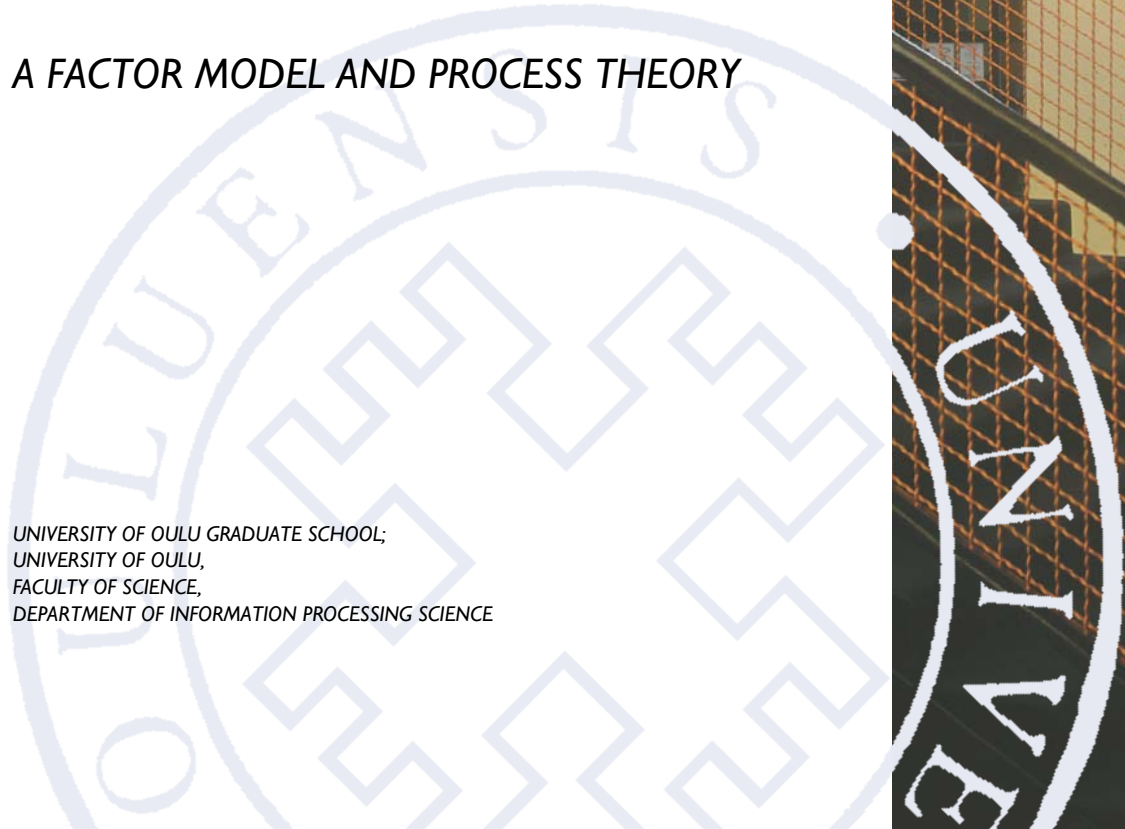*Katja Leiviskä*

WHY INFORMATION SYSTEMS AND SOFTWARE ENGINEERING STUDENTS ENTER AND LEAVE THEIR STUDY PROGRAMME

A FACTOR MODEL AND PROCESS THEORY

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A factor model and process theory

Abstract

The issues that influence students' decisions to enter and drop out of university IT programmes are a major concern for universities worldwide. The low enrolment of women in IT studies has received considerable attention from the academic world. This doctoral thesis aims to contribute to alleviating these problems.

The primary contribution of this thesis is the laying out of implications for theory and practice in relation to the high student dropout rates in IT programmes. To elucidate this phenomenon, previous research on student dropout rates has advanced various factor models that explain or predict the dropout tendencies of university students. Although these studies enhance our understanding of the reasons students drop out of Computer Science (CS) courses, university studies, and online learning programmes, I found no research that describes the process that causes students to drop out of university. Such a process viewpoint is important given that students' decision to abandon a programme is not a static phenomenon, but a complex and dynamic occurrence. This phenomenon develops through a number of stages. As an initial step in filling the gap in research, I analysed qualitative interviews that centred on 40 Information Systems and Software Engineering (IS/SE) students who dropped out of the programme. I also conducted a second round of interviews with nine of these students to collect more accurate information on their motivation and emotions at the time they decided to drop out. On the basis of the interviews, I inductively developed a process theory approach, drawing from van de Ven (1992) and van de Ven and Poole (1995). The proposed process theory explains the trajectories that prompt university students to abandon the IS/SE programme. It also explains the course that the dropout process takes after decisions have been made. The findings reveal potential research directions in student dropout, and provide new insights into the reasons students abandon IS/SE studies. On the basis of the results, I formulate strategies for preventing student dropout.

The second contribution of this thesis is that it sheds light on the factors that influence students' decision to enter IT programmes. Previous studies have been conducted in the US, Canada, and Australia, but only a few have been devoted to Europe. Not much research has been done on the Scandinavian context. To address this problem, I analysed the qualitative responses of 64 female sixth form students regarding their attitudes towards studying IT disciplines, including CS, IS, and SE. We also examined their perspectives on IT as a profession. This study extends the literature by offering new information on why females shun CS or IS careers and what attitudes they hold about these disciplines.

Keywords: dropout, information technology

Leiviskä, Katja, Miksi tietojenkäsittelytieteiden (IS/SE) opiskelijat aloittavat ja keskeyttävät opintonsa. Faktorimalli ja prosessiteoria

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Tiivistelmä

Asiat, jotka vaikuttavat IT-alan (tietojenkäsittelytieteet) opintoihin hakeutumiseen ja opintojen keskeyttämiseen, ovat keskeinen kiinnostuksen kohde yliopistoissa ympäri maailman. Erityisesti tyttöjen ja naisten vähäinen osuus tietojenkäsittelytieteiden opinnoissa on koettu akateemisessa maailmassa ongelmaksi. Tämän väitöskirjan tavoitteena on vastata em. tutkimusongelmiin.

Väitöskirjan ensisijaisena kontribuutiona on esittää implikaatiota, jotka liittyvät teoriaan ja käytäntöön suhteessa opintojen keskeyttämisen korkeisiin määriin IT koulutusohjelmissa. Tähän ilmiöön liittyen on aiemmassa tutkimuksessa esitetty erilaisia faktorimalleja, joilla on pyritty selittämään ja ennakoimaan opintojen keskeyttämistä yliopisto-opiskelijoiden keskuudessa. Vaikka nämä tutkimukset lisäävät ymmärrystämme teoreettisen tietojenkäsittelytieteen kurssien keskeyttämisestä, yliopisto-opinnoista ja verkko-opiskelusta, aiempi tutkimus ei ole tarjonnut kuvausta opintojen keskeyttämisen prosessista kokonaisuudessaan.

Kyseinen prosessinäkökulma on tärkeä, koska se osoittaa, ettei opintojen keskeyttämispäätös ole staattinen. Itse asiassa kyseessä on dynaaminen ja monimuotoinen ilmiö, joka etenee monen eri vaiheen kautta. Täyttääkseni tämän puutteen tutkimuskentässä olen haastatellut 40 tietojenkäsittelytieteiden opiskelun keskeyttänyttä opiskelijaa. Haastattelin heistä yhdeksää vielä uudelleen saadakseni tarkempaa tietoa opiskelijan motivaation tilasta ja tunteista päätöksentekohetkellä. Haastatteluiden perusteella kehitin induktiivisesti prosessiteorian, joka perustuu van de Venin (1992) ja van de Venin & Poolen (1995) esittämiin ehtoihin. Prosessiteoria selittää opintojen keskeyttämispäätöksen etenemisen kokonaisuudessaan. Tutkimuksen tuloksilla on vaikutuksia niin tutkimukseen kuin käytäntöönkin, sillä se tarjoaa uusia näkökulmia ja tutkimussuuntauksia liittyen opintojen keskeyttämiseen ja siihen, kuinka keskeyttämistä voidaan ehkäistä.

Väitöskirjan toisena kontribuutiona on täsmentää niitä syitä, jotka vaikuttavat IT-alan opintoihin hakeutumiseen. Ilmiötä on tutkittu Yhdysvalloissa, Kanadassa ja Australiassa, mutta vain vähän Euroopassa ja Pohjoismaissa. Tämä tutkimus vastaa kyseiseen ongelmaan, sillä siinä on selvitetty 64 lukiolaistytön asenteita IT-alan (teoreettinen tietojenkäsittelytiede, tietojärjestelmätiede, ohjelmistotuotanto) opintoja kohtaan. Selvitimme myös heidän suhtautumistaan IT-alaan ammattina. Tutkimus toi uutta tietoa myös siitä, miksi tytöt eivät halua lähteä opiskelemaan tietojenkäsittelytieteiden ammattilaisiksi.

Asiasanat: keskeyttäminen, tietojenkäsittelytieteet

Acknowledgements

Contents

1   Introduction

The factors that influence students' decisions to enter and drop out of IT programmes are a major concern in the academic world. This thesis aims to extend the literature on these issues. Student dropout is a crucial component in the efficiency evaluation and funding of universities (Belloc *et al.* 2010). Although previously proposed models that explain students' reasons for dropping out have contributed to our understanding of the determinants of such behaviour, such representations lack two important perspectives. First, none of the models describe the entire dropout process from a student's perspective. These models usually only attempt to predict the reasons students drop out, and researchers formulate assumptions on these reasons without comprehensively probing into students' points of view. The reasons students abandon their programmes have been extensively studied. Examples include research on student dropout from Computer Science and Informatics courses (Kinnunen & Malmi 2006, Xenos *et al.* 2002, Howles 2009); studies on high education students in Spain (Lassibille & Gomez 2008, Araque 2009), Germany (Georg 2009), Italy (Pietro & Cutillo 2008, Belloc 2010), the US (McGrath Cohoon 2003, Allen *et al.* 2008, Porchea 2010), Australia (Willcoxson 2010), the United Kingdom (Bennett 2003), and Korea (Shin & Kim 1999); and investigations on online learning (Park & Choi 2009, Willging & Johnson, 2004, Yukselturk & Inan 2006). Despite these efforts, no study presents the process that causes students to drop out of university. Such a process view is important given that students' decision to drop out is not a static phenomenon, but a complex and dynamic occurrence.

Second, making a difference in student dropout rates necessitates a clear understanding of why dropout persists. I advance this goal by refraining from making assumptions beforehand, and instead focus on obtaining information directly from the students recruited for the current research. Early research models, such as Tinto's model (1975), provide assumptions on how students reach dropout decisions but the framework does not enable the validation of such assumptions through direct interactions with study subjects (Brunsden *et al.* 2000). This approach limits the applicability of results given the lack of reliability validation. The present study aims to obtain in-depth information on the reasons students abandon Information Systems and Software Engineering (IS/SE) programmes. My process model provides succinct answers to the continuously arising questions regarding dropout issues. I anticipate such information to be facilitative of preventing student dropout.

The other theme of this thesis is that Information technology (IT) education and the industry continue to be male dominated and less women are entering into computing studies (Greenhill *et al.* 1997). Women are still under-represented in the IT workforce (Quesenberry *et al.* 2006). The low amount of women in the IT workforce is causing global concern, for example in the United States a drop in the number of women in the IT workforce has been observed between 1996 and 2002 (representation of American women in high-tech employment fell from 41% to 34.9%). In Finland, the number of women in the IT workforce has slightly decreased from earlier times. The percentage of women in the IT workforce in Finland was about 29 percent in 2011 (Tietotekniikan liitto 2011). There is shortage of women IT workers and we need to understand the reason for low enrolment of women in Computer Science (CS) and IS/SE programmes. Although research has been carried out in European countries such as Ireland (Trauth 1995), Germany (Oechtering & Behnke 1995), Greece (Papastergiou 2008), and the UK (French & Richardson 2005, Adam *et al.* 2004, 2006), only a few (Hiltunen 2009, Robertson *et al.* 2001) focused on Scandinavian countries. This deficiency motivates the research community to explore women's attitudes and perspectives towards the IT field as a discipline and as a profession. My findings reveal certain misconceptions.

The manner by which students view a given field of study is important because perceptions affect dropout decisions, particularly when individuals lack a clear understanding of a programme or when expectations do not correspond with actual experiences. Determining ways to develop accurate views of a field, particularly of the IT discipline, is essential. Some women have a narrow conception of computing-related work, discouraging them from pursuing CS and IS/SE programmes (Clarke & Teague 1996). Exploring personal viewpoints paves the way for examining the implications of student behaviour. These implications can be useful in improving the understanding of potential enrolees regarding IT programmes, and in elucidating the determinants of dropout rates. For example, role models are a considerable influence on women's behaviour (Moorman & Johnson 2003) because the guidance that they provide has a positive effect on how women view computer scientists. With appropriate mentoring, students regard IT professionals as regular people, and not as eccentrics who are excessively preoccupied with technical matters (Graham & Latulipe 2003).

The research process for this thesis is characterised by two perspectives: the first is the hermeneutics view, and the second is the qualitative and interpretive perspective. This study is grounded on hermeneutics, in terms of Klein & Myers

(1999), because it is a theoretical inquiry that enables understanding and compelling explanations via the interpretation of parts of a whole (Webb 1997). Qualitative content analysis was employed as the research method in the first phase of the study (women's essays n = 64). Grounded theory was used in the second phase (interviews n = 40, n = 9 for the second round). The first phase was introduced in Leiviskä and Siponen (2006) and Leiviskä and Siponen (2010).

Two reasons justify the use of qualitative content analysis. First, this study aims to understand the actual viewpoints of women regarding IT. Content analysis enables the establishment of a theory-creating research setting. This study explores women's attitudes without any particular theory as its focus, and aims to contextualise original attitudes as they emerge from the essays written by the participants. Second, content analysis is a practical approach to abstracting key knowledge from information-rich material without losing any important components. That is, effective content analysis condenses substantial volumes of significant information and highlights key messages in a brief and concise manner (Strauss & Corbin 1990: 22).

Manwhile, grounded theory 'is a qualitative research method that uses a systematic set of procedures to develop an inductively derived grounded theory about phenomenon' (Strauss & Corbin 1990: 24). As Orlikowski (1993) stated, three factors justify the use of grounded theory: it is useful in areas where no theory has been previously proposed; it incorporates the complexities of organisational contexts into the understanding of phenomena; and it is suitable for studying processes and change (Urquhart 2007). The third factor particularly accords with the purpose of my research.

1.1   Research focus and questions

The continued increase in dropout rates in IS/SE programmes has created an urgent need to thoroughly comprehend the determinants of dropout decisions and reduce dropout rates. Eventually, such initiatives will enable the prevention of student dropout. In particular, the factors that underlie student dropout should be examined from students' perspectives. This study aims to acquire comprehensive information on what drives students to abandon IS/SE studies and the reasons women do not want to pursue an IS/SE programme. Statistics show that IT education is considered unattractive by most high-achieving students, particularly female students (von Hellens *et al.* 2001a). The research question and sub-questions are presented in Table 1.

Table 1. Research questions and sub-questions.

Research questions	Case
What kind of issues affect the decision to enter and leave the IT (the IS/SE view)?	Case 1, Case 2
Sub-research questions	
How do the women, girls, and men view the IT field?	Case 1, Case 2
Why do girls shun entry into the IT field?	Case 1
How do students go about the decision to drop out of IS/SE studies?	Case 2

1.2   Thesis structure

The rest of the thesis is organised as follows. Chapter 2 describes the research approach, design, and methodology. The concepts related to this thesis are also introduced in this chapter. In Chapter 3, I discuss case study one and in Chapter 4, I present case study two. Chapter 5 provides the evaluation of the thesis, and Chapter 6 presents the conclusions drawn.

2 Research approach, design, and methodology

In this chapter, I first present the content analysis, grounded theory, and ontological and epistemological assumptions of this research. I then discuss the concepts that are related to this study.

2.1 Content analysis, grounded theory, interpretive study, and hermeneutics

Ontological and epistemological assumptions

As previously mentioned, this research is grounded on hermeneutics, as well as the qualitative and interpretive perspective. I aim to elucidate the actual viewpoints of females about the IT field. Hermeneutics facilitates understanding and provides convincing arguments as parts of a whole are interpreted (Webb 1997), whilst qualitative content analysis fosters theory creation. Content analysis is suited to the purpose of this research because my approach is to probe into female attitudes without emphasising only a single theory, and to contextualise original attitudes from the essays written by the participants. Content analysis is also advantageous in abstracting core elements from information-rich material, in which volumes of information are condensed without losing principal components (Strauss & Corbin 1990: 22).

The second case study is based on grounded theory, developed by sociologists Barney Glaser and Anselm Strauss. An important difference between the two can be seen in the axial coding process, which Strauss encourages researchers to conduct in accordance with coding paradigm prescriptions. By contrast, Glaser assumes that grounded theory is only one of eighteen theoretical families (Urquhart 2001). Glaser and Strauss also differ in their perspectives: the Glaserian view is inductive (based largely on the original grounded theory methodology), whereas the Straussian perspective advocates the combined use of deduction and induction. The grounded theory approach is defined by Strauss and Corbin as 'a qualitative research method that uses a systematic set of procedures to develop an inductively derived grounded theory about phenomenon' (Strauss & Corbin 1990: 24). The premise of the theory is to create a theoretical formulation of the reality being studied. A researcher attempts to present an accurate

description of the object of investigation (Strauss & Corbin 1990: 22). One of the underlined reasons for using grounded theory is that it satisfies four central criteria: fit, understanding, generality, and control. The idea is that if the theory faithfully reflects everyday reality in the substantive area of research and its conclusions are induced from data, then it fits that substantive area. Theory represents reality; it should therefore be comprehensible. The grounded theory approach holds that theory should be sufficiently abstract and account for variation, so that it is applicable to different contexts that are related to a given phenomenon. Theory should also have control over action towards a phenomenon. (Glaser & Strauss 1967, Strauss & Corbin 1990.) Glaser (1978) stated that substantive theory can be analysed by comparing it with other similar theories in the field. According to Urquhart *et al.* (2010), formal models of process, structures, and analyses may be useful to integration. For the current work, I adopted the Glaserian view of grounded theory. Glaser (1978) indicated that 'the goal of grounded theory is to generate a theory that accounts for a pattern of behaviour which is relevant and problematic for those involved'.

Grounded theory also draws from positivist and interpretivist approaches (Sarker *et al.* 2001, Charmaz 2000). In the current study the inductive, contextual, and processual characteristics of grounded theory were the interpretive orientations used. Interpretive studies assume that people form their own subjective and intersubjective meanings by interacting with the world around them. Interpretive researchers attempt to understand phenomena by assessing these meanings. On this basis, interpretive studies seek a relativistic and shared understanding of phenomena (Orlikowski & Baroudi 1991). Research in IS can be considered interpretive if it assumes that our knowledge of reality is gained through social constructs, such as shared meanings. Interpretive research does not predefine independent and dependent variables. It focuses on the complexity of human sense making when situations emerge. A summary of the principles of interpretive field research is presented in Table 2. These principles are usually applied in evaluating interpretative research of a hermeneutic nature (Klein & Myers 1999).

