enable students to be more engaged in their learning. Thus, the study suggests the need for teachers to be aware
of their own beliefs and of the influence beliefs can have on pedagogical preferences.

Fourthly, the study shows the need for personnel involved in staff development programmes to be equipped with knowledge about pedagogy. This means the support team should have both technological and pedagogical knowledge in order to really help teachers manage ICT innovation. This is reflected in NE10’s comment about this inadequacy among the support team and in the experience of NE1, who describes his frustration at CED’s inability to answer his questions about how to motivate his students to use the Discussion Board (see section 5.2.2.3).

Finally, the study may be useful to management considering programmes aimed at teacher development and teacher learning. The study suggests that such programmes should take into account the role of teacher beliefs. In other words, the starting point of staff development programmes should not be on changing or improving practice. Teacher development is not so much about seeking to change teachers’ beliefs. Rather, it is about working with what teachers already have and utilising that as the starting point to help them meaningfully manage change. This is in contrast to change imposed on teachers, which is likely to fail in the event of obstacles or a clash with policy. Understandably, changing beliefs is difficult, as the literature shows (for example, Pajares 1992; Nespor 1987). In spite of this, the reasons for teacher resistance to pedagogical innovations have to be identified. As mentioned (see section 2.2), understanding teacher beliefs is the first step to understanding how teachers view their work and what they go through in discharging their duties (Nespor 1987) before change can be successfully implemented.

### 6.5 Limitations of study

Some limitations are noted about the research design and the sample.
6.5.1 Research design

The current study uses only the interview and interview summaries as data collection tools. An additional tool might be the diary, which will allow informants to include information not covered in the interview questions. Alternatively, a longitudinal study might be more informative; if informants are willing to participate in such a study, case studies would provide in-depth investigations. Secondly, the metaphor analyses were done by one person, that is, me. This suggests limitations in theme and metaphor identification and in interpretation of meaning. The analyses could have benefited from the use of more checks (Cameron & Low 1999a). The use of second or third parties or the use of ‘complex identification procedures involving triangulation between the different groups’ (ibid, p.55) are possible solutions to address this limitation. An issue arising from this is the potential differences between informants’ verbalisations and their deeds. This could be addressed by investigating not just verbalisations of beliefs and verbalisations of ICT use, but also actual use of ICT, which can be done through observing informants’ behaviours to track their decisions on ICT use.

6.5.2 The sample

The study is not able to provide a bigger sample of text or data than its current sample. First, as mentioned in chapter 3, a limitation with the sampling is that teachers who were using ICT other than edventure might have been missed out, since CED did not have a record of these users. Next, the current sample size of 22 informants within the engineering schools forms a very small percentage of the total faculty strength. This sample also excludes teachers who were teaching Years 3 and 4 courses (see chapter 3). If time had permitted, more faculty members could have been invited to participate in the study. A truly random sample could also be used.

The study will have wider applicability both within and outside the institution if it had included faculty from schools other than the engineering schools. At the time of the study, these would include the schools of Business and Information and Communication. Similarly, more than one sample group could have been involved. One of these is the group of instructional designers from CED for their perspectives on faculty use of ICT.
Another group are the learners for their perspectives on what learning means to them and the use of ICT for learning. It may be that learner evaluation of the effectiveness of ICT use by their teachers could be informative for both teachers and staff development personnel. The study could potentially offer stronger evidence of the closeness of match between teachers’ and learners’ beliefs in the areas of teaching and learning and ICT use.

I recognise that there are limitations to this study, but I have considered the drawbacks and related ethical issues (see chapter 3). I believe the findings from this study add to our knowledge of what and how engineering and non-engineering teachers see ICT and its place in higher education.

6.6 Suggestions for future research
Below are suggestions for future studies, which relate to research design and other research questions.

6.6.1 Research design
As mentioned in section 6.5.1, various checks could have been used to strengthen the analyses of the data in the current study.