Table 2. **Summary of the principles of interpretive field research and the current study's principles (modified from Klein & Myers 1999).**

Principles of the Hermeneutic Circle

1. The Fundamental Principle of the Hermeneutic Circle
This principle suggests that all human understanding is achieved by iterating between considering the interdependent meaning of parts and the whole that they form. This principle of human understanding is fundamental to all the other principles.

Example: Lee's (1994) study on information richness in e-mail communications iterates between the separate message fragments of individual e-mail participants as parts and the global context that determines the full meanings of the separate messages to interpret the message exchange as the whole.

2. The Principle of Contextualization
This principle requires critical reflection on the social and historical background of the research setting, so that the intended audience can see how the current situation under investigation emerged.

Example: After discussing the historical forces that led to Fiat establishing a new assembly plant, Ciborra *et al.* (1996) showed how old Fordist production concepts still had a significant influence despite radical changes in work organisation and operations.

3. The Principle of Interaction Between the Researchers and the Subjects
This requires critical reflection on how the research materials (or 'data') were socially constructed through the interaction between the researchers and participants.

Example: Trauth (1997) explained how her understanding improved as she became self-conscious and started to question her own assumptions.

4. The Principle of Abstraction and Generalization
This principle requires relating the idiographic details revealed by the data interpretation through the application of principles one and two to theoretical, general concepts that describe the nature of human understanding and social action.

Example: Monteiro and Hanseth's (1996) findings are discussed in relation to Latour's actor–network theory.

5. The Principle of Dialogical Reasoning
This requires sensitivity to possible contradictions between the theoretical pre-conceptions guiding the research design and actual findings ('the story which the data tell') with subsequent cycles of revision.

Example: Lee (1991) described how Nardulli (1978) came to revise his pre-conceptions of the role of case load pressure as a central concept in the study of criminal courts.

6. The Principle of Multiple Interpretations

This requires sensitivity to possible differences in interpretations amongst the participants as are typically expressed in multiple narratives or stories of the same sequence of events under study. This approach is similar to multiple witness accounts even if all tell it as they saw it.

Example: This principle is reflected in Levine and Rossmore's (1993) account of the conflicting expectations for the threshold system in the Bremerton Inc. case.

7. The Principle of Suspicion

This requires sensitivity to possible 'biases' and systematic 'distortions' in the narratives collected from the participants.

Example: Forester (1992) looked into the facetious figures of speech used by city planning staff to negotiate the problem of data acquisition.

The hermeneutic community suggests, as its first principle, that we understand a whole from pre-conceptions of the meanings of its parts and their connections. The second principle is contextualization, in which a study subject is set in its social and historical contexts. The third principle requires critical reflection on how study materials are socially constructed through interactions between researchers and participants. The fourth principle is that theoretical abstraction and generalization entail scrutinising details in order to present the experience of how phenomena occur in reality. The idea is that readers can easily grasp how researchers arrive at theoretical insights. The fifth principle holds that researchers should confront their pre-conceptions, and the sixth assumes that researchers observe how social contexts influence the events under study. The seventh principle assumes a need for sensitivity and scepticism (Klein & Myers 1999).

Search issues

To select previous studies for review, I conducted a search in the following databases:

- Academic Search Premier (EBSCO)
- ACM Digital Library
- Google Scholar
- IEEE Xplore - IEEE/IEE Electronic Library

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- Lecture Notes In Computer Science - LNCS
- ProQuest Databases
- Scopus
- Web of Science (ISI)

Search terms included 'girls and IT', 'girls and computer science', 'women and it', and 'women and computer science'. I also searched information on student dropout and motivation, as well as early research on computer science. More than 100 papers were read, amongst which I chose the most relevant.

2.2 Concepts

Computer science, information technology, and IT field

The IT field is classified into four disciplines: CS, Information Systems Science, SE, and Computer Engineering (Steelman 2001). CS revolves around systematic research on algorithms (Denning *et al.* 1988: 41), and its theory is based on mathematics (Iivari 2003: 5). SE pertains to the application of science and mathematics with the aid of computing technology that enables people to use procedures and computer programmes (Boehm 1981: 16). It is a science that involves the specification, planning, implementation, and development of programmes, documents, and operations models. CS and SE differ in terms of research methodologies; the former is more independent of practical applications (McDermit & Bennett 1999: 179). Information Systems Science examines information systems, their development, and their use in and effect on communities and organisations (Iivari 1991: 250). The Department of Information Systems Science at the University of Oulu is home to two IT schools: the schools of Information Systems Science and SE. The current study is directed towards these schools.

IT is related to computers, telecommunications, and data processing (Suominen 1999). It is a field that is viewed as connected to CS and regarded by students as offering appealing employment opportunities.

Sixth form female students and youth stages

The sixth form female students recruited for this research are those studying in a sixth form college in Oulu or Lapland Province. These students are 16 to 19 years

old—ages that correspond to the mid-youth and end-of-youth stages. At these ages, individuals typically suffer from identity and ideological crises. The mid-youth stage is characterised by identification, crushes, identifying one's own identity, breaking through limits, and forming deep relationships (Hägglund *et al.* 1978). In this stage, the youth find their place in the community and explore different study avenues. At the end of the youth stage normally comes a mellowing stage, at which individuals contemplate over their own positions in society and begin to independently carve out a life (Hägglund *et al.* 1978). Knowing at what stage the students are when they express their views on the IT field and associated professions is important because this is the point where girls transition into adulthood; they are searching for their place in the world, which includes determining where to study and what occupation to pursue (Dunderfelt 1992: 87).

Attitude

Attitude is a concept that covers the human feelings, facilities, fears, threats, prejudices, ideas, and beliefs that are projected towards certain subject matter. Opinions are a verbal expression of attitudes (Thurstone 1959: 216). Allardt (1993: 55) defined attitude as the aptitude to react to an acceptable or unacceptable item, situation, or person. Attitudes are ambiguous; they rapidly change and are, therefore, impermanent. They have three different components: content, intensity, and activity reserves. Content is an attitude's cognitive component, whereas intensity is the emotional component. The behavioural aspects of attitudes constitute activity reserves (Allardt 1993: 55). The media affects human cognition of reality and the attitudes that are formed on the basis of world views; the ideas advanced by the media are opinion shapers. The media significantly influences the daily life of Finnish people because they spend a third of their time within the media's sphere of influence (Uimonen 1996: 14–15).

Motivation

Motivation is related to psychological processes that direct and sustain action (Latham & Pinder, 2005). An understanding of motivation is central to explaining individual and organisational behaviour (e.g. Mitchell & Daniels, 2003).

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Emotion

Emotion is understood in a social context, and emphasises emotional display as part of an interpersonal, meaning-creating process (Harré 1986). Emotions have a formation and maintenance effect on social relationships (Keltner & Kring 1998).

3　Case one

In this chapter, I discuss previous studies on women's attitudes towards IT. The research methods, setting, and results of the first case study are also presented. I conclude the chapter with a discussion of the implications of case study one.

3.1　Previous studies on women's attitudes towards IT

Previous researchers have studied women's attitudes towards IT in relation to prejudices, computer use, software, stereotypes, socialisation, the gender gap, and underestimation of abilities (Table 3). The subsequent discussion presents the aforementioned concepts in this sequence.

Table 3. Previous research on women's attitudes towards IT.

Research topics	Studies	Country
Prejudices	Clarke & Teague (1996)	Australia
	von Hellens *et al.* (2001a)	Australia
	Leever *et al.* (2002)	United States
	Nielsen *et al.* (1999)	Australia
	Scollary *et al.* (2003)	Australia
	Teague (2002)	United States
	Trauth (1995)	Ireland
	Trauth (2002)	Australia and New Zealand
	Trauth *et al.* (2003)	Australia
Computer use	Ahuja *et al.* (2006)	United States
	Clarke & Teague (1996)	Australia
	French & Richardson (2005)	United Kingdom
	Graham & Latulipe (2003)	Canada
	Leever *et al.* (2002)	United States
	Moorman & Johnson (2003)	United States
	Papastergiou (2008)	Greece
	Varkila (1992)	Finland
Software	French & Richardson (2005)	United Kingdom
	Graham & Latulipe (2003)	Canada
	Leever *et al.* (2002)	United States
	Moorman & Johnson (2003)	United States
Stereotypes	Clarke & Teague (1996)	Australia
	Graham & Latulipe (2003)	Canada
	Leever *et al.* (2002)	United States
	Papastergiou (2008)	Greece

Research topics	Studies	Country
	Teague (2002)	United States
	Trauth (2002)	Australia and New Zealand
Socialisation	Clarke & Teague (1996)	Australia
	French & Richardson (2005)	United Kingdom
	von Hellens *et al.* (2001a)	Australia
	von Hellens *et al.* (2001b)	Australia
	Leever *et al.* (2002)	United States
	Moorman & Johnson (2003)	United States
	Trauth (1995)	Ireland
	Teague (2002)	United States
	Trauth (2002)	Australia and New Zealand
	Trauth *et al.* (2003)	Australia
	Trauth & Quesenberry (2007)	United States, Australia, New Zealand and Ireland
Gender gap	Adam (2002)	United Kingdom
	Adam *et al.* (2004)	United Kingdom
	Adam *et al.* (2006)	United Kingdom
	Adya & Kaiser (2005)	United States
	Clarke & Teague (1996)	Australia
	French & Richardson (2005)	United Kingdom
	von Hellens *et al.* (2001a)	Australia
	von Hellens *et al.* (2001b)	Australia
	Howcroft & Trauth (2008)	United States
	Hiltunen (2009)	Finland
	Leever *et al.* (2002)	United States
	Kvasny *et al.* (2009)	United States
	Moorman & Johnson (2003)	United States
	Oechtering & Behnke (1995)	Germany
	Papastergiou (2008)	Greece
	Pegher *et al.* (2006)	United States
	Robertson, Newell, Swan, Mathiassen and Bjerknes (2001)	United Kingdom, Sweden and Denmark
	Teague (2002)	United States
	Trauth (1995)	Ireland
	Trauth (2002)	Australia and New Zealand
	Trauth *et al.* (2003)	Australia
	Trauth & Quesenberry (2007)	United States, Australia, New Zealand and Ireland
	Trauth *et al.* (2008)	Australia, New Zealand, Ireland and United States
	Trauth *et al.* (2009)	United States

Research topics	Studies	Country
	Vehviläinen (2005)	Finland
	Wilson (2004)	United Kingdom
Underestimation of abilities		
	Clarke & Teague (1996)	Australia
	von Hellens *et al.* (2001b)	Australia
	Moorman & Johnson (2003)	United States
	Teague (2002)	United States
	Sieverding & Koch (2009)	Germany
Role Models	French & Richardson (2005)	United Kingdom
	Graham & Latulipe (2003)	Canada
	von Hellens *et al.* (2001b)	Australia
	Leever *et al.* (2002)	United States
	Moorman & Johnson (2003)	United States
	Trauth *et al.* (2003)	Australia
Attitudes of university students towards the IT field	Jousranta (2002)	Finland

Prejudices

According to the literature, women are confronted with prejudice in the workplace. On the basis of their literature review, Leever *et al.* (2002) argued that gender bias exists in the workplace. Goff (1997: 61) hypothesised that a male candidate is more likely to be chosen for an IS position and that women who hold IS jobs suffer from a lack of respect in professional settings (Leever *et al.* 2002: 169–170). According to Scollary *et al.* (2003), women in IT are denied equal promotion opportunities. In an interview of 31 women who work in the IT field in Australia and New Zealand, Trauth (2002) found that women experience discrimination and other barriers to their attempts to enter the IT industry (Trauth 1995, 2002, Trauth *et al.* 2003). A study by von Hellens *et al.* (2001) also confirmed that women experience instances of patronising behaviour towards them.

In a literature review, Teague asserted that women in IT face discrimination (Teague 2000: 149). In a similar study, Clarke and Teague (1996) assumed that girls do not enrol in CS classes because they feel that teachers are prejudiced against girls and view their computing abilities as inadequate (Clarke & Teague 1996: 241).

Through interviews and surveys amongst IT students at Griffith University, Nielsen *et al.* (1999: 264) found that condescending behaviour towards female students is prevalent. Women are subjected to continuous disparagement.

Computer use

Computer use has been studied in relation to gender. Moorman and Johnson (2003, 193) examined high school students' computing abilities and their interest in studying IT as a college major. The study group included 941 mid-western American high school students. The authors (2003: 195) reported that although girls and boys use computers with equal frequency, more girls than boys regard a career in computing as boring. Clarke and Teague (1996: 241) explored the low enrolment of females in computing courses at university**.** Their sample consisted of 34 male and 34 female students who enrolled in a university CS course, 33 secondary school girls (between 13–17 years old), and 19 women who have IT careers. The authors (1996: 243) found that girls had learned computing at school and found it uninteresting.

Graham and Latulipe (2003: 322) focused on the issue of encouraging female high school students (n = 40) to take CS courses. One of the authors' aims is to determine whether early exposure to a computer course affects attitudes regarding such courses. The authors (2003: 325) revealed that girls use computers almost every day for e-mail, word processing, Web surfing, chatting, and research.

Varkila (1992: 29–30) showed that computer usage amongst students is dominated by males. Men use computers more often than do women, but the type of computer use is similar in both genders. In their literature review, French and Richardson (2005) asserted that women view computers as tools for quickly completing tasks, whereas men regard computers as toys, with which they can enjoy surfing and playing.

Ahuja *et al.*'s (2006: 13) study sought differences in demographics, behaviours, and student attitudes regarding their field of study and their own career potential. They examined how men and women differentially respond to factors that determine IT-related career choices. The authors (2006: 13) also revealed that women begin working and playing on computers at a later period than do their male counterparts. This study (n = 1516) featured a Web-based survey of students majoring in CS at US universities.

Papastergiou (2008) examined high school students' intentions and motivations towards pursuing academic studies in CS, students' perceptions of

this discipline and the IT profession, computer use in the home, and self-efficacy beliefs regarding computers. The study group comprised 358 students (177 boys and 181 girls, aged 17–18 years) to whom questionnaires were administered. The author (2008: 603) indicated that boys use home computers more extensively than do girls.

Leisure software

The literature shows that men and women differ in terms of choices in leisure software. Leever *et al.* (2002: 171) argued that leisure software has been primarily designed to appeal to men, but an increasing number of games have recently been designed specifically for women. They indicated that the software industry views girls as desiring types of software and games that are different from boys' choices (Leever *et al.* 2002: 171). French and Richardson (2005) asserted that the primary users of computer games are boys and that the main characters in games are male.

Moorman and Johnson (2003: 194) found that 72.4 percent of male respondents play computer games, whereas only 45.9 percent of female respondents engage in such activities.

Stereotypes

Studies also show that stereotypes influence women's perception of studying CS. The stereotype of the male hacker is reported as one reason women are unenthusiastic about pursuing a CS programme (Leever *et al.* 2002: 172). Young women want to avoid the 'geek with a monitor tan' image (Graham & Latulipe 2003: 322). According to a study by Clarke and Teague (1996), girls perceive computer users as male hackers or as word processing operators (Clarke & Teague 1996: 243). Trauth (2002) observed that many of the personal traits that respondents (women in her study) possess lead them to become 'odd girls out.'

According to Papastergiou (2008: 604), students view CS and IT professions as programming-oriented. Girls more frequently perceive CS as centred on hardware and programming than do boys (Papastergiou 2008: 604).

According to Teague (2000: 149), women are indoctrinated to live according to stereotypical roles in society—this behaviour is especially evident during high school. Such indoctrination prompts a natural tendency to view certain professions as suitable only for males.

Socialisation

Socialisation influences women's IT views. Trauth *et al.* (2003: 9) presented a review of a research stream, which indicates that women have been socialised away from IT, projecting the IT field as a masculine domain.

The respondents interviewed by von Hellens (2001a: 118) believe that their differences in aptitudes and skills are a result of socialisation. According to the women recruited for the study, attendance at an all-girls school and having supportive parents are the factors that encourage them to challenge the male-oriented domain stereotype.

According to Moorman & Johnson (2003: 194), boys are more likely to receive computers as gifts or have greater access to them.

Gender gap

The gender gap is another significant issue in the IT field. In exploring the association between gender and IT careers, Adam *et al.* (2006: 368) determined how women perceive gender identity in relation to technological work, and the strategies they use to maintain their identities and cope in the workplace. The authors interviewed 11 women who work in the IT industry, and administered a separate Web-based questionnaire to 37 other respondents. Adam *et al.* (2006: 368) revealed that women employ two coping strategies: the first is distancing themselves from IT work and the other is dissociating themselves from their identities as women.

Trauth *et al.* (2009: 2) analysed the important organisational factors that may affect the retention of women in the IT field. The study is grounded on the individual differences theory of gender and IT. The interviews with 92 women in the IT workforce in the US showed that the following organisational factors influence women's career development: work–life balance, organisational climate, and mentoring (Trauth *et al.* 2009: 2).

Howcroft and Trauth (2008) presented arguments for the benefits of adopting a critical perspective for studying IS research and gender. This article was built upon earlier work of the authors (see Howcroft & Trauth 2004, Kvasny *et al.* 2005) on interconnections amongst epistemology, methodology and the research topic. Adam (2002) argues that appropriate feminist theory may be useful in augmenting our understanding of foundational issues, such as emancipation. According to Adam (2002), theorizing gender may be important in forming an

understanding of the topic of emancipation. For more background about feminism literature, readers are asked to refer to sources such as Butler (1990) and Wajcman (1991), and for more information about culture and gender issues refer to Smith (1997). According to Wilson (2004) the phenomenon of gender and IS is a subset of four broader phenomena. These are gender and ICTs, gender and society, gender and organisational arrangements and gender and technology. According to Adya and Kaiser (2005) their model of girls' career choices in technology fields indicates that parents are the key influencers of girls' choices of IT careers. They also noticed that teachers and counsellors provide little or no career direction advice. Their model is based on past research and hypotheses about the future of the information technology (IT) workforce.

Papastergiou (2007, p.594) indicated that girls are less likely to pursue a CS degree than are boys. This tendency is attributed to the lack of opportunities for early familiarization with computing in the home and in scholastic environments. Hiltunen (2009) indicated that upper secondary school students value the ICT field more than younger pupils. Yet, there were no differences on answers between genders. Her research is based on questionnaires at different age levels such as 7th–9th graders in compulsory education (age 13–16, n = 107) and students in upper secondary school (age 17–19, n = 263). Hiltunen (2009) carried out two similar questionnaires for 1) participants in the local academic science day and 2) participants in the local recruitment fair. According to Hiltunen (2009) 13–16-year- old girls seem to value the ICT field a little more than boys. Both genders equally agree on how highly valued the ICT field is as a profession. Both genders also agree that one does not need to be a nerd to work in the field. From the respondents, half of the boys would apply to the field and girls are less willing to apply to the field.

According to Moorman and Johnson (2003: 193), both male and female students continue to view CS as a primarily 'masculine field,' and choose careers accordingly.

Teague (2002: 147) speculated that career stereotyping and misperceptions about the nature of computing result in the underrepresentation of women in computing careers. Vehviläinen (2005: 23) asserted that information and communication technology (ICT) is 'gendered' and carries male-dominated subtexts. The author revealed that women define themselves as non-experts in the ICT field. Robertson *et al.* (2001) indicated that there is gender segregation within computing.