Future studies could include more stringent inter-coder checking on theme identification (see section 3.4) and the use of ‘concordance data as a methodological framework to identify metaphorical expressions, that is, linguistic metaphors’ (Deignan 1999, pp.180-185), where the areas of investigation would include syntax and semantic relations (ibid). In addition, the use of documentary material such as lesson materials or documents from CED (like announcements and posters) could also strengthen data triangulation. This is because documentary material may be used for verification purposes, or they may be valuable as data that have already been collected and waiting to be used (Johnson 1984). Documentary analysis could also be used to provide another angle to the research findings. In addition, a mini-case study or sub-sample of diaries could be used to triangulate and validate the data. And, as mentioned in section 6.5.2, learner perspectives could also be included in future investigations.
6.6.2 Other research questions

Other research areas and questions could be included to further our understanding of the topic.

First, my findings show that informants hold different teaching and learning beliefs simultaneously, and that these beliefs are complementary to each other (see section 4.2). Since a detailed study of the implications of this and of the different combinations of beliefs is beyond the scope of the current research, this could be an area for future investigation. For instance, it would be interesting to find out if teaching beliefs or orientations compete with each other, under what conditions this happens, what the nature of resulting tensions is and how tensions are resolved.

Next, related to the topic of teacher beliefs is the area of teacher knowledge, such as teachers’ technological knowledge and technological pedagogical content knowledge (see section 2.4.2). In online teaching and learning, it is useful to find out what new approaches are employed ‘which compensate for the limitations of technology and if professors make the effort to create and maintain the human touch of attentiveness to their students’ (University of Illinois 1999, cited in Brennan, et al 2001, p.26). In fact, ‘high quality online teaching is not just a matter of transferring class notes or a videotaped lecture to the Internet; new paradigms of content delivery are needed’ (ibid). Hence, it would be useful to investigate what other members of the professional community are doing to develop their knowledge and enhance their experience of teaching with ICT, such as the new approaches employed by faculty engaged in online teaching, the strength of professor-student and student-student online interactions, and the depth at which students engage in the material.

Another area for future research is on cultural perceptions. As my informants are mostly of Asian origin, it may be that they hold predominantly Asian perspectives about teaching and learning. Understanding the cultural dimension to their perspectives is one other area in which the study could be extended. As Albirini (2006) describes in the title
of his article, research on cultural perceptions may be ‘the missing element in the implementation of ICT in developing countries’. Therefore, future research in this area might investigate what cultural perceptions teachers hold regarding teaching and regarding their learners, and the role that cultural perceptions play in forming a teacher’s knowledge about teaching and learning involving ICT. A related question on the perceived position of the learner in the classroom (see chapter 2) could be about the kind of training learners need for autonomy in learning so that they could learn effectively through ICT.

Yet another area for future research relates to management’s role in introducing pedagogical innovation (see section 5.3). My study shows that even when they are using the innovation, teachers adopt lower-order approaches in their teaching or replicate traditional teaching methods. It could be that they use these as coping strategies in the face of contextual obstacles. The study also suggests that management might play a more supportive role. (Various ways were presented in section 6.3.) Future research could investigate what management’s perceptions are of the needs of teachers and students in their introduction of ICT into the curricula, what changes in beliefs and teaching strategies management expects of teachers, and whether the goals of the introduction of technology (leading to change) are clearly and specifically spelt out. In other words, what else can heads of schools and departments do to actively encourage pedagogical change (Fullan 2001)?

Related to management’s role in change introduction is the issue of teachers’ resistance to ICT adoption (see sections 2.5.3 and 5.3). As we have seen, teachers resist ICT innovation for various reasons, such as a lack of the necessary technological pedagogical knowledge, a mismatch between teaching goals and management expectations, and competition for the same resource, like time. My study did not include non-adopters but their views are certainly worth investigating. Future research might consider non-adopters’ conceptions of teaching and learning (as opposed to the current study’s focus on ICT adopters), their views of ICT affordances, their reasons for not adopting ICT in their teaching, and the way that management can incorporate non-adopters’ concerns in
their push for ICT use in teaching and learning.