Underestimation of abilities

An empirical study by Moorman and Johnson (2003: 195) demonstrated that girls underestimate their own skills in comparison to those of others, particularly males. This underestimation persists even when girls have the same grades as boys in mathematics and CS, or even when they exceed the performance levels of boys. Female students view themselves as less competent in terms of advanced skills, such as writing programmes (von Hellens *et al.* 2001b). An empirical investigation (of 206 university students) conducted by Sieverding and Koch (2009) showed that women evaluate their computer competency as lower than that of men (2009: 696). In the study, participants were asked to observe a person on video and estimate whether the individual successfully completed a task within a limited period. The participants were required to assess their own computer competency against that of the target. They were later informed that the performance of the person on the video was above average.

Role models

Positive role models are important for eliminating stereotypes and changing attitudes; they help girls understand that IT workers are regular people, not anti-social technological experts who 'eat code' (Graham & Latulipe 2003: 325). Female role models can show that women's success in the IT field is possible (Leever *et al.* 2002: 174). According to a study by Moorman and Johnson (2003: 195), such role models change the perception that CS is a field suited only for males. Trauth *et al.* (2003) agreed with the need for female role models.

Attitudes of university students towards the IT field

Jousranta's (2002: 21) study revealed that society is increasingly taking on a computer-related structure: IT is important in many aspects of everyday life. Hence, Jousranta sees the IT field as the field of the future. The author also found that respondents believe that the IT field offers high-paying jobs.

3.2 Research methods and setting

The aim of the first case study is to explore the attitudes of female sixth form students towards the IT field and provide more comprehensive information on

this issue. Specifically, I intended to determine the actual perception of girls regarding IT and contextualise the initial attitudes that emerge from the essays written by the girls. Content analysis facilitates the realisation of these objectives because it is conducive to theory creation and enables the investigation of attitudes without focusing on only a single theory.

Content analysis also enables researchers to extract and summarise key points from information-rich material without compromising on substance. The categories created through content analysis should correspond to the perspectives originally presented by a research population. Hence, the categories synthesised from text are considered valid if they reflect respondents' actual opinions. In this study, I demonstrate fidelity to original perspectives by providing the original statements of the respondents as support for my findings and categorizations.

The research sample consisted of 64 female sixth form students from whom essays (the length of the essays was 4 pages or more) were collected in 2000 (n = 54) and 2003 (n = 10). The essays were entries in two different essay competitions held by a Finnish university (appendix 2). The strength of the essays is that they describe the writers' genuine opinions, unlike interviews, in which the respondents are prone to deliver answers out of prompting. Personal documents, such as essays, have a successful and long history of use in qualitative research and social science (Taylor & Bogdon 1998). In this study, a female sixth form student is aged 16–19 years and studies in an upper secondary school in Finland.

3.3   Case one: Results

The results highlight both positive and negative impressions of the IT field. These two images were divided into five subclasses: impression by field, profession, employee characteristics, programme characteristics, and information technology (Table 4). The results were analysed by category, beginning with positive images.

Table 4. Results of the study.

Positive images	Number/percent	Negative images	Number/percent
Field		Field	
highly-valued	21 / 32.8%	competition	3 / 4.7%
developing, growing	12 / 18.8%	urbanization	2 / 3.1%
field of the future	9 / 14.1%		
challenges	2 / 3.1%		

Positive images	Number/percent	Negative images	Number/percent
Profession		Profession	
benefits	34 / 53.1%	boredom	8 / 12.5%
employment	19 / 29.7%	monotony	9 / 14.1%
		occupational hazards	13 / 20.3%
		antisocial aspects	9 / 14.1%
		rush	3 / 4.7%
		stress	3 / 4.7%
Employee		Employee	
elegant and dignified	7 / 10.9%	geek	22 / 34.4%
capable	7 / 10.9%	antisocial	8 / 12.5%
gifted	8 / 12.5%		
high education	8 / 12.5%		
Studies		Studies	
necessary	2 / 3.1%	physics and mathematics oriented	4 / 6.25%
good employment possibilities	8 / 12.5%	interruption	3 / 4.7%
Information technology		Information technology	
useful	16 / 25%	computerization	4 / 6.25%
acceptable	5 / 7.8%		

3.3.1 Positive images

Although many girls do not perceive IT as a suitable profession, they nevertheless hold positive attitudes towards the field. They describe the IT field as *growing, developing,* and *respected,* and view it as *a field of the future*.

> *'Information technology is a continuously expanding field. Development in IT is happening all the time: better and better devices are being invented'.*

> *'Many people appreciate the IT field. It is one of the fields of the future'.*

Two of the girls do not consider the field as amongst the most respected by the public, but they agree that the popularity of the profession is rising.

> *'The field is not one of the most highly respected of professions, but appreciation for the profession seems to be increasing'.*

Two of the respondents perceive the IT profession as challenging.

> *'The work is very challenging and success is great.'*

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Thirty-four girls believe that the industry offers *good employment possibilities* and *benefits*, including travel, a good salary, and a company car.

> *'There are of course good aspects of the work: the salary is good, you get to travel, and you have a company car, maybe even a company house'.*

> *'The field offers good wages and employees get good benefits. A company will give its workers a company car and laptops'.*

Seven girls consider employees in the field to be *elegant* and *dignified*.

> *'... they dress smartly in black trousers and jackets, and carry expensive-looking briefcases with them'.*

Eight girls consider employees to have a *high level of education* with advanced skills.

> *'The information technology employees that large and small companies are hiring are well-educated and skilled'.*

Eight girls regard the employees of the field as *trained* and *gifted people*.

> *'I think that if you want to become successful in the IT field you need to be particularly talented; whiz kids and geniuses seem to dominate the field'.*

Eight girls indicated that the IT field offers *good employment possibilities*. Two other girls agree with the necessity of studying IT because computers have become ubiquitous and are required tools in any profession.

> *'IT companies are hiring more IT employees; therefore, studying information technology would be a good decision'.*

> *'All of us should know how to use a computer because whatever you're studying, you need to use computers'.*

Sixteen respondents view *information technology* as *useful* and five consider *information technology* as *an accepted* innovation that we use in our everyday life.

> *'For me, information technology is an advantage that makes my life easier; it benefits me and our society'.*

3.3.2 Negative images

Two girls view the IT field negatively because they believe employment opportunities are available *only in large towns*. Three girls deem *competition* in the field as intense.

> *'The negative side of the field is that the jobs are mostly in cities, and if you are interested in those jobs, you have to leave your home area'.*

> *'As I mentioned earlier, the work is demanding and competitive, but if the demands are too great for you, you can always choose another field'.*

IT-based professions are associated with *rushing*, *stress, and monotony.* They are also seen as *dull*.

> *'My own view of the IT profession is that it is a dull profession; I cannot imagine myself as an IT professional'.*

> *'The work can be very difficult and stressful, although you might think that employees only sit in front of a computer'.*

Thirteen girls believe that the profession presents many *occupational hazards*, including head, neck, and shoulder pain.

> *'In the field of information technology, you're paid a large salary, but you also suffer from backaches and neck pain'.*

IT employees are regarded as *antisocial* and *lonely*.

> *'In brief, information technology as a job is boring and lonely, albeit well paid and highly-valued'.*

Nine respondents showed a shift in their perceptions of an IT employee, from someone who is a 'nerd' and a 'man in a suit' to an ordinary man.

> *'The employees I know are ordinary people who have to wear suits for business meetings. But they still wear tracksuit trousers in their homes, just like other people'.*

> *'Needless to say, many who work in the IT field do not use computers at home, and their real images are far from the image of a nerd'.*

Five of the girls have observed how the media has affected their impression of IT professionals. For example, the image of a 'nerd' was created by the media.

'I think that the media has affected the development of stereotypes. Magazine covers portray IT people who are either showing off their new sports cars, or who have their noses glued to the computer screen'.

Studying IT necessitates a *physics and mathematics orientation*, a feature that four girls view in a negative light. One of the girls does not want to enter the field because she would be compelled to *drop out of school* and work before graduating from an advanced degree. Overall, three girls view the possibility of dropping out as a negative aspect.

'Students are recruited in the very early stages, and consequently do not have time to complete their Master's thesis until they have put in many years of work. I could not do this'.

As four girls stated, all activities will become computerised.

'I am afraid that in this promised land of information technology, everything will be computerised'.

3.3.3 IT as a profession

Girls have different reasons for abandoning the IT profession as a potential career choice (Table 5).

Table 5. IT as a profession (n = 64).

IT could be my profession	Number/percentage	IT would not be my profession	Number/percentage
Physics and mathematics-oriented	1 / 1.6%	IT jobs are not human-related	15 / 23.4%
Challenges	1 / 1.6%	The work is too computer-related	11 / 17.2%
Employment	6 / 9.4%	Unfamiliarity of IT	9 / 14.1%
Interesting	2 / 3.1%	Craftsmanship	2 / 3.1%
		Physics and mathematics-oriented	4 / 6.25%
		Nervousness	1 / 1.6%
		Passing fad	1 / 1.6%
		Preparedness for computer use	8 / 12.5%

According to six respondents, respect for the field, *good employment possibilities*, and *benefits* tempt them to choose IT as a career.

'Information technology is the profession of the future, in which people are investing a lot. So my path will be in computer education, if I want to get a well-paid job or even any kind of job in the future.'

Two girls consider IT as captivating and *interesting*.

'I have thought about going into the information technology field when I graduate, or studying something that includes information technology as a significant part. Information technology fascinates me and one reason for this is the low number of women in the field'.

Learning new things was identified by one of the girls as a reason for choosing the IT field.

'I would like a job where you can learn new things all the time, and you can develop and widen your skills. I think information technology provides excellent, varied possibilities for this'.

One of the girls considers studying *physics and mathematics* an advantage in entry into the IT industry.

'I have not yet found the field that interests me, but perhaps because of my studies in mathematics and physics, it would be possible for me to pursue an IT programme and even a career in this field'.

3.3.4 IT – not my profession

The negative perspectives that girls hold towards the IT field are the underlying factors that discourage them from enrolling in an IT programme. Fifteen girls perceive this discipline to be *non-human–related* (the work is only computer-related, according to the respondents).

'Working in the field of information technology is not human-related, except when employees go to drink coffee together. The work is related to technical values, so my interest quickly comes to an end when I start to hear talk about it'.

Eleven girls deem *working with a computer* indoors as monotonous and dull.

'I could not imagine earning a living in a dusty, boxy office, reading screens full of text and clicking away at the mouse. It doesn't sound like my dream job'.

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'The worst, most horrible image I have about my soon-to-be job is that I end up sitting in a small stuffy booth, referred to as an office, and tapping at the computer all day long without meeting a single living creature'.

The requirement for *mathematics and physics* skills is also listed as a key factor that dissuades girls from becoming IT students.

'If I wanted to get into the information technology field, I would have to be good at mathematics'.

Nine girls state that they *do not know enough* about IT, leading them to believe that they do not possess the qualifications to enter the field.

'I could not become an information technology professional. I don't understand anything about machines. Every time I work with them, they start to act strangely'.

'If I could do more than write e-mails and surf the net, or use basic word processing, I would head straight to the nearest university to take information technology'.

One of the girls believes that the field is unsuitable for people who are prone to *nervousness*.

'This field cannot become my field because I am the nervous type and I do not possess steady hands'.

Another respondent views the field as a passing fad.

'If I consider my personal skills, the information technology field could be a likely study possibility. But I will still continue my lonely battle against the present bandwagon, and will say no to it'.

Two girls prefer to *work with their hands*, and they do not believe the IT profession will offer them such tasks.

'I am more interested in working with my hands than in using machines in order to accomplish something'.

Eight girls foresee that they will use *information technology* in their future work, but they would rather not be IT professionals.

> *'Information technology is not necessarily going to be my profession, but it will be a large part of the profession I practise in the future because it will be a bigger and bigger part of every profession'.*

The girls are exposed mostly to positive ideas about the IT field, but negative images continue to strongly affect their perceptions, so that they are discouraged from considering IT-related professions. Amongst the factors that fuel the negative impressions of IT, the most influential are its perceived detachment from human-oriented activities, the requirement for mathematics and physics aptitude, and early recruitment that hinders the pursuit of higher studies.

3.4   Case one: Discussion

The empirical findings of case study one are summarised as follows.

The results suggest that although many of the respondents do not consider IT as a potential career, they nevertheless have positive attitudes towards the field. They observe that the IT field is a respected and continually developing field. The respondents consider it the field of the future. Our results are consistent with those of previous studies, such as that conducted by Jousranta (2002).

I found that the respondents are encouraged to pursue an IT programme because of the esteem with which the discipline is held, as well as the good employment prospects and benefits that the industry offers. A number of the girls find IT appealing, similar to the views of the respondents in Jousranta's (2002) research, in which university students exhibit respect for the IT field. Teague (2002) revealed that women select the IT field because of the good employment prospects, high income, and the challenges presented by a computing career. Papastergiou (2009) drew the same conclusions.

New avenues for learning are seen as a challenging but appealing aspect of the IT industry, a result that is also reflected by Teague (2002) as he examined why women enjoy computing careers. The reasons that these women provided include problem solving, learning new ideas, and opportunities for challenge. These views are similar to the findings reported in early studies.

Some of the girls deem an IT background necessary because computers are used everywhere. IT professionals are also perceived as well-trained and gifted employees. Jousranta (2002) declared that IT is a pervasive component of everyday life and that securing employment necessitates knowledge of this discipline. Her results correspond with ours in that the university students in his

sample acknowledge IT as a practical innovation. Varkila's (1992) study indicated that students at a vocational school view IT in a favourable light. Students perceive the discipline as useful even though they are uncertain about how they will employ it in their professions. Contrastingly, the girls in my sample believe that IT will be a ubiquitous component of their future careers, but do not wish to pursue it as a profession.

A number of the respondents in the current research are uninterested in studying and working in the IT field because they are of the opinion that employment is available only in highly urbanised areas, and that intense competition will be difficult to manage. I have found no other studies that present results in this regard.

Furthermore, our respondents associate the IT profession with rushing, stress, monotony, and dullness. According to the girls, IT professionals suffer from many occupational hazards, another finding that no other previous studies reflect. IT professionals are also regarded as unsociable and isolated. Klawe (2002) argued that images of a nerd doing dull and simple work dissuades girls from entering the IT field. According to Clarke and Teague (1996), girls regard IT professionals as tasked with uninteresting work that also keeps them from socialising.

According to the participants in the current study, the field removes them from human-related activities and that it mostly revolves around technical work. The need for skills in mathematics and physics is another prohibitive factor. A few girls believe their knowledge of IT is insufficient to guarantee entry or success in the industry. These findings agree with those of Leever, Dunigan, and Turner (2002), who stated that women do not hold negative views of IT-related jobs, but that they opt not to work in this industry. The authors also reported that students believe IT studies and careers to be grounded on mathematics and the natural sciences. I obtained similar results. Teague (2002) showed that girls' decision to shun IT careers stem from their misconceptions about the nature of such vocations. In the current work, the participants immediately associate an IT career with sitting in front of a computer all day.

The current results also highlight the influence of stereotypes on the low number of women in the computing field. Clarke and Teague (1996) similarly suggested that stereotypes account for why women do not enrol in CS classes. They view the IT field as being related to mathematics and technology. A study by Margolis (2002) indicated that women avoid CS because they do not wish to be seen as 'nerds.' Moorman and Johnson (2003) found that such tendencies

originate from the lack of female role models in the IT field. One of my respondents also pointed out the need for someone worthy of emulating.

3.4.1 Limitations of the study

This study has typical statistical limitations, such as the small sample size, but the volume of material can provide sufficiently clear information when data saturation is reached. I believe I have maximised data collection from the chosen sample. Case sampling includes all the essays (n = 64) that were written in two competitions, making the sample in this study sufficient. The analysis is deemed comprehensive because it is not based solely on random selection; all useful information was extracted from the material. I also verified the relevance of the essays and obtained exhaustive information on the topic of the thesis. Conducting research on chosen subject matter beforehand also strengthens results (Mäkelä 1990). One limitation of the study can be that girls were recruited for this research by their participation in a competition and essay writing about subjects that had been given to them beforehand. Girls had the opportunity to choose between a numbers of questions, so those who had chosen certain questions wanted to write about those certain subjects.

3.4.2 Implications for research

This study provides a number of potential future research directions.

Our findings shed light on the effect of stereotypes on females' perceptions of IT, prompting the need to investigate the importance of positive role models on women. Educational programmes, in which female role models share their educational backgrounds and discuss their work, can be initiated. Before an event, a questionnaire regarding girls' views on IT-related studies, fields, and careers can be administered. The questionnaire can be re-distributed after the event to determine whether perspectives have changed. Workshops are also potential avenues for change. The idea is to provide women a picture of what an IT career entails. Courses taught by female role models can be included in the curricula of sixth form schools. The questionnaire approach suggested for educational initiatives is equally applicable to workshops and courses.

Given that female high school students perceive IT professions as heavily grounded on extensive skills in mathematics and physics, educational intervention is a promising measure for enhancing attitudes towards the IT discipline. A pre-

and post-study setting can be established, with the pre-study conducted to obtain baseline results. The second phase would be the educational intervention programme, after which a post-survey is administered for evaluation against the baseline findings.

Scholars can also conduct studies similar to the current work, maybe even in other countries, and compare results (Are there cultural differences?); this time with interviews as the primary instruments. Interviews can provide a wider range of results and enable in-depth investigations on attitudes, seeing as face-to-face interactions present an immediate opportunity for clarifying responses or probing respondents for more information.

Finally, researchers can examine computer use amongst girls and its effects on perspectives regarding IT. Such studies can be extended by comparing results with those obtained for boys.

3.4.3 Implications for practice

I recommend four strategies for encouraging female students to enter the IT field.

Given the influence of stereotypes on the low number of women in the computing field, educational programmes should consider the involvement of female role models in teaching IT-related courses and workshops.

The natural sciences are viewed by this study's respondents as significant to carving out an IT career; thus, educational institutions (high school to university level) should provide a wider picture of the different responsibilities involved in the IT profession. Teachers in high schools and equivalent institutions should inform students that not all IT positions require extensive skills in mathematics and physics. Information Systems and MIS positions, for example, place a premium on a humanities or social sciences background (Dhillon & Backhouse 2001).

For sixth form schools, educators and policymakers can consider introductory classes that cater specifically to girls. Female students who are studying IT can visit these schools and share their views and experiences. Such events can create a realistic yet positive image of IT studies amongst girls. The same recommendation on introductory courses is applicable to universities.

3.5 Case one: Conclusion

In case study one, I explored how high school female students perceive the IT field, and why they are encouraged or discouraged to pursue it as a programme of study or profession. The results suggest that the IT field is viewed in a relatively positive light by the girls. Although many of the respondents do not consider IT as a potential future career, they regard it in a favourable manner. The positive attributes of the IT industry, such as its continued development, the respect it has earned, and the employment prospects and benefits it provides, are amongst the factors that encourage entry into the field. On the other hand, its detachment from human-oriented activities and the need for mathematics and physics skills are the key reasons some girls do not wish to pursue an IT degree. These results highlight the need to involve female role models in efforts to reduce stereotypical views and encourage girls to enter the IT field.

Sixth form students should be made aware that IT careers are categorised into CS, IS, and SE, each requiring different competencies. Not all IT positions require extensive skills in mathematics and physics. Third, female IT majors should visit high schools and offer a more realistic picture of IT professions.

Future research should revolve around how positive role models motivate females to study IT courses. Given the perceptions on the importance attached to mathematics and physics, educators should advance intervention programmes that are designed to inform students that not all IT careers require competency in the natural sciences.

4 Case two

In this chapter, I present previous studies on student dropout. The analysis, results, discussion, and conclusions of the second case study are also provided.

4.1 Previous studies on student dropout from university

In the CS field, 'retention' reflects a student's persistence in pursuing CS studies. A 'dropout' is a student who has not graduated from a programme. Dropout decisions are made either by the student or the school. Retention has been a long-standing issue in high education institutions worldwide. Schools want to maintain student attendance; thus, examining student departure for various student populations in different institutional settings is crucial for improving retention rates (Tinto 1988, Elkins *et al.* 2000). In the US, there is a strict adherence to the practice of monitoring student persistence and other factors related to student dropout. As a reflection of this practice, a journal is devoted specifically to this purpose: the Journal of College Student Retention: Research, Theory, and Practice.

The causes of low retention are wrong choice of study field, personal variables (e.g. illness), and work-related factors, such as leave of absence policies (Virtanen 2000: 49). Motivation affects dropout decisions (Liljander 1996: 30), and such choices have been studied from many perspectives. These include investigating dropout from CS and Informatics courses (Kinnunen & Malmi 2006, Xenos *et al.* 2002, Howles 2009), as well as studies on high education students in Spain (Lassibille & Gomez 2008, Araque 2009), Germany (Georg 2009), Italy (Pietro & Cutillo 2008, Belloc 2010), the US (McGrath Cohoon 2003, Allen *et al.* 2008, Porchea 2010), Australia (Willcoxson 2010), the United Kingdom (Bennett 2003), and Korea (Shin & Kim 1999). Dropout from online learning programmes has also been explored (Park & Choi 2009, Willging & Johnson, 2004, Yukselturk & Inan 2006, Rovai 2003). The factors that drive dropout from university and the CS discipline are shown in Table 6.

Table 6. Dropout research related to CS and university studies.

Research topics	Studies	Country	Findings
Online learning dropouts	Park & Choi 2009	United States of America	Park *et al.* (2009) showed that the theoretical framework can predict learners' decision to drop out or persist.
	Willging & Johnson 2004	United States of America	The students' reasons for dropping out of an online programme are varied and unique to each individual.
	Yukselturk & Inan 2006	Turkey	The most important factor affecting student retention is finding sufficient time to study. Personal problems andaffordability of the programme were other reasons.
	Rovai 2003	United States of America	The persistence model explains factors affecting a learner's decision to drop out of online learning programmes.
Dropouts from CS and Informatics courses	Kinnunen & Malmi 2006	Finland	The results indicated that the most popular reasons students drop out are lack of time and lack of motivation.
	Xenos *et al.* 2002	Greece	Drop out reasons can be categorised into five categories: professional, academic, family, health-related, and personal.
	Howles 2009	United States of America	Students have misconceptions of what computer scientists are and what kind of career opportunities the field offers.
Dropouts from high education	Lassibille & Gomez 2008	Spain	Academic preparedness is one of the major influences on student completion. Older students and students

Research topics	Studies	Country	Findings
			who delay entry into higher education are more likely to drop out.
	Araque *et al.* 2009	Spain	Starting age, parental education, academic performance, success, average mark in the degree, form of access, and in some cases, the number of courses that students should pass are the variables that appear repeatedly in explanations for dropping out.
	Belloc *et al.* 2010	Italy	High-performing students in previous schooling are more likely to change fields if they have low grades at university. High performance means low dropout possibility.
	Di Pietro & Cutillo 2008	Italy	Flexibility in the degree programme and student services are part of a new reform method. Results suggest that the reform reduces dropout risk.
	Willcoxson 2010	Australia	The reasons students have for dropping out differ each year of undergraduate study and each semester within each year.
	McGrath Cohoon 2003	United States of America	Encouraging women to persist, mentoring, and actively recruiting are the suggested methods for overcoming women's under-representation in CS.
	Shin and Kim1999	Korea	Learners' work responsibilities have a significant indirect effect on grade-point average via the study time variable.

Research topics	Studies	Country	Findings
	Bennett 2003	United kingdom	Finances are a reason students drop out/persist. Teaching quality affects satisfaction and commitment to a university.
	Allen *et al.*2008	United states of America	Academic performance influences the likelihood of retention. Academic self-discipline results in high performance; it also affects retention and transfer.
	Georg 2009	Germany	Students drop out generally because of weak commitment to their course of study. Other reasons include the commitment to a specific field of study.
	Porchea *et al.* 2010	United States of America	Students with greater motivation are more likely to obtain a degree and transfer rather than drop out. Full-time students are also more likely to obtain a degree.

Online learning dropouts

Rovai (2003) proposed a persistence model that explains the factors that affect a learner's decision to drop out of an online learning programme. His model includes two prior-to-admission variables (student characteristics and student skills prior to admission) and two after-admission variables (external factors, such as finances, and internal factors, such as academic integration, social integration, and self-esteem). Rovai's framework (Figure 1) was established via a thorough review of the most popular previously proposed frameworks [e.g. Tinto's student integration model (1993) and Bean & Metzner's student attrition model (1985)]. This model was tested and expanded by Packman *et al* (2004). (Park 2009.)

Prior to Admission

Student Characteristics (Tinto, Bean & Metzner)	Student Skills
Age, Ethnicity & Gender	Computer Literacy
Intellectual Development	Information Literacy
Academic Performance	Time Management
Academic Preparation	Reading & Writing
	Computer-based Interaction

After Admission

External Factors (Bean & Metzner) Finances
Hours of Employment
Family Responsibilities
Outside Encouragement
Opportunity to Transfer
Life crises

Internal Factors

(Tinto)

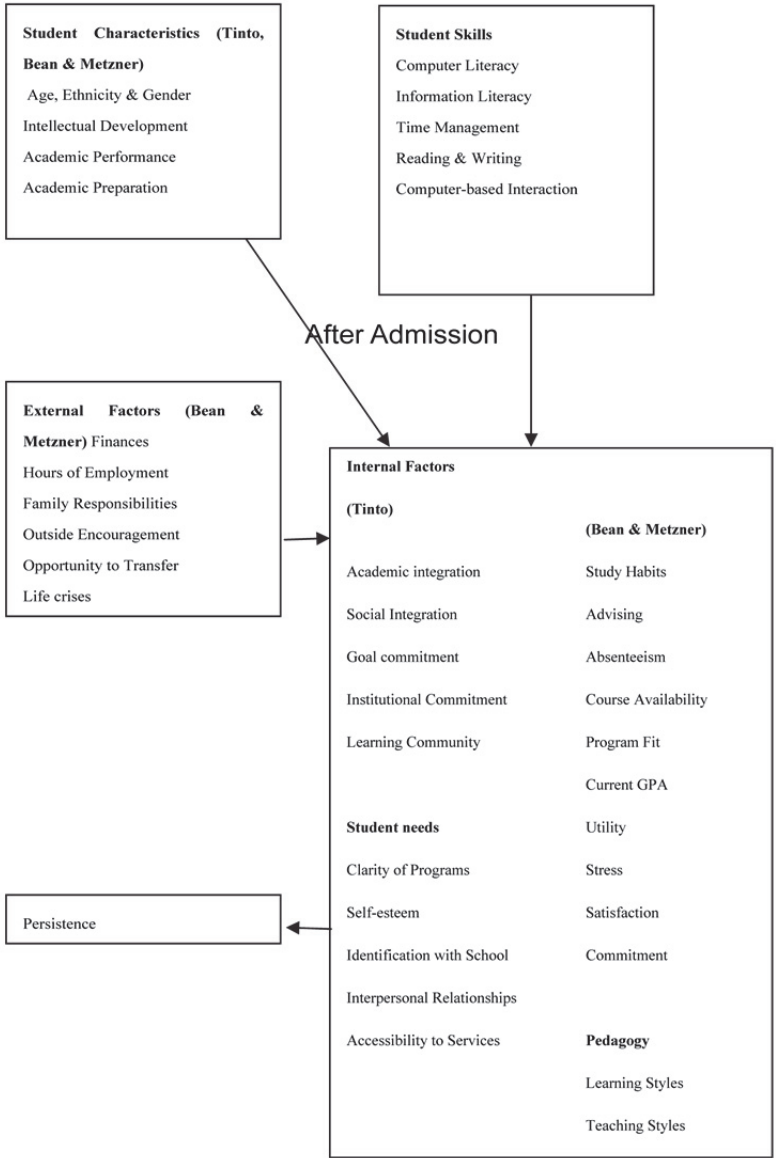|	**(Bean & Metzner)**
Academic integration	Study Habits
Social Integration	Advising
Goal commitment	Absenteeism
Institutional Commitment	Course Availability
Learning Community	Program Fit
	Current GPA
Student needs	Utility
Clarity of Programs	Stress
Self-esteem	Satisfaction
Identification with School	Commitment
Interpersonal Relationships	
Accessibility to Services	**Pedagogy**
	Learning Styles
	Teaching Styles

Persistence

Fig. 1. Rovai's model (modified from Rovai 2003).

Study on dropout from online learning programmes show that Park *et al.*'s (2009) theoretical framework (which includes family support, organisational support, satisfaction, and relevance) can predict learners' decision to drop out or persist. Enhancing the relevance of courses and providing organisational support to adult learners are important measures. These measures are included in the theoretical framework shown in Figure 2. As indicated in the figure, Park (2007) proposed a revision to the structure of Rovai's (2003) model; that is, some of the variables were eliminated. For example, 'learner skills' are placed in the grey box because this variable has minimal empirical support. External factors are located between the 'prior to' and 'during' levels of the courses given that these determinants influence student decisions not only as the course is being studied, but also prior to enrolment in the course. Adult distance learners may drop out of a course because of increased workload or job changes. These events occur during the course of study. Some may drop out of a course even before they begin because of the aforementioned external reasons. Internal and external factors are likely to interact with each other. Park *et al.*'s (2007) quantitative study (147 questionnaire respondents) focused on three main categories of factors: individual characteristics (age, gender, educational background, employment status are the most cited (Park 2007)], external factors (family and organisational support), and internal factors. As Park (2007) pointed out, most adult learners have many familial and professional responsibilities, which are the key factors that affect the learners' decision to drop out of online courses (Park, 2007). Park (2007) also revealed that motivation is one of the most frequently studied variables in dropout cases (Chyung 2001, Chyung, Winiecki, & Fenner 1998, Doo & Kim 2000) (Park *et al.* 2009). Motivation has sub-dimensions, amongst which relevance and satisfaction are the most frequently studied (Chyung *et al.* 1998, Doo & Kim 2000, Shea, Pickett, & Pelz 2003).

Prior to the course   During the course

Learner characteristics
-age
-gender
-education
-employment status

Learner skills

External factors
-scheduling conflicts
-family issues
-financial problems
-managerial support
-personal issues (e.g. health)

Dropout/persistence

Internal factors
-social integration
-academic integration (instruction follow-up, instructional design, assignment level, activity level, etc.)
-technology /technical/usability issues
-lack of motivation

Fig. 2. Park *et al.*'s (2007) study's the theoretical framework (modified from Park 2009).

Willging and Johnson (2004) demonstrated that demographic variables (such as age, gender, location of residence) do not predict the likelihood of dropping out of online programmes. The reasons for dropping out of an online programme vary and are unique to each individual. Yukselturk and Inan (2006) listed the core determinants of the dropout decisions of distance and online learners (Table 7).

Table 7. List of dropout problems regarding learners and online programmes (modified from Yukselturk & Inan 2006).

Learners	Programmes
Unexpected emergency situations (Vergidis & Panagiotakopoulos 2002)	Course schedule and pacing (Morgan & Tam 1999)
Underestimating time and effort necessary for courses (Vergidis & Panagiotakopoulos 2002, Arsham 2002, Xenos, Pierrakeas & Pintelas 2002)	Insufficient feedback (Morgan & Tam 1999) Quality of learning materials (Morgan & Tam 1999, Rossett & Schafer 2003, Frankola 2001)
Lack of time management (Parker 1995, Phillips, Chen, Kochakji, & Greene 2004, Saba 2002)	Lack of interaction amongst learners and teacher (Saba 2002, O'Brien & Renner
Poorly defined educational goals (Parker 1995)	2002)
Lack of technology proficiency (Phillips, Chen, Kochakji, & Greene 2004, Frankola 2001)	Inexperienced instructors (Terry 2001) Lack of social integration (Hill & Raven 2000, Rovai 2003,
Lack of learning responsibility (Saba 2002)	King 2002)
Lack of study space (Saba 2002)	Lack of student support
Unfamiliar learning environment (Rovai 2003, Lynch 2001, Arsham 2002, Martinez 2003, Terry 2001)	(Frankola 2001)

Dropout problems can be analysed from two perspectives: by examining the problems that originate from the learner side and those that stem from the programme. Willging and Johnson (2004) showed that the most influential factor in student retention is finding sufficient time to study. Personal problems and the affordability of a programme are other factors.

Dropout from CS and Informatics courses

Kinnunen and Malmi (2006) investigated the reasons CS students drop out of the CS1 course and how drop out reasons accumulate. CS1 is an introductory course in Java programming. The authors conducted qualitative interviews with 18 students. The results indicate that the factors that most commonly drive dropout decisions are lack of time for studying and lack of motivation. These factors are, in turn, influenced by other determinants, including the perceived difficulty of the course and problems with time management and planning. Student preference for

another programme, plagiarism of programming projects (i.e. working in groups when individual effort is required), and low level of comfort are other factors that affect dropout decisions. Xenos *et al.* (2002) examined the reasons Greek students drop out of an Informatics programme offered at an open university. Informatics is a four-year course (12 modules) and graduates are awarded a Bachelor's degree after completion. Xenos *et al.* (2002) categorised the reasons students drop out into five classes: professional, academic, family, health-related, and personal reasons. For data collection, the authors employed student registry (age, gender, family status, number of selected modules), tutors' records (e-mails, meetings, class participation), questionnaire-based survey, and telephone interviews. Howles (2009) stated that students hold misconceptions about CS studies and associated career opportunities. These false impressions originate from the existing knowledge of the students as they applied for the major and the number of programming tasks involved at the beginning of the programme. Some students withdrew from the programme because they could not cope with the course load (assignments). Apart from poor time management, deficient study skills prevent the students from coping with the demands of the discipline. Such skills were also discussed in the study of Kinnunen and Malmi (2006).

Dropout from high education

Willcoxson (2010) showed that the reasons students drop out vary across different years and semesters. The author administered questionnaires to 456 students majoring in accounting, financial planning, information systems, international business, human resource management, management, and marketing or tourism. Students completing a generic Bachelor of Business programme are also included in the sample.

The key factors that underlie attrition decisions are as follows (Table 8):

– Commitment to institution
– Commitment to degree/course
– Teachers' skills/attitudes
– Teachers' accessibility/support
– Feedback on assessment
– Academic self-efficacy/expectations
– Academic engagement/behaviour

- Learning environment/infrastructure
- Socio-cultural environment/infrastructure
- Course/career advice
- Personal circumstances

Table 8. Summary of key factors underlying attrition decisions by year and semester of study (modified from Willcoxson 2010).

Factor	Year of study			Semester of study				
	1st	2nd	3rd	1st year 1st semester	1st year 2nd semester	2nd year 1st semester	2nd year 2nd semester	3rd year 1st semester
Commitment to institution	x	x		x				
Commitment to degree/course	x	x		x	x		x	
Teachers' skills/attitudes	x			x	x		x	
Teachers' accessibility/support	x		x	x	x			x
Feedback on assessment	x			x			x	
Academic self-efficacy/expectations	x	x		x	x	x	x	
Academic engagement/behaviour	x			x	x			
Learning environment/infrastructure			x	x	x			x
Socio-cultural environment/infrastructure	x			x	x	x		
Course/career advice	x			x				
Personal circumstances		x				x	x	

Willcoxson (2010) also demonstrated that the reasons students drop out during the first year considerably differ. First-year students are most likely to leave if they lack commitment to an institution or a specific career direction or degree, were ill-advised about enrolment options, or feel socially disengaged. Others feel that they lack the requisite academic preparation for university study, or that their teachers or administrative employees appear unsupportive or inaccessible; these students also assess their teachers as failing to create learning experiences that are characterised by clarity of content and expectations, engagement, and helpful and timely feedback. Sophomore student withdrawals are related primarily to personal issues, such as health, finances, social integration, clarity of career direction, and self-efficacy in relation to academic capacity. Institutional commitment, accessibility of teaching staff, and helpfulness of feedback may also exert some influence on decisions to withdraw. Third-year students have expectations regarding teaching and learning. Early departure is strongly associated with the lack of sensitivity to their individual needs and adequate IT resources. Homesickness and progression to another university also affect withdrawal decisions, albeit to a lesser extent. (Willcoxson 2010.)

Lassibille and Gomez (2008) conducted a longitudinal study on 7000 students in a university in Spain. Specifically, their sample comprises the entire population of first-year entrants in the university. The students were observed over an eight-year period, and the authors employed statistical analysis and data from administrative records. They examined personal characteristics and family background (age, gender, location, parental education) at the time of entry into the university, secondary educational experience (grade-point average before university examinations), financial support received, and information on whether the students were accepted into their preferred majors. The authors concluded that academic preparedness is a major influence on programme completion. Older students and students who delay entry into higher education are more likely to drop out. Students who drop out have fewer abilities and less motivation. Factors, such as age and family background, also account for students' decision to drop out of school. Allen *et al.* (2008) analysed enrolment data on 6872 college students, and concluded that academic performance influences the likelihood of retention. Academic self-discipline encourages high performance and affects retention and transfer rates. Motivation indirectly and directly affects long-term enrolment through academic performance and college commitment, respectively. Porchea *et al.* (2010) conducted a study on 4481 college students, and concluded that students with greater motivation are more likely to obtain a degree and

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transfer rather than drop out. Full-time enrolees are also more likely to complete their programmes. Shin and Kim (1999) studied a sample of 4668 students of a Korean national open university. The authors administered a survey to these students by post and carried out a follow-up survey on 1994 students. The authors concluded that workload has a significant indirect effect on grade-point average via the study time variable. Araque *et al.* (2009) conducted statistical database analysis. The database on 75830 students contains student marks, personal information, and degree and course information. The authors revealed that university students (majoring in SE, humanities, and economic sciences) who have weak learning strategies and lack the persistence to achieve their aims in life exhibit low academic performance and low success rates. Such attributes imply a high risk of abandoning a programme. Di Pietro and Cutillo (2008) carried out their study on university students in three phases. The students began their university studies in 1995, 1998, and 2001. The data used by the authors include information on previous educational attainments, degree results, parental socio-economic status, and personal attributes. The authors stated that the flexibility of a degree programme (Bologna declaration 3+2 years, first degree; specialised degree, 2 years) and services (e.g. internship placement and guidance) constitute reform measures that are implemented by the university. The findings suggest that such reforms decrease dropout risks. In nine surveys where questionnaires were administered to 28000 students, Georg (2009) found that students generally drop out because of weak commitment to their course of study. Other factors that affect dropout decisions include commitment to a specific field of study.