With this final chapter, I have returned to my research objective and reviewed the findings to the research questions. My findings on teacher beliefs about teaching and learning have helped me better understand how engineering and non-engineering faculty at my institution do what they do in the classroom and with ICT. It seems to me that what is needed on the long road to ICT innovation in pedagogy are the willingness of teachers and learners to adopt ICT as well as management support to create optimal conditions for online teaching and learning. Teacher knowledge and beliefs about teaching and learning with ICT are certainly areas that merit further research to understand how teachers could utilize the opportunities afforded by ICT for teaching and learning.
INFORMATION AND COMMUNICATION TECHNOLOGY IN TEACHING:
SINGAPORE UNIVERSITY TEACHERS’ PERSPECTIVES

INTERVIEW

TOPIC ANNOUNCEMENT

I would like to talk with you about your teaching experiences with information and communication technology, or ICT. What I mean is how you have used ICT in your teaching. By ICT, I mean any software programme you use to engage your students, whether with software, or through the Internet or through Blackboard (edventure). It could also be the use of any of the functions in Blackboard. So, that’s what it is – talking about your ICT-based teaching experiences and what you think about using these technologies in your teaching.

Before we begin, I should make it clear that I will be making notes as we go along. There will be bits that I will miss, so if it’s okay with you, I’d like to record our conversation to help me recall our discussion. I also want to assure you that what we talk about here will be treated in confidence and used only as data in my research. And if you like, I am happy to share my findings with you when I complete the study.
INFORMATION AND COMMUNICATION TECHNOLOGY IN TEACHING:
SINGAPORE UNIVERSITY TEACHERS’ PERSPECTIVES

INTERVIEW SCHEDULE

Name of informant: ________________________________________
Contact details:  __________________________
Date of interview:  ______________

ISSUES AND QUESTIONS

Motivation
1. Let’s start with this: How long have you been using ICT in your teaching?
2. What ICT do you use most frequently in your teaching?
   (What software do you use most often in your lessons? Do you use edveNTUre?
    What functions do you use most often?)
3. What motivated you to use ICT?
   (How did you get started? Why did you decide to use ICT? What were your reasons
    for using ICT?)

Expected learning outcomes
4. Think of one lesson or course that you taught using ICT. In a typical online lesson,
   what were your students required to do?
5. How did you measure what your students gained in that lesson? Or how much they
   had gained?
   (How do you tell whether students understood what was going on in that lesson? Or
    how much they understood?)
Teaching experience with ICT

6. What did you do in setting up the lesson (or course) or in preparing the materials?
   (Prompt: How did you make sure that students would be able to achieve the lesson (or course) objectives?)

7. What was topmost in your mind when you were planning or preparing the online lesson (or course)?

Evaluation of online teaching

8. Were you, on the whole, happy with the outcome of the lesson (or course)?
   (Prompts: Why did the lesson (or course) go the way it did? What happened? Could something have been done differently?)

9. Why did you feel this way?

10. What is one aspect of online teaching that you are most pleased about?

11. What is one aspect that you are most unhappy about?

Assistance required

12. What type of assistance (e.g. technical; administrative; related to pedagogical issues) did you need when teaching online?

13. Can the school or CED do more to enhance your online teaching experience?

14. What can they do?

Online teaching vs. face-to-face teaching

15. To you, then, how does teaching with ICT compare with face-to-face (i.e. classroom) teaching?

16. Did you get a sense of whether your students preferred online or face-to-face teaching?

17. Why is that so?

18. What about you – Which do you prefer? Why?
Teacher roles

19. I’d like now to talk about your role as an online teacher. If you were to describe your role, what would it be?

(Prompt: It might help to think of a simile; e.g., it has been said that a friend is like a mirror, or a friend is like an anchor. What, then, is an online teacher? Think of it as filling in the blank: An online teacher is like a/an _____.)

20. Why is that so?

Summary of online teaching experience

21. This is the final question. Let’s say a colleague wants to use ICT in his or her teaching. He/She knows you do online teaching. If you were asked by this person what online teaching is about, what would say to him or her?

(Prompt: You might think of online teaching as an object or an activity. If you were to describe online teaching in this way, what would it be? Why do you say that?)

22. Is there anything I have not covered which you would like to share or clarify at this point?

Thank you very much for your time and for sharing. If I need to come back for clarification, is that okay?
# SUMMARY OF DATA COLLECTING PROCESS

## I. Pilot study (1 engineering; 1 non-engineering)

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<thead>
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<th>Length of interview</th>
<th>Summary verified</th>
<th>Remarks</th>
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## II. Actual study (11 engineering; 11 non-engineering)

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SAMPLE OF SUMMARY OF INTERVIEW

Name of informant (Date)

This summary is based on our conversation regarding your experience with using ICT in teaching. I hope to have accurately noted your feelings and opinions. If you think I have misread you in any way, please correct the relevant part(s) using a different colour. If you have additional comments, the final section (page 5) is for your use.

Thank you.

You have used ICT in your teaching for at least two years. You use edventure (Blackboard) most frequently, for communication with students. You started using edventure as faculty have been asked to use it; this was a top-down initiative.

The features you use most frequently are Announcements and Course Documents. Students are expected to download the sets of notes and to print them out themselves. You are aware that the choice to use and access edventure belongs to the instructors and students. In this particular subject that you teach, which is Engineers and Society, ICT is used comprehensively. You mentioned that almost everything is done through edventure, and the lectures are conducted through the computer; transparencies are not used anymore. These lecture slides are what students can find in Course Documents. Furthermore, the live lectures are video-recorded and posted on edventure. This has been going on for two years.

You find the use of ICT ‘convenient’ and ‘efficient’, but you realise there are also drawbacks, especially when used to teach a non-technical subject like Engineers and Society. In particular, you observe that attendance at the lectures has been affected ever since the video-recorded lectures are made available online. Another reason for the fall in attendance could be the fact that this is not a technical subject, which suggests that students do not take the subject seriously and may think that watching videos from home is good enough for them to handle the subject matter. You clarify that this affects the lectures only; tutorial attendance is not affected. In spite of this problem with lecture attendance, you think video-recording is a good idea for students to review lecture material, except that you think students do not actually do that. Every lecture is two hours long, and you suppose students procrastinate and end up not viewing any. You acknowledge they may not then have the time to view all the videos. The fall in attendance bothers the course instructors and messages are sent to students to encourage them to turn up for the next lecture.

In spite of the attendance problem, you think ICT is good for people who want to review the lecture. This is so especially for ‘good’, ‘hardworking’ and ‘conscientious’ students.
as a second viewing may enhance understanding. But for students who think they can save time by just attending to online lectures, you think in the end, these students learn less as the examination results did not seem to reflect that they were aware of the material covered in the online lectures. You feel use of ICT is a ‘two-edged sword’, useful for some and not for others.

If given a choice to use ICT or not, you stated that you might perhaps use it later, not now. The main reason is the need to convert all lecture notes into Power point slides. However you acknowledge that going through this process has helped you become familiar with the Power point software. And although you do not use transparencies these days, you are not sure whether Power point is a better aid than transparencies. On the whole, you are unsure of the effectiveness of ICT in teaching. However, you think the quality of students is an important factor to consider, as for example, MIT’s online courses are successful because they have top quality students there.

In a typical lesson of yours, students are expected to read the material for that lesson. But you find that as usual, students do not do that. They also have to answer the tutorial questions, which usually require them to have read from sources other than the essential texts. During tutorials, students do both oral and written work. Basically, they have to consider a social issue from different perspectives and to have a discussion on the issue in class. But all this is not conducted through edventure.

Of the other features in edventure, you use also the Discussion Board and email. You think the Discussion Board is a good feature although it is not used very often. Students usually ask questions related to how to approach a tutorial question, whether on the Discussion Board or directly to you. You do not restrict them on the means of communication to use. Although students do answer each other’s questions, that is not common; they usually wait for the lecturer’s answer. But when there is exchange of views among students, you think that is good.