McGrath Cohoon (2003) suggested that encouraging women to persist, mentoring, and actively recruiting can resolve women's under-representation in the CS field. Her study focused on 210 (25 percent are women) mid- to large-sized undergraduate CS students. Women are more likely to switch majors than are men; that is, 21 percent of women and 15 percent of men switch to a different major.

Bennett (2003) concluded that finances are a factor in decisions to drop out or persist. Teaching quality affects student satisfaction and commitment, as well as the decision to stay at university. Self-esteem is determined as significant to motivation, especially for students who exhibit low performance or financial problems. Bennett (2003) analysed 377 questionnaires from the students of a business university. Belloc *et al.* (2010) investigated students with high academic performance in previous schooling, indicating that they are more likely to change majors if they have low grades at university. On the basis of administrative data

that include 9725 economics and business students, the authors concluded that high performance translates to low dropout possibility.

Models of dropout reasons

Numerous models [e.g. Bean's (1978, 1980, 1990), Spady's (1970), Pascarella's (1980), and Fishbein and Ajzen's (1975)] for analysing dropout reasons have been proposed. Amongst these, the most extensively applied are Spady's (1970) and Tinto's (1975) models.

Spady's (1970) first theoretical model of the dropout process is based on Durkheim's (1961) idea that group values and peer support reduce the incidence of suicide. The former adapted this idea to the reduction in dropout decisions. Social and academic integration influence dropout decisions. Spady's (1970) explanatory sociological model of the dropout process includes shared group values, performance, normative congruence, and peer support. These elements increase social integration, which in turn, increase satisfaction and strengthen institutional commitment. Institutional commitment reduces the likelihood of dropout. Spady stated that dropout decisions are a result of a lengthy process, and background characteristics are important in this process. Such characteristics include family background, academic potential, ability, and socio-economic status. Spady also identified normative congruence and peer support as important endogenous variables in his model. These variables influence performance and intellectual development. (Bean 1981.)
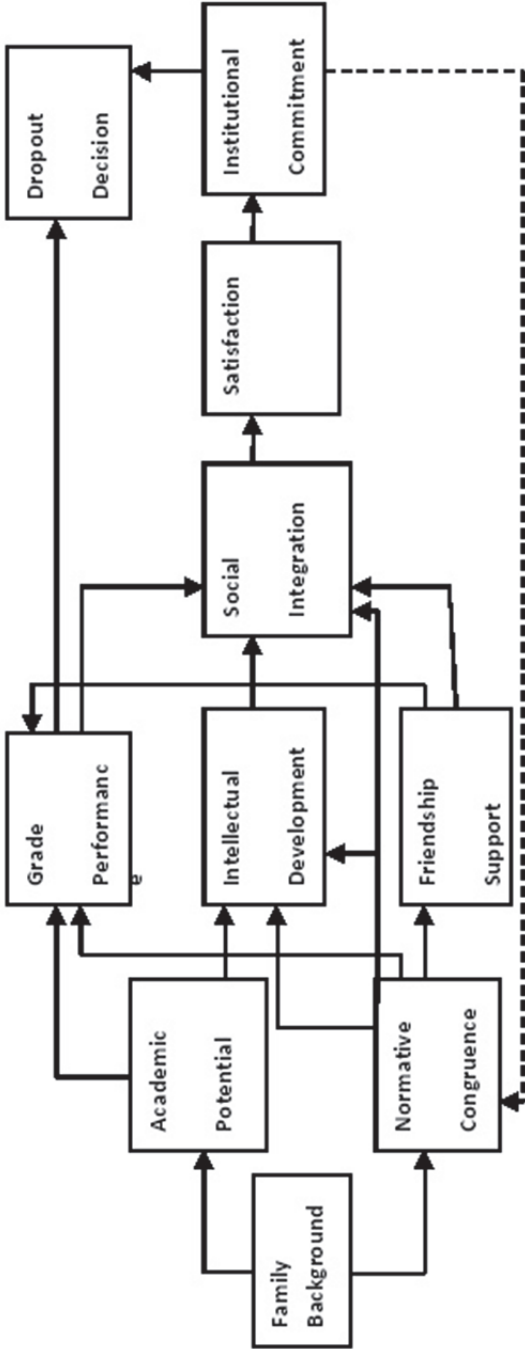
Fig. 3. Spady's (1970) explanatory sociological model of the dropout process (modified from Bean 1981).

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Tinto's student integration model has been the most influential model of dropout from tertiary education (McCubbin 2003). This model assumes that departure is analogous to suicide, and that it occurs when students fail to integrate into a university's academic and social worlds. Tinto's model is also based on Durkheim's idea. Tinto (1975, 1987) explained the attrition process using a longitudinal model.

Attrition is a result of the interaction between the societal pressures in an institution and the personal characteristics of an individual (Terenzini *et al.* 1980) From pre-entry attributes arise individual values, academic intentions, and commitment to the educational process. The experiences in an institution are categorised into two types: the social and the academic. Individuals form an understanding of their personal level of integration according to these types of experiences. After this, students re-evaluate their goals and commitment, facilitated by remembering the effect of any external commitments that they have. Decisions are then made on whether to drop out or persist in the educational process. (Brunsden *et al.* 2000.)

Fishbein and Ajzen's theory of reasoned action (1975) is a schematic presentation of the conceptual framework for predicting specific intentions and behaviours. Behaviour is preceded by an intention to perform the behaviour. Attitude towards the behaviour and a subjective norm that is related to the behaviour are immediate antecedents of intent to perform. Beliefs about the consequences of a behaviour precede the attitude towards the behaviour. Normative beliefs about a behaviour influence the subjective norm that is related to the behaviour. The feedback loop from the behaviour to these beliefs is also incorporated into the model. (Bean 1981.)
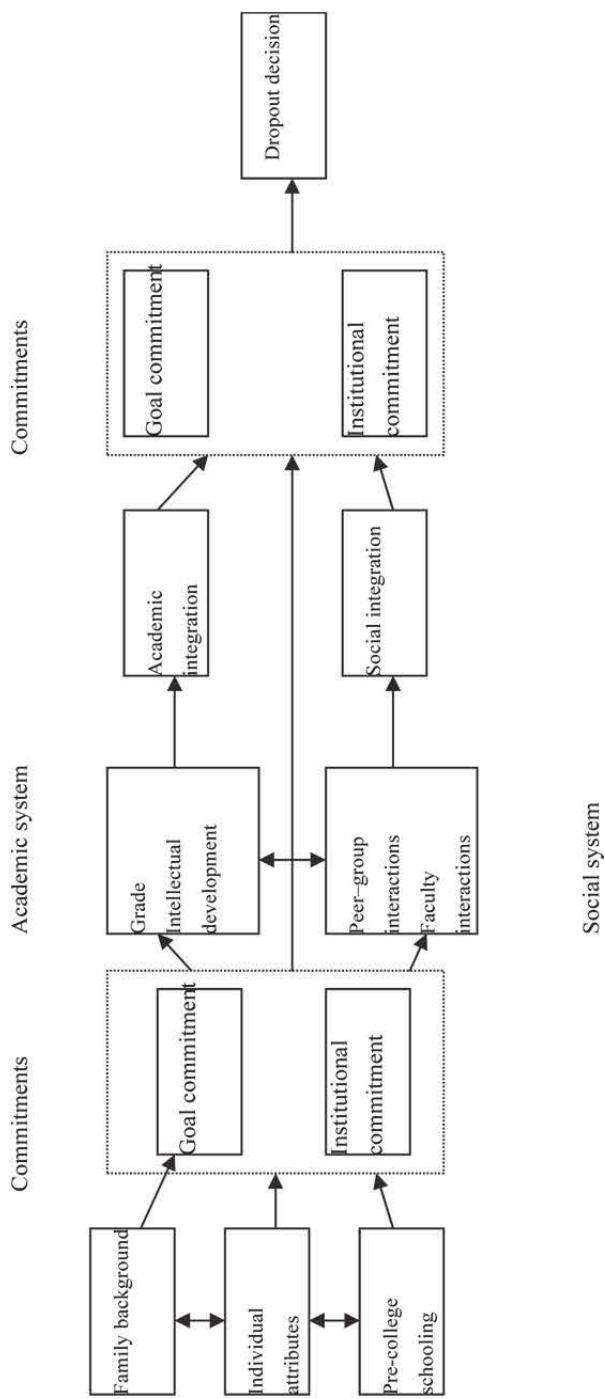
Fig. 4. A conceptual schema for dropout from college (modified from Tinto's attrition model 1975).
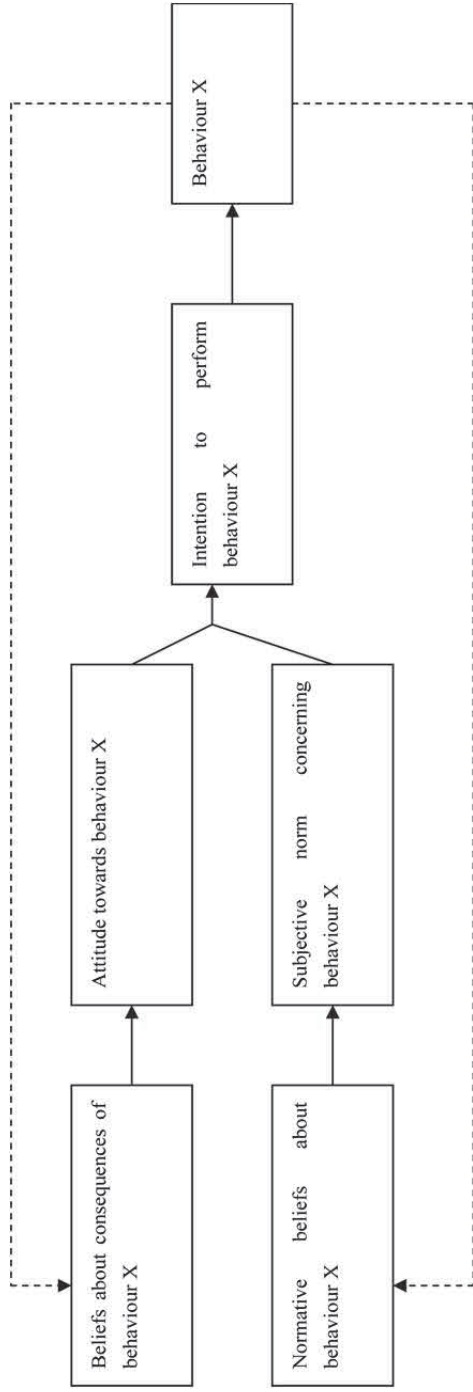
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Fig. 5. TRA by Fishbein and Ajzen (1975) (modified from Bean 1981). Schematic presentation of conceptual framework for the prediction of specific intentions and behaviours.

In 1978, Bean adapted Price's model (1977) of turnover in work organisations to the student attrition process models. He slightly modified the model in 1980. Price's (1977) original model includes six independent variables: pay, having close friends, participating in decision making, repetitiveness of work, knowledge of work roles, and being treated fairly. These variables influence job satisfaction, and increased satisfaction reduces turnover. The opportunity to leave is related to satisfaction, indicating that employees leave an organisation if they are dissatisfied and will perceive an opportunity to transfer elsewhere. (Bean 1981.)

Bean's (1979) model includes seven background variables (e.g. parental education) that influence 20 indicators (e.g. having close friends) of students' interaction with an organisation. Social and academic integration are incorporated as organisational variables. The organisational variables influence seven intervening variables, which in turn, affect institutional commitment, including the intention to stay at an institution. The stronger the intention of a student to stay, the less likely he/she will drop out. Personal variables, such as goal commitment, major and occupational certainty, and confidence, directly affect institutional commitment and dropout decisions. Environmental variables, such as opportunity to transfer, opportunity to secure employment, familial approval of an institution, familial responsibilities, likelihood of marriage, and difficulty of financing education, directly influence institutional commitment and dropout rates. (Bean 1981.)

Pascarella's (1980) model is a descriptive model that was constructed on the basis of an extensive literature review on student attrition. Pascarella (1980) also developed a conceptual model of the dropout process (Bean 1981). In this model, the background characteristics interact with (for example) institutional image, as well as administrative policies and decisions. Institutional factors shape informal contact with faculty, educational outcomes, and other collegiate experiences. Educational outcomes are viewed as direct determinants of persistence or withdrawal decisions. Background characteristics are assumed to have a direct influence on institutional factors, other collegiate experiences, educational outcomes, and informal contact with faculty. Informal contact with faculty can also affect other collegiate experiences and educational outcomes, and vice versa. Other collegiate experiences and educational outcomes have a mutually reciprocal relationship. (Bean 1981.)
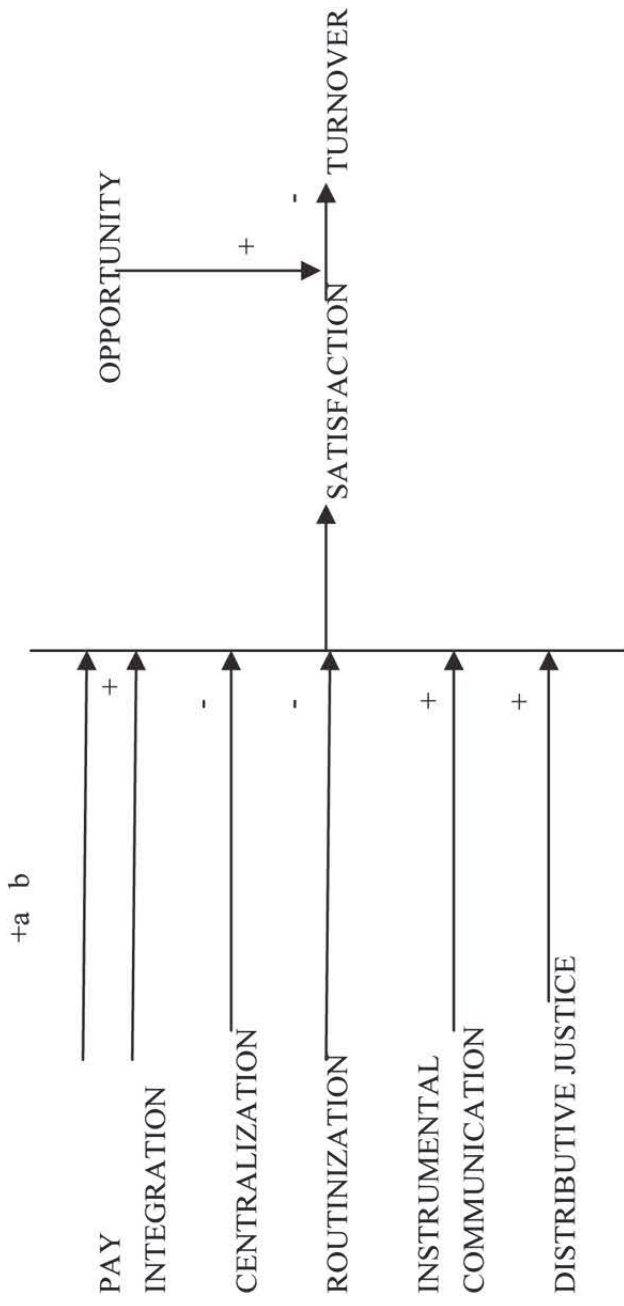
Fig. 6. Price (1977) . Relationships between the determinants, intervening variables, and turnover (modified by Bean 1978). (Model modified from Bean 1981. '+' indicates a positive relationship and "-" indicates a negative relationship; arrows indicate the direction of the relationship.

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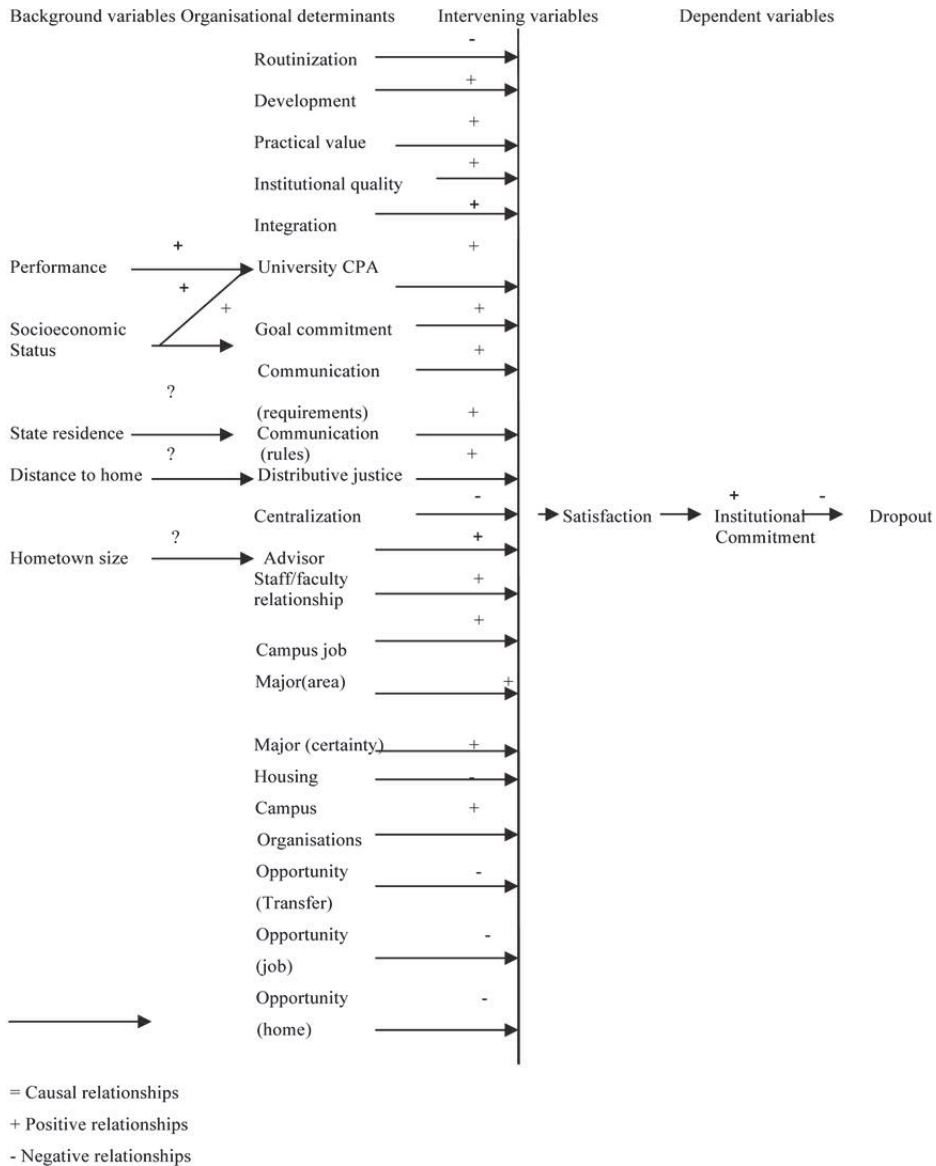
Fig. 7. Causal model of student attrition (modified from Bean 1980).