You believe that in the online platform, there is no way to measure what students have learned or how much they have learned, unless it is to compare yearly results.

The lecture materials that you prepare are your own, except when you find an interesting, short video clip to post on edventure. These clips are not readily available. You will use a clip if it is short and is ‘convenient’ to use, meaning it does not need for relevant bits to be extracted. You do not really like to use these clips but you think use of other material might make the lectures interesting. This particular clip you mentioned having used was a short ministerial speech.

In preparing lecture material, topmost in your mind is making the lectures ‘clear and concise’. You will also ‘add a bit of highlighting’ to attract students’ attention. You think what is most important is the way a lecture is delivered. From your experience, you have found that students dislike mere reading; you have learnt to state the main points and ‘tell the whole story’, which is an easy thing to do in Engineers and Society. You attributed this to the fact that you know the subject well and you try to present it in an interesting
way. You tell them real-life experiences and stories to help students understand the theories. You have observed that students enjoy listening to stories. These stories are your own, that is, from your experiences, as well as from books. It is in this way that your lecture materials are different from the notes posted on edventure. You explained that including these stories in the online space would only create clutter; besides, students would only be reading the stories, and the impact that one can derive from the stories would not be there. You reiterated that while making the lecture notes easy to read, as with a good font size and highlighted points, is necessary, delivery is still the key concern. You asserted that a subject like Engineers and Society, especially, needs to have an interesting delivery or students will be bored, as the topics covered concern social issues such as engineers’ role in society and Singapore’s problems. You have learnt that it is not enough to explain the issues; it is better to illustrate the issues ‘from a layman’s point of view’. You supported this with positive feedback you received from your students regarding the telling of stories and recount of history. You tell them of interesting past events if you think that can help you in your teaching. You also use visual aids to help students’ understanding, for instance, you show them graphs and tables when you talk about the corruption index and engineering developments over the years.

You are, on the whole, happy with the use of ICT in your teaching. But you are not happy with it when it affects attendance. You find it is a dilemma, so that you can’t decide whether ICT should continue to be adopted. On the one hand, ICT can help understanding, when it functions as an additional ‘avenue’ for students to contact you and to get lecture notes. However, you cautioned that we have to be ‘a bit careful’ as it can be ‘subject to abuse’ and ‘it cuts both ways’. You reflected that what works in a good university may not necessarily work elsewhere, as the environment and situations are different. You agreed that the important question is how one uses technology rather than whether technology is efficient. You think, though, that there are probably more merits than shortcomings, although you could not say offhand what these are.

You needed technical assistance in the process of using ICT, like how to use edventure. You found that an easy task; just one session and you were able to work with Blackboard on your own. Help for you came from CED but mostly from your colleagues. Like these colleagues, you have attended some of CED’s courses on the use of edventure, but you did not use it right away and gradually you forgot how to go about it. But a colleague helped you revise what you had learnt. You also found Blackboard ‘user-friendly’. You think user-friendliness is very important for people to want to use Blackboard. In other words, if people have to go through many steps just to get one thing done, that will demotivate them from using it. You find that edventure is ‘not bad’. You suppose that is probably why it is widely used now, although in NTU, not many instructors use it. You can tell this from CED’s list of subjects that have a site on edventure. You think the relatively low take-up rate could be due to the ‘hassle’ of having to convert material to Power point and to upload that onto edventure. In particular, you referred to the time needed to get all this done. But of course, when one is familiar with edventure, time may not be a factor anymore. You mentioned that with a technical subject which you are teaching, you do not use edventure; for non-technical subjects, converting and uploading are ‘easy’. You explained that CED offers technical assistance; everything else is left to
the instructor.

You suggested that CED or the school could help enhance your teaching experience using ICT by clearly listing the operation procedures for the computer in the lecture theatres or labelling where the switches are. Also, perhaps the hotline for technical assistance could be available after office hours. This is crucial especially when technical problems arise during evening classes.