Bean's (1990) model of student departure predicts persistence on the basis of behavioural intention. These intentions are shaped by beliefs and attitudes. A student's experiences within an institution can affect beliefs, attitudes, and

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decisions. Bean and Metzner (1985) also developed a model of student retention specifically for non-traditional students. The core difference between non-traditional and traditional students is that the former are often more strongly affected by the external environment than by social integration. Bean constructed a psychological model of student retention with Eaton (2000). This model describes how three psychological processes affect academic and social integration. The structure of the model is based on attitude–behaviour theory. Self-efficacy theory, coping behaviour (approach–avoidance) theory, and attribution (locus of control) theory elucidate how students develop academic and social integration. This model features a reduced emphasis on social integration factors because non-traditional (e.g. older, working) students less frequently interact with other individuals on campus than do traditional students. Bean's model is also of a complex and longitudinal nature. It differs from Tinto's original model in terms of two significant aspects: environmental variables and student intentions. Tinto incorporated these factors into his model in 1993. (Education Encyclopedia 2012.)

Background and defining variables

Age
Hours enrolled
Educational goals
High school performance
Ethnicity
Gender

Academic variables

Study hours
Study skills
Academic advising
Absenteeism
Major and job certainty
Course availability

Environmental variables

Finances
Hours of employment
Family responsibilities
Opportunity to transfer

Social integration variables

Memberships
Faculty contact
School friends

Academic outcome

GPA

Psychological Outcomes

Utility
Satisfaction
Goal commitment
Stress

Intent to leave

Dropout

Key:

Direct effects
Direct effects presumed to be most important

Possible effects

Fig. 8. Bean and Metzner's (1985) modified attrition.

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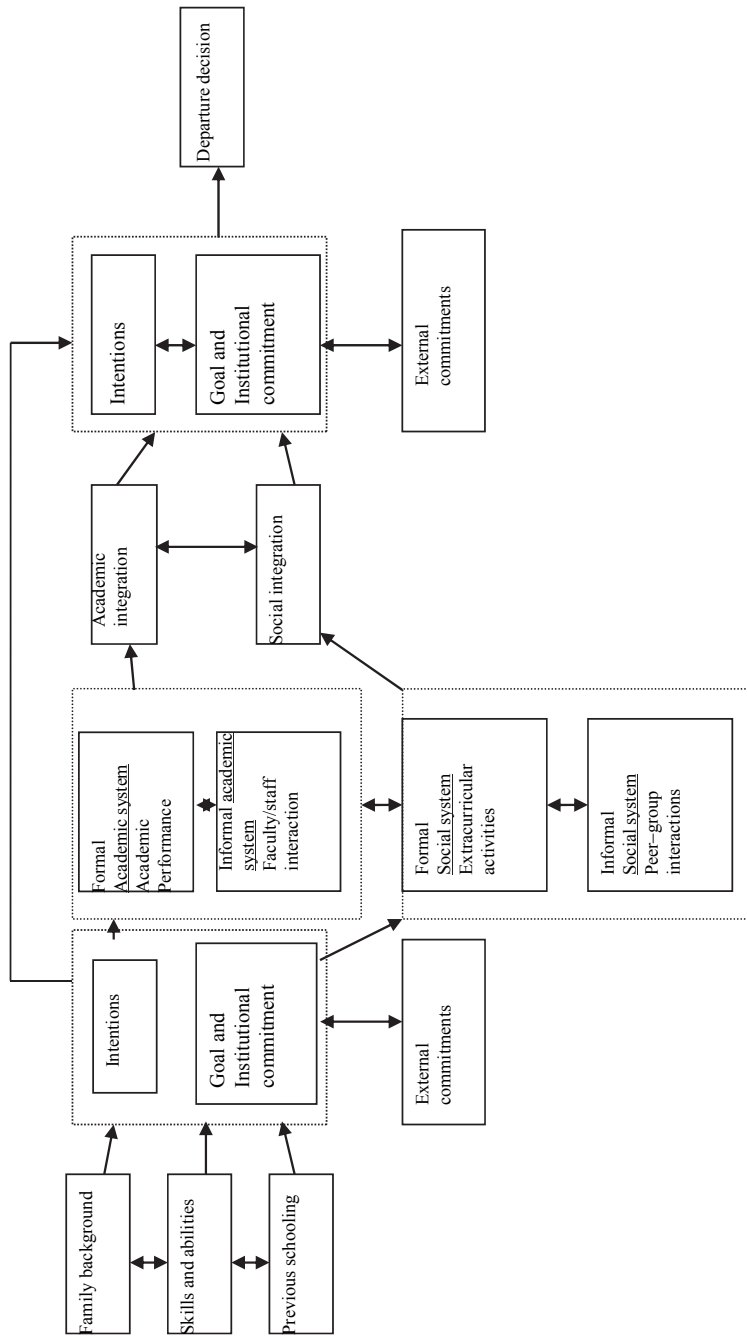
Fig. 9. Tinto's (1993) revised attrition model (modified from McCubbin 2003).

Persistence/ Withdrawal decisions

Educational outcomes
Academic performance
Intellectual development
Personal development
Educational/Career aspirations
College satisfaction
Institutional integration

Informal contact with faculty
Context
Exposure
Focus
Impact

Other collegiate experience
Peer culture
Classroom
Extracurricular/ leisure activities

Institutional factors
Faculty culture (e.g. professional interests, values, and orientations)
Organisational structure, institutional image, administrative policies, and decisions,
Institutional size, admission standards, academic standards

Student background characteristics
Family background
Aptitudes
Aspirations
Personality orientations, goals, values, and interests
Secondary school achievement and experiences
Expectations on college
Openness to change

Fig. 10. Pascarella's (1980) conceptual model for research on student–faculty informal contact (modified from Bean 1981).

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Tinto revised his model in 1997, and the revised version assumes that the classroom is the place where academic and social involvement or integration occurs. The classroom is therefore an important consideration in persistence theories. The author pointed out that involvement carries significant weight. He argued that the greater the student involvement or integration in college life, the higher the likelihood that he/she will persist. High levels of involvement are an independent predictor of learning gains. Students learn more when they invest more in learning activities (e.g. Pace 1984, Ory & Braskamp 1988, Kaufman & Creamer 1991, Tinto 1997). Tinto's study was conducted with different samples: first-year students in the Coordinated Studies Programme (CSP) and those in the traditional curriculum. Th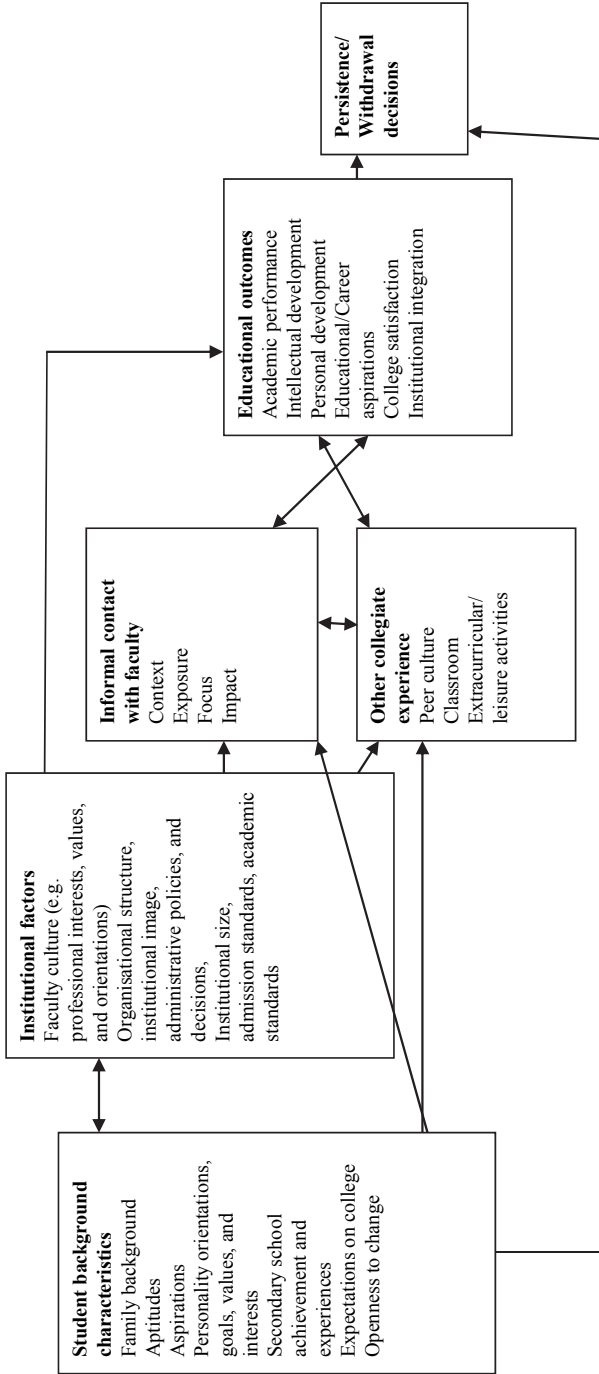e author selected a sample of CSP (four) and comparison (11) classes, and then administered questionnaires to these students. The data used include the responses to the questionnaires and institutional records. These records, together with estimates of students' learning gains, make up the basic outcome variable set. The qualitative data were used to determine how participation in a collaborative learning programme influences learning experiences. Tinto (1997) also examined how these learning experiences correspond with the participants' broader experiences as first-year students. The author performed inductive analysis to formulate hypotheses. The quantitative analysis shows evidence of the effect of learning communities on student persistence. The qualitative analysis links classroom experiences to persistence. In the modified model, classroom environment is related to effort and persistence (Tinto 1997).

Tinto (2006) has recently developed a model for describing the basic structure of an institutional model of action for student success. This model assumes that students enter an institution with a variety of attributes (e.g. gender), abilities, skills, and levels of previous academic preparation (e.g. academic skills), as well as attitudes, values, and knowledge about higher education (e.g. goals, commitments, motivations, and expectations). At the same time, students participate in external settings (e.g. family, work, community) that each impose demands on students' time and energies. Students enter different institutions with varied attributes and resources. The following factors are not fixed: institutional commitments, the expectational climate established by members of an institution (i.e. faculty, staff), 'the academic, social, and financial supports provided by the institution, the feedback that is provided to and about students by the institution, and the educational and social activities that shape student academic and social involvements and/or engagements within the classroom and with other members

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of the campus' (Tinto 2006). The model assumes that institutional commitments provide the overarching context for institutional action, and institutions that are committed to student success are more likely to generate that success. Many actions facilitate student success; examples include institutional commitment and leadership, as well as expectational climate.

In sum, although numerous studies have been conducted on student dropout, none of these present a model of the decision-making process. Clarifying the manner by which students come to this decision is necessary. Although existing studies aid our understanding of the reasons students drop out of CS courses, university studies, and online learning programmes, no research describes the specific decision-making trajectory. The complex and dynamic nature of dropout underscores the importance of examining this phenomenon from a process perspective. Process theory explains why a phenomenon exists, and such explanation corresponds with what is observed in real-world settings (van de Ven & Poole 1995). The current work fills the gap left by early research. I conclude that motivation directly affects the drop out/persist decision of students.
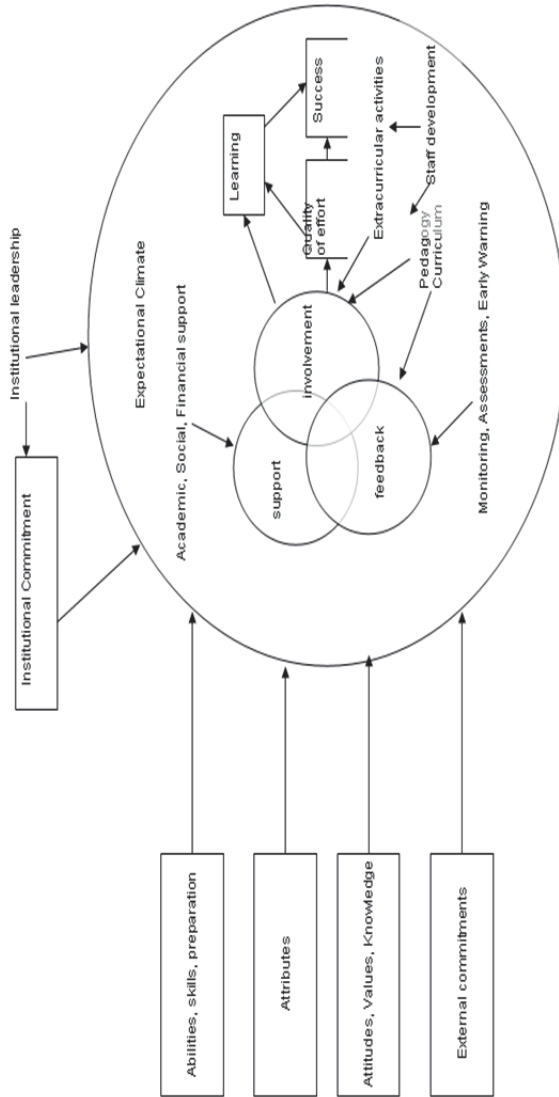
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Fig. 11. Modified from Tinto's (2006) elements of preliminary model of institutional action.

Process studies on IS

A theory can be an account of a given empirical phenomenon (Gregor 2006, Burton-Jones et al. 2011). A theoretical background can be constructed from Burton-Jones et al. 2011). A theoretical background can be constructed fromet al. 2011). IS research espouses three core theoretical approaches: variance, process, and systems approaches (Burton-Jones et al. 2011). The differences in these approaches are presented in Table 9.

Mohr (1982) contended that the variance approach is unsuitable for studying organisational change. He instead advocates the process approach, introduced in IS research by Markus and Robey (1988). The governing principle of process theory is that entities are connected to events. The process approach uses efficient causality, which is crucial to outcomes. A considerable number of studies (e.g. Mohr 1982, Abell 1987, Abbott 1988, Monge 1990) are based on the process approach. IS research, such as that carried out by Newman and Robey (1992), is grounded on this approach. Another example is the coping model of user adaptation (Beaudry & Pinsonneault 2005). According to Pare *et al.* (2008), in leading IS journals 20 percent of the studies are conducted using the process approach (Burton-Jones *et al.* 2011). The process perspective is also represented in IS success and failure studies. Success and failure are viewed as outcomes of organisational processes (Fincham 2002).

Table 9. Espoused differences amongst the process, variance, and systems approaches (modified from Burton-Jones *et al.* 2011).

Dimension	Variance approach	Process approach	System approach
Types of concepts	Properties of entities that have varying values	Entities that participate in or are affected by events	Wholes (comprising parts) that have emergent properties
Change in concepts over time	Properties do not change over time (only their values change)	Entities change over time	Wholes, their parts, and their properties can change over time
Types of relationships	Variations amongst values of properties	Sequences amongst events (typically probabilistic)	Interactions amongst parts and reciprocal relationships
Time sequence in the relationships amongst concepts	Time sequence amongst independent variables (properties) is immaterial	Time sequence of events is important	Time sequence of events and properties is important
Causal logic in the relationships amongst concepts	Causal logic based on necessary, sufficient, and efficient causality	Causal logic based on necessary, final, formal, and efficient causality	Causal logic based on material, final, efficient, and reciprocal causality

The four different types of process theories are lifecycle, teleological, dialectical, and evolutionary theories. These explain how and why change unfolds in social or biological entities. Process pertains to the progression of events in an organisational entity's existence over time. Change is an empirical observation of difference in (for example) the quality or state of an organisational entity over time. A change process is equivalent to development. Process theory explains why a phenomenon occurs, and why organisational entities develop and change. These theories can be depicted in a metatheoretical scheme for illustrating and distinguishing the four ideal-type theories (Figure 12; van de Ven & Poole 1995).
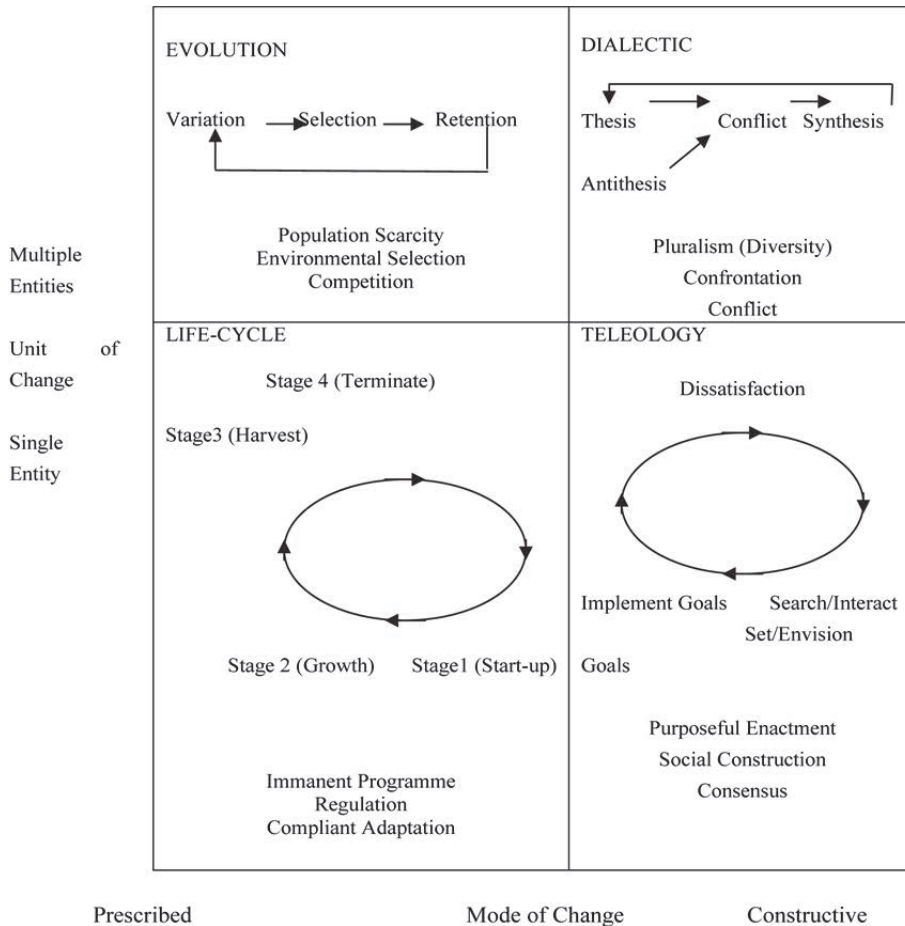
Fig. 12. Process theories of organisational development and change (modified from van de Ven & Poole 1995).

In Figure 12, the cells represent each theory and the process of development unfolds in a fundamentally different progression of change events. The lifecycle model illustrates that the progression of change in an entity proceeds through a necessary sequence of stages. The teleological model regards development as a cycle of goal formulation, implementation, evaluation, and goal modification; this cycle is based on the learning of an entity. In the dialectical model of development, conflicts emerge between entities that espouse theses and antitheses. These opposing views collide to engender synthesis for the thesis of the next cycle of dialectical progression. The evolutionary model of development includes

a sequence of variation, selection, and retention events amongst entities in a precisely determined population. For example, the competition for resources generates this evolutionary cycle. Evolutionary and dialectical theories operate on multiple entities, whereas lifecycle and teleological theories operate on a single entity. Evolutionary forces are defined for populations, whereas dialectical theories require at least two entities. Lifecycle theory regards development as a function of potentials immanent within a single entity; by contrast, teleological theory needs one entity's goals to explain development. (van de Ven & Poole 1995.)