On how teaching with ICT compares with face-to-face teaching, you repeated that the recorded lectures that have been posted online allow students to learn if they would ‘take the trouble’ to view them.

If given a choice to go fully online, that is, with online lectures only and no face-to-face contact with students, you would not choose that. You expect that this would involve video-recording all your lectures, and doing that in the lecture theatre would be like lecturing to ‘a void’, ‘a vacuum’. And if the recording could be done in a room, you would do it only if it would save you time. Otherwise, it is important for you to be able to see students’ reactions while you are teaching so that you can ‘adjust’ your course accordingly, like adjusting your speed of delivery. You believe that this is something which the online lecturer cannot do; you think there is also no way the online lecturer can check students’ understanding or get feedback from them regarding problems they may have with particular sections of the lesson. Therefore, you do not think online teaching can replace face-to-face teaching.

Although you think students would not prefer a fully online lecture, you acknowledged that the online lecture may replace the face-to-face lecture for a big group of eight or nine hundred, especially as you believe that teaching to a big group is less effective than teaching to a class of fifty. You think the face-to-face medium is better for small groups. In the case of a big group, watching the lecturer from the back of the lecture theatre is very different from watching a video-taped lecture. You reflected that this could be the reason for the falling attendance rate at the lectures. In short, you believe it is important that students are able to see your facial expressions and body language. At the moment, recorded lectures do not show the lecturer’s face; you suggested this should be improved on by recording the lecturer’s expressions on video.

On your role as an instructor using ICT, you see yourself as a facilitator, as someone ‘facilitating understanding’. By this, you referred to the need to adjust to students’ pace of learning and level of understanding, to ensure that you ‘have the whole class with you’, that ‘you are taking them all along with you’. For instance, when preparing lecture notes, you put yourself in the students’ position. You have to decide what details you need to include and what to leave out for a two-hour lecture. You stated that when you have the time, you will think about these matters, but when you do not have time, you may not think much about them. You think this kind of decision-making is what a teacher does regardless of whether ICT is used or not.

You believe that ICT is more ‘visually impressive’ if used well and that it can hold
students’ attention better. The key, you think, is whether the instructor is skilful in using it. For instance, if ICT is used just to present some slides or to prepare a simple video, to you, then, it is no different from what transparencies do. But if used ‘properly’, it can enhance teaching. Although you would recommend the use of ICT, class size would be a determining factor. You reiterate that small classes would benefit from face-to-face sessions while big classes may be better served by online lessons. In spite of that, it still seems to you that the face-to-face medium is more effective than the online platform. You believe that even with student queries regarding an online lesson, there is no way for the instructor to know the extent of the difficulties that students may be having with that lesson. Therefore, it seems you prefer face-to-face sessions because they allow the instructor to have access to his or her students and to respond to their needs accordingly.

You reassert that at the end of the day, the instructor is ‘key’. You believe that a good lecturer ‘makes the world of difference’. ICT may make teaching less monotonous, but like transparencies, it is just a tool. The instructor must be ‘good’ and ‘responsible’. Technical support is necessary, but more than that, the instructor is the one who affects students’ reactions to the subject.

-- End of interview--

Additional comments
Appendix D

SAMPLE OF SUMMARY FEEDBACK

Finally, you state that for you, ICT is just a tool, for instance, for slide preparation. You maintain that there are advantages to using a tablet. You repeat that the instructor must have the means to show students the steps in writing. This is what a software program like Just Write Office [6] was you do. You believe that without writing, the lesson with ICT use is more projection and talk. But with the writing feature, you are able to engage students, to help them focus attention rather than just look at the slides while listening to you. You assert that when instructors are able to write as they teach, they become more energetic as well. You are willing to share with colleagues this idea of using the tablet.

--- End of interview ---

Additional comments

The piece of equipment I use in my lectures is a simple “tablet” connected to a USB port of an ordinary notebook computer. A Tablet PC is a special (and expensive) notebook computer with a screen that is specially designed for one to write on using “digital ink”.
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