Lifecycle theory

Lifecycle theories include many factors, such as biogenesis (Featherman 1986), developmentalism, ontogenesis, number of child development stages, human and organisational development, and group decision-making stages. Next to teleology, lifecyle theory is the most commonly used explanation of development in management literature. Change is imminent, as indicated by lifecycle theory. A developing entity goes through the process of change, which advances the entity from a given point of departure to a subsequent end (which is prefigured in the present state). External environmental events and processes can affect how the entity expresses itself, but these factors are often mediated by (for example) rules. The typical progression of change events in this model follows a unitary sequence, which is cumulative and conjunctive. A cumulative sequence is one in which the characteristics acquired in the early stage are retained in later stages. A conjunctive sequence is one in which stages are related because they are derived from a common underlying process. The final end stage is prefigured and requires a specific historical sequence of events. Every event contributes to the final product, and these events occur in a prescribed order. They set the stage for the next phase. According to Nisbet (1970), organisational development is driven by the same genetic code within a developing entity. Development is explained in the lifecycle theories of organisational entities as an institutional rule that requires developmental activities that enable progression to the next sequence. Other lifecycle theories rely on logical or natural sequences in the development of organisational entities. (van de Ven & Poole 1995.)

Teleological theory

Teleological theory is grounded on teleology as its philosophical doctrine. Its purpose or goal is the final catalyst that guides the movement of an entity. This approach includes aspects, such as functionalism (Merton 1968), decision making, and epigenesist, as well as most models of strategic planning and goal setting. The teleological perspective holds that the development of an organisational entity proceeds towards a goal or an end state. The entity should be purposeful and adaptive, and should construct an envisioned end state, take action to reach it, and monitor progress. Development is a repetitive sequence of goal formulation, implementation, evaluation, and goal modification. These elements are based on what was learned or intended by the entity. Teleology pertains to creativity because an entity (group or individual) has the freedom to enact different goals. Teleology does not prescribe a sequence of events or specify which trajectory the development of the organisational entity will follow, as is done in lifecycle theory. Instead, it treats development as the process of steering an entity towards its final state. Therefore, this theory implies a standard for evaluating change. If a theory relies on a teleological process, it cannot specify the developmental trajectory of an organisational entity; only possible paths can be introduced. (van de Ven & Poole 1995.)

Dialectical theory

Dialectical theory hinges on the Hegelian assumption that an organisational entity exists in a pluralistic world of colliding events and contradictory values or forces that complete each other (for domination and control). In dialectical theory, two or more distinct entities embody these oppositions to confront and engage others in conflict. Stability and change exist, and these are explained by referring to the balance of power between opposing entities. Stability is engendered by struggles and accommodations (which maintain the status quo between oppositions). Change occurs when these opposing values (forces or events) gain sufficient power to enable confrontation and engagement of the status quo. (Van de Ven & Poole 1995.)

Evolutionary theory

In evolutionary theory, as in biological evolution, change proceeds through a continuous cycle of variation, selection, and retention. Variations (the creations of novel forms of organisations) are usually viewed as yielding random change; such variations arbitrarily occur. Change is a recurrent, cumulative, and probabilistic progression of the variation, selection, and retention of entities of an organisation. An evolutionary model is useful for representing variation, selection, and retention amongst numerous organisational entities (van de Ven & Poole 1995).

Stage theories

There is also theory that is used considerably in health behaviour issues. These aspects can also be observed in the process theory adopted in the current work; hence, they are introduced in brief in the succeeding section. Stage theories are theories that are used in health behaviour issues. Many factors are considered in validating these theories. Weinstein *et al.* (1998) observed that four key characteristics typify stage theory: a category system, a sequence of categories, similar barriers to change within categories, and different barriers to change between categories. According to the authors, stages are a theoretical construct. We can define a prototype for each stage, but only few people match this ideal. Health behaviour stages are categories in which people exhibit relatively small differences within the same stage. People can also exhibit relatively large differences in varied stages. Stage theory provides accurate explanations when most people follow a specified sequence. Nevertheless, different paths towards an action can exist. People address the same issues before they can proceed to the next stage. Thus, the same barriers to change are encountered within a single stage (Weinstein *et al.* 1998).

Motivation theories and process theories are important because accumulated motivation-related issues are reasons for dropping out. These theories are introduced briefly in the next two sections, and are discussed at the end of this thesis.

Motivation theories

The motivation theories introduced in this study are Maslow's hierarchy of needs, McClelland's achievement motivation theory, and Herzberg's motivation and hygiene theory.

Maslow created the hierarchy of needs, which includes physiological needs, the need for safety and security, the need for love and belonging, the need for esteem, and the need for self-actualization. Examples of physiological needs are air, water, and food. Maslow deems these as individual needs, and that a lack of, for example, vitamin C, causes a very specific hunger for the items that have in the past provided this vitamin. When physiological needs are mostly taken care of, safety and security needs arise. Humans become increasingly interested in searching for safe circumstances, stability, and protection. The need for love and belonging are next in the hierarchy, in which individuals begin to feel the need for friends, a romantic partner, children, affectionate relationships in general, and even a sense of community. These are also part of what we desire in a career. Maslow noted two versions of esteem needs: a lower one and a higher one. Lower esteem needs include respect from others, status, fame, glory, recognition, attention, reputation, and appreciation. The higher form refers to the need for self-respect, including feelings, such as confidence, competence, achievement, mastery, and independence. Needs may direct you. Under stressful conditions, we can 'regress' to lower need levels, which are categorised into four deficit needs (D-needs). For example, when your family leaves you, you may view love as the only thing you have ever wanted. If you do not have enough of something, you feel a need, but once you acquire all of your needs, you feel nothing and the needs cease to be a motivating factor. Maslow presents these four levels in terms of homeostasis. Homeostasis is a principle similar to how a thermostat operates. When it becomes too hot, it switches heat off and turns on the cold. The last rung in the hierarchy is self-actualization and it differs from the four D-needs in that it is not characterised by homeostasis. When this stage is reached, desire for it continually grows. An individual constantly craves to fulfil his/her potentials. Only few of us can reach this level. (Boeree 2006.)

In McClelland's achievement motivation theory, all motives are learned and individual behaviour can influence them. Motives are arranged in a hierarchy of potential for influencing behaviour. People develop and they learn to associate positive and negative feelings with certain events that may directly or indirectly affect them. For example, a challenging task may stimulate pleasure for an

individual, and this person may experience an achievement motivation that drives him/her to complete the task. Achievement is at the top of the motive hierarchy. Situations have varied characteristics that enable people to attain success through their own efforts. Achievement situations present difficulty and risk, and a given situation must provide information on results in a timely manner. (Miner 2005.)

Herzberg's motivation and hygiene theory includes factors that contribute to satisfaction at work. These are the motivation factors. Job satisfaction is an outgrowth of achievement. It includes aspects, such as the work itself, responsibility, recognition, and advancement. As these factors are presented in an individual's work, this person's basic needs are fulfilled, thereby resulting in positive feelings and improved performance. Herzberg's theory also includes factors that contribute to dissatisfaction. These are the hygiene factors, including company policy and administrative practices, supervision, interpersonal relations, job security, physical working conditions, salary, and benefits. When hygiene factors are appropriately provided, they can resolve dissatisfaction and improve performance up to a certain point. They cannot generate considerably strong positive work-related feelings or high-level performance without having management move towards motivation. (Miner 2005.)

Process theories (cognitive theories)

In this section, process theories are introduced as cognitive theories, which include Vroom's expectancy theory, Adam's equity theory, and Locke's goal setting theory.

The principle of Vroom's expectancy theory (1960) is that people prefer certain goals over others. Feelings regarding specific outcomes are categorised as valence, which may either be positive or negative. Expectancy is the central variable of the theory. People link actions and outcomes, and choose amongst action alternatives in a rational manner to maximise effects. When force is linked to highly positive valent outcomes with strong effects, the ensuing force can be sizable. This theory is the basis for Porter and Lawler's model (1968). Their theory goes beyond the motivational force concept and extends to performance as a whole. (Miner 2005.)

Adam's equity theory maintains that striving for equity is a motivating force. Some inequities are also perceived, so that this force can be advanced. According to this theory, a person provides (inputs) something and earns (outcomes) something in return. For example, the input and outcome of employment

exchange are education and pay, respectively. An individual evaluates the equity of his/her own exchange relationship. Fair relationships are learned in the socialisation process. Inequity occurs when an individual's inputs and outcomes differ from those in the reference source. Equity occurs when an individual receives the same outcomes as that indicated in the reference source. (Miner 2005.)

Locke's goal setting theory indicates that clear goal setting should be performed, and that challenging goals are more encouraging than moderately challenging objectives. Locke and Latham's (1990) idea was to help people understand that goal setting should be specific and that difficult goals are effective. According to the authors, goals should be specific, measurable, and timed. Complex goals are achievable provided that people devote sufficient time, ensure clarity of goals, and enhance learning abilities. (Miner 2005.)

4.2   Research methods and setting

For the second case study, I recruited 40 participants (20 women, 20 men), who were interviewed by phone (appendix 3). Out of the participants, 34 have studied at the University of Oulu, and 6 have not yet begun the programme. The respondents major in IS/SE and entered the university at different periods. The second study was extended to autumn 2010, and more interviews with the same students were conducted (appendix 4). Nine students were chosen for a follow-up interview about motivation for decision making and emotions at the time of dropout decision.

I used grounded theory (Orlikowski 1993) for three reasons: it is useful in areas where no theory has been previously proposed; it incorporates the complexities of an organisational context into the understanding of phenomena; and it corresponds with the study process and change (Urquhart 2007). The third particularly fits the purpose of this case study.

Empirical data were collected through semi-structured qualitative interviews with dropouts. The questions were formulated without initiating a literature review. Because of personal experiences and conceptual structures of the phenomenon (Sarker *et al.* 2001), I tried to avoid having any pre-conceptions that may affect data collection and analysis. A theme interview was used only to support data collection, and was not the main instrument for data analysis. I asked questions that I was interested in, and endeavoured to avoid concluding that the results obtained represent final truth (Urquhart 2007). Most of the interviews were

recorded (only one was transcribed by hand). The proximate interviews lasted for 15 and interviews lasted for 6 to 35 minutes. The 40 interviews were then transcribed by Tutkimustie Organisation. I transcribed the 9 other interviews. Upon receipt of the transcribed documents, I initiated analysis with coding. I coded data items, which are incidents that are classified into categories. Coding (open coding, selective coding, and theoretical coding) was conducted as follows. An incident was coded by assigning it a descriptive category and then comparing it with other similarly coded incidents. The result was the emergence of the distinctive theoretical properties of categories (Glaser & Strauss 1967). The categories were then compared and the number of categories is reduced. Theoretical saturation was achieved because all new incidents that were reflected in the data could be incorporated into the existing categories of the model; no new information could be derived after this process. After this, I formulated a theory and identified conceptual categories (Glaser & Strauss 1967).

The semi-structured interview was not based on a direct literature review because I wanted to avoid making assumptions on incoming data. My aim was to generate new insights without holding pre-conceptions that may direct the research design and actual findings. Although a preliminary literature review was carried out, the main literature search was conducted after the data had been collected and analysed. Relevant literature was chosen after the theory emerged (e.g. Urquhart *et al.* 2010).

The analytic path followed in this thesis is as follows: data > open codes > selective codes > categories > theme.

4.3   Case two: Results

Main categories and their discovery through analysis

Figure 13 illustrates the main coding categories (upper side of the figure) and the levels between each category. The connections between the categories are represented in the figure, and I began from a bottom-up approach to demonstrate how the different categories were constructed.
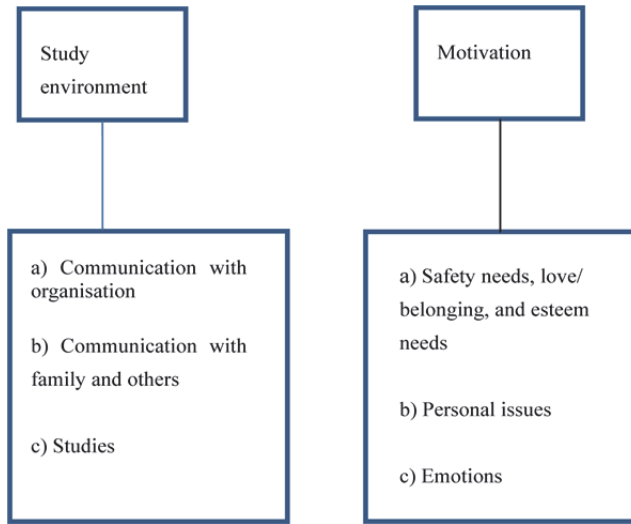
Fig. 13. Coding categories.

The construction of the two main categories is illustrated in Table 10. Open coding was carried out by analysing the interview data line by line. This coding approach is demonstrably fruitful (Urquhart 2007). Selective coding was conducted by concentrating on the categories that are connected to the core classifications. Theoretical coding involved considering the relationships between the categories. The memos that were created facilitated categorization. The next subsections present the analysis process and how different categories were discovered.

Table 10. Construction of categories.

Category	Selective codes
Motivation	Safety, love and belonging, and esteem needs
	Personal issues
	Emotions
Study environment	Communication with organisation
	Communication with family and others
	Studies

4.3.1 Motivation

I identified three selective codes that contribute to the motivation category.

Motivation

In the beginning of their studies, 14 of the men and 16 of the women exhibited motivation. Only 1 man and 3 women were unmotivated. One of the unmotivated women stated that she views her studies only as a hobby. Another woman said that she initiated her studies soon after she obtained her first degree, and the third woman indicated that her enrolment in the programme was her way of exploring what kind of studies are offered by the department.

The woman who did not enrol in the department was not motivated to study at all. Motivation is central to programme completion, but even when a student exhibits enthusiasm, the obstacles that he/she may face may prompt a dropout decision. Motivation can also fail when a student perceives a programme as not being right for her/him.

Extending the second case study enabled me to acquire more information on motivation status at the time of decision making and what kind of emotions were related to the decision. Motivation diminishes during the time a dropout decision is explored, as evidenced by six of the nine students. These findings are related to those for the second case study. The three students still exhibited motivation at the time they were exploring the possibility of dropping out. One of them was frustrated, whilst another was motivated but did not have sufficient time to study. She did not want to prioritise her academics. One man was motivated to continue his studies even as he had decided to drop out. His plan is to carry on with his studies at a later period, and he did not display any strong emotions as he made his decision. The illustrative statements that made up the open codes for selective coding of motivation are presented in Table 11.

Table 11. Construction of motivation category and its analytical memos, selective codes, and open codes.

Category	Selective codes	Open codes	Analytical memo
Motivation	Emotions	Stability Certainty	Students experience different emotions and difficulty during dropout decision time and after the decision has been made. Motivation to drop out or continue is observed. The two core emotions that arose were stability and certainty. Stability covers feelings, such as disappointment, anger, frustration, and annoyance. Certainty includes emotions that are related to correct decision making; examples are relief and satisfaction.
	Safety, love and belonging, and esteem needs	Health Work Family Field and studies	Safety, love and belonging, and esteem needs were discovered through data analysis. These are motivation-related and strongly influence dropout decisions. When safety needs arise, students drop out. Health issues and aging also give rise to safety needs, thereby diminishing the motivation to study. Loss of a family member is also a factor because family is central to everyday life. Safety in employment issues, such as work responsibilities and fear of unemployment, are also key factors. Motivation to drop out arises because there are safety needs that require addressing. Five students dropped out because of family needs (belonging). Some students realised that the field is unsuitable for them. Study direction and belonging needs affect motivation. Some students fulfilled their esteem needs through work duties, eliminating the need for studies. Previous degree holders do not see a need for completing the programme. Motivation and emotions are related to dropout decisions.
	Personal issues	Time, moving, locality	Personal issues were discovered through data analysis. These are motivation-related and strongly influence dropout decisions. Moving to a different city and studying at a distantly located university were obstacles to continuing studies. Lack of time was another reason for dropout. Motivation and emotions are related to dropout decisions.

Emotions

The two core emotions that arose were stability and certainty. Stability covers feelings, such as disappointment, anger, frustration, and annoyance. Certainty includes emotions that are related to correct decision making; examples are relief and satisfaction. Emotions affect the decision-making process. Many students felt annoyed and angry when they were compelled to drop out. Some students were forced to choose this option even when they wanted to continue their studies. The annoyance stemmed from having to give up an item that they still wanted. Some of the students were disappointed in themselves.

Positive effects arose in that the students felt relieved when they perceived their decision to be the correct one. These students view dropping out as an opportunity to pursue positive aims, such as having more time for themselves. The decision-making process also generated contradictory emotions or none at all. Some students spent years before finally making the decision to drop out, an experience that was very difficult. Some of the statements of these students, which formed the open codes for selective coding of emotions, are presented in Figure 14.
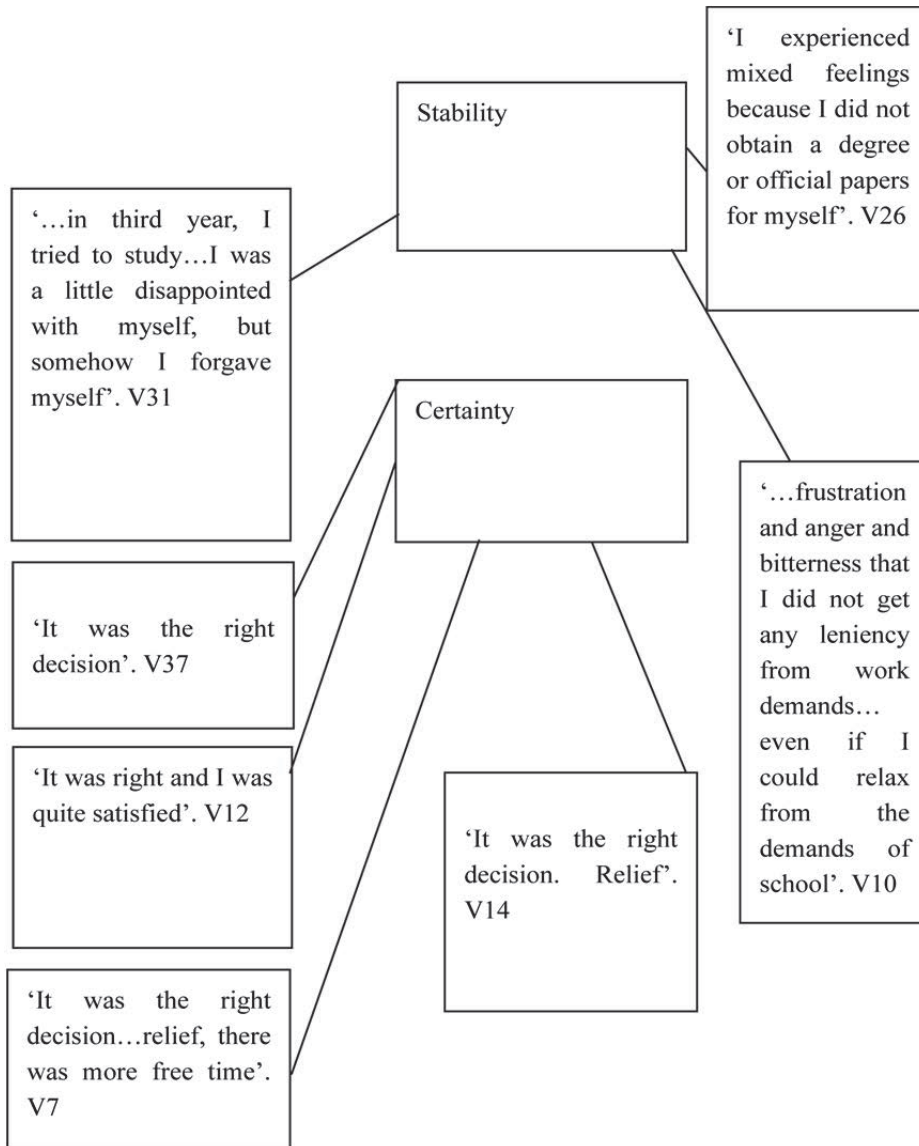
Fig. 14. Emotions.

Safety, love and belonging, and esteem needs

Safety, love and belonging, and esteem needs were discovered through data analysis. These needs are motivation related and strongly influence dropout decisions. They were the obstacles that compelled students to withdraw from the programme. Research shows that employment affords people safety. Without work, a person's concerns revolve around safety issues; the decision to withdraw from studies engenders the desire for some guarantee of safety. Some students fear that individuals without a degree will not be able to secure employment. Two interviewees believe that even when they complete the programme, they will not be able to find jobs.

> *'You realise that even if you graduate, you will probably be unemployed with the current skills that you have'.*
>
> *V5*

> *'One reason was that they provide too much education and there would not be enough work'.*
>
> *V36*

These statements clearly indicate the need for motivation. When students perceive no solid reason for completing a programme, they are demotivated from carrying on with their studies. Too much education was viewed as a good reason to drop out. One of the students feels that she will be overqualified if she continues to pursue her studies. She is comfortable in her present workplace. People yearn for safety in their employment, and a secure work environment eliminates the need to continue studying.

> *'As a bachelor's degree holder, I feel comfortable in my present work place; if I studied for a master's degree, then I would have been overqualified for this work. So I am not motivated to pursue a master's degree'.*
>
> *V7*

Concerns over bodily functions or aging can affect the development of safety needs. One student deems age as an influence on the desire for a degree.

> *'I do not know whether this kind of degree as a goal is still suitable for me…it may no longer be'.*
>
> *V3*

A healthy person is normally satisfied with her/his needs (Green 2000). Health-related concerns can drive people to explore safety issues. One of the students became ill, after which he attempted to pursue a vocational degree elsewhere. He was provided study grants, but his illness and transfer to a vocational programme drove him to drop out.

> *'I went to non-military service and came back; I became ill and then I wanted to take a vocational programme, but I had used up all my study grants. There was no point in starting over'.*
>
> *V29*

One of the students lost a family member, prompting the decision to withdraw. Such an experience points to the need for family safety.

> *'...so it was like spring reset everything. I could not study'.*
>
> *V3*

Family is a crucial factor that can drive dropout decisions. Four students struggled with family issues; that is, they wanted to spend more time with their families—a desire that is related to the need for love and belonging.

> *'At work, you are hurried...something has to be given up'.*
>
> *V6*

IT field and studies

The issues related to academic field and studies are connected to belonging and esteem needs. Many students realised that they were in the wrong discipline and consequently experienced disinterest in carrying on. Their directions in life changed, a phenomenon that affects motivation. Studying is no longer regarded as a need because the students consider that they will achieve their goals by directing their efforts elsewhere. Some students addressed this problem by transferring to another major. Motivation was directed elsewhere, a behaviour related to belonging needs.

Four of the students were accepted in a different field; hence, they dropped out of the IS/SE programme.

> *'I got into another school because the programme did not interest me'.*

V14

Nine of the students were uninterested in their current major.

'Yes, it was not the field for me and if I had been wise I would have dropped out earlier'.

V42

The demands of the field, such as coding work, was highlighted as another reason for dropping out.

'Some other things interested me more, and I was tired of coding'.

V37

One student stated that she did not find any interesting courses.

'I already did all the courses that benefit my work...there were no more interesting, useful courses to study'.

V4

Some students indicated that they were compelled to complete prerequisite courses before they become eligible to study those that they find stimulating. These prerequisite courses are seen as too dull. One student felt that what she was being taught does not correspond with reality.

'That was mainly work life related…the remaining courses were far from reality, so there was no need to get a degree'.

V1

Some students fulfil their esteem needs through work, prompting them to believe studying is a non-crucial goal. A previously obtained degree also satisfies the need for esteem. Some students had decided in the beginning of their studies that they will not aim to actually obtain a degree given that the courses are not directly related to the discipline itself.

'That was not degree related, so I did not plan to study more than what is appropriate'.

V21

One student indicated that she did not need another degree because she had already obtained one from another field.

88

'I have a master's degree from another field, but my work in this field is very interesting and challenging, so I will continue doing it'.

V24

One student enrolled in the programme only so he could apply for another.

'I got a degree from L… and I focus now on work.. In three years' time, I completed some courses that I needed to get into another programme'.

V39

Work

Work influences the motivation to study. Most of the students dropped out because of work-related issues. Two students stated that changes in work responsibilities prompted them to withdraw from the programme.

'The main reason was that work duties became more demanding'.

V31

Ten other students dropped out because their professional responsibilities demanded more time.

'Yes, my summer job changed into fulltime work. I tried to study and work at the same time, but then I got a new job offer that exposed me to the international IT field'.

V23

'There are many reasons but the most important is work; how to organise time for studies and work became an issue'.

V27

Two students view studies as non-beneficial to their work. When the benefits that studies provide are unclear, students become demotivated.

'I, noticed that I obtained maybe no benefits for work from my studies'.

V30

One of the interviewees stated that the company she works for demanded all her time, whilst another interviewee wanted to secure employment.

'My responsibilities in the company took so much time that I became uninterested in the field. I had no time to study'.

V26

'My problem is that if I study, then I cannot seek employment. This is the main reason I dropped out'.

V3

Some of the statements that formed the open codes of selective coding for safety, love and belonging, and esteem needs are shown in Figure 15.

'Yes, it was not the field for me; if I had been wise I would have dropped out earlier'. V42

'I got a degree from L… and I focus now on work.. In three years' time, I completed some courses that I needed to get into another programme'. V39

'That was not degree related, so I did not plan to study more than what is appropriate'. V21

'At work, you are hurried…something has to be given up'. V6

'…it was like spring reset everything. I could not study'. V3

Field and studies

Family

'I went to non-military service and came back; I became ill and then I wanted to take a vocational programme, but I had used up all my study grants. There was no point in starting over'. v29

'You realise that even if you graduate, you will probably be unemployed with the current skills that you have'. V5

Health

Work

'One reason was that they provide too much education and there would not be enough work'. v36

'Yes, my summer job changed into fulltime work. I tried to study and work at the same time, but then I got a new job offer that exposed me to the international IT field'. V23

'There are many reasons but the most important is work; how to organise time for studies and work became an issue'. V27

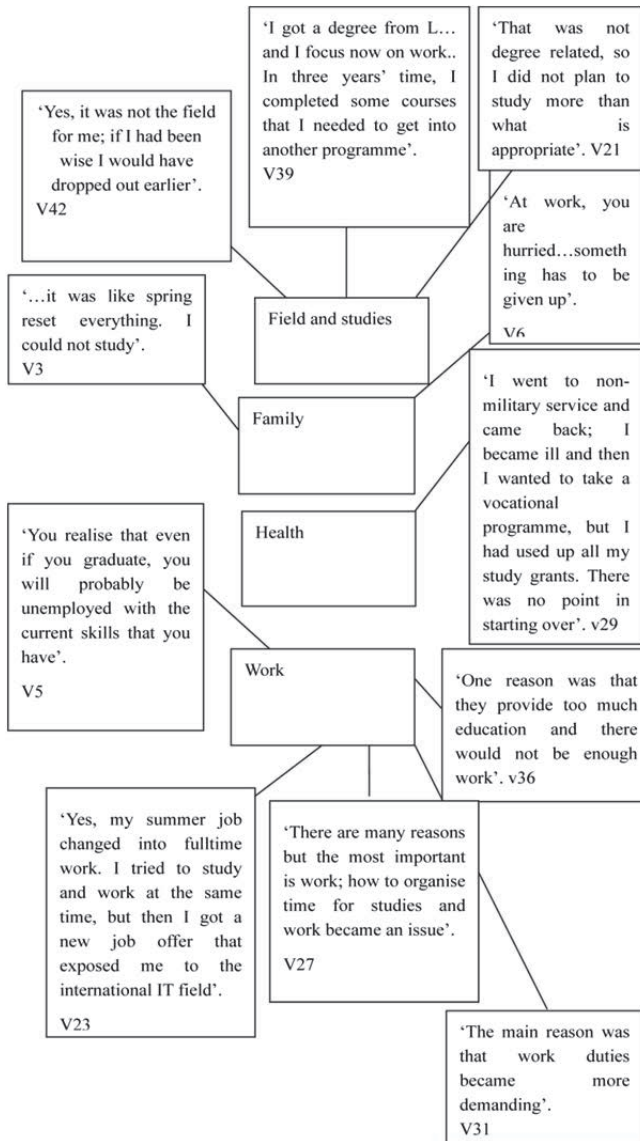'The main reason was that work duties became more demanding'. V31

Fig. 15. Safety, love and belonging, and esteem needs.

Personal issues

Personal issues are motivation related and strongly influence dropout decisions. Three students dropped out because they moved to a different town. When a university is located in another town, proximity becomes a problem. One student lived too far from the university. Another student declared a combination of moving and the level of education as demotivating factors.

> *'The first reason was that I moved localities, to K...so the distance from my home to the school was so long'.*
>
> *V32*

> *'There were personal reasons; I wanted to move to the southern area, but if the level of education had been better, I would have had a reason to stay'.*
>
> *V15*

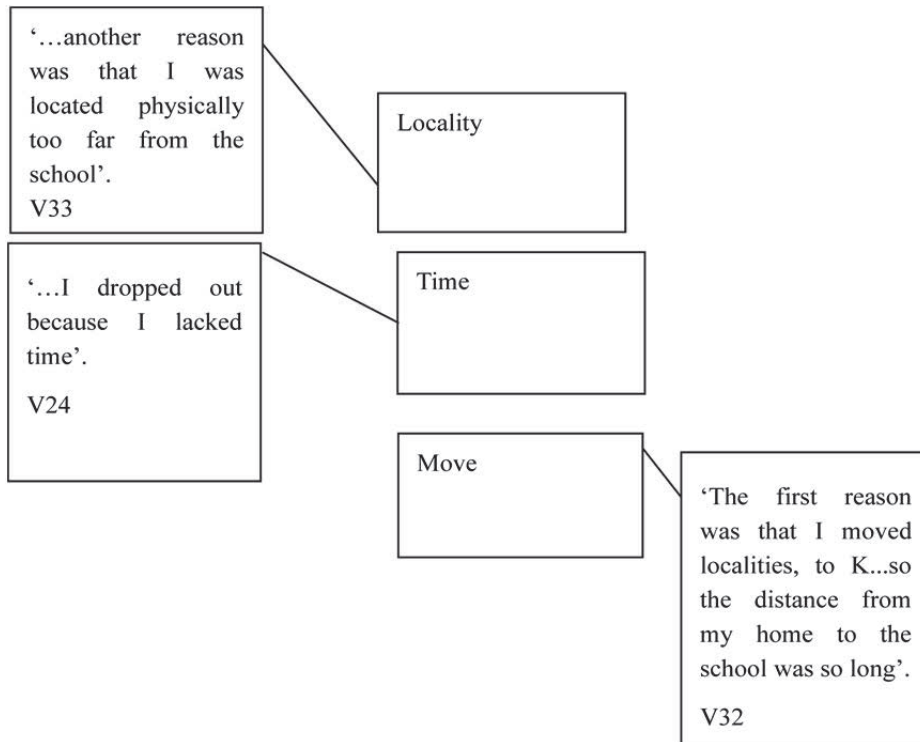> *'...another reason was that I was located physically too far from the school'.*
>
> *V33*

Five students dropped out because of lack of time.

> *'..I dropped out because I lacked time'.*
>
> *V24*

Some of the statements that formed the open codes of selective coding for personal issues are presented in Figure 16.

Fig. 16. Personal issues.

Connections between selected codes in the motivation category

The connections between selective codes in the motivation category are clearly observable. Safety, love and belonging, and esteem needs, as well as personal issues and emotions, were the obstacles that the students faced. Emotions arose during the dropout decision-making process. Such emotions are related to the obstacles and resulted in the decision to withdraw from the programme.

4.3.2 Study environment

I identified three selective codes that contribute to study environment issues. Table 12 shows the construction of the study environment category and its analytical memo, selective codes, and open codes.

Table 12. Construction of study environment issues category

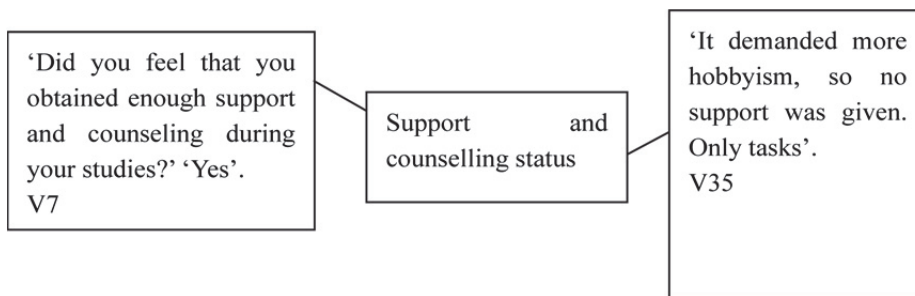| Category	Selective codes	Open codes	Analytical memo
Study environment	Communication with organisation	Support and counselling status	Mainly support and counselling; connection between communication and organisation and studies
	Communication with family and others	Support status	Communication with family, friends arise as factors in the organisational environment;
		Friends	social connections not a reason for dropping out
	Studies	Negative and/or positive experiences, grade, academic progress, study activities	Negative and positive experiences, expectations regarding studies and matching with actual experiences; most of the students were satisfied with their grades; most (18/34) were unable to attend classes full-time; progress was not same as classmates; connection between communication and organisation and studies

.

Communication with organisation

Most of the students (25/34) were satisfied with the support and counselling provided by the department. Eight students were dissatisfied. One of them declared that no counselling and support are provided for programming courses. Another mentioned that she needed counselling in practice activities. The students require extensive counselling as they formulate study plans; one of the respondents indicated that half an hour was insufficient to complete a personal study plan. Another student pointed out the excessive number of students in one group, so that no time is devoted to individual questions. Nevertheless, I found no direct relationship between dropout decision and support and counselling.
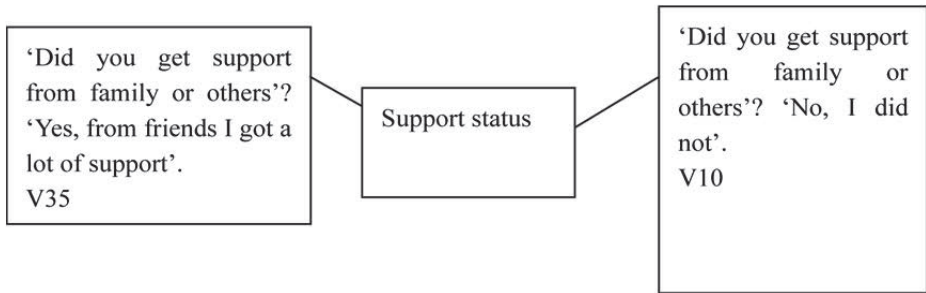
Some of the statements that formed the open codes of selective coding for communication with organisations are presented in Figure 17.

Fig. 17. Communication with organisation.

'Did you feel that you obtained enough support and counseling during your studies?' 'Yes'. V7

Support and counselling status

'It demanded more hobbyism, so no support was given. Only tasks'. V35

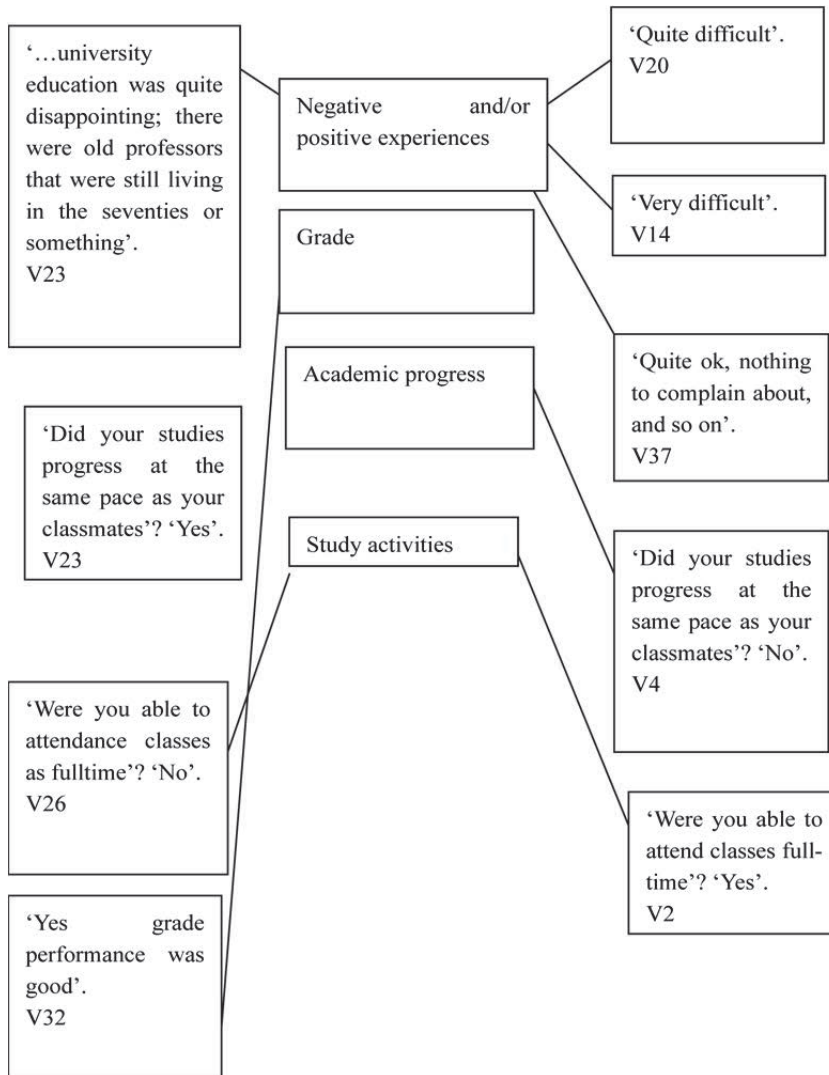*Communication with family and others*

Most of the students (23/34) obtained support from family and friends. Nine students received no support. Out of these nine, three indicated that they were provided support but that such assistance was not directly related to their studies. Most of the students relied on friends (24/34). Only 10 students did not receive support from their peers. No connection was found between the decision to drop out and social connections. Figure 18 shows the illustrative statements that formed the open codes of selective coding for communication with family and friends.

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┌──────────────────────────┐        ┌──────────────┐        ┌──────────────────────────┐
│ 'Did you get support     │        │              │        │ 'Did you get support     │
│ from family or others'?  │────────│ Support status│────────│ from  family  or         │
│ 'Yes, from friends I got a│       │              │        │ others'? 'No, I did      │
│ lot of support'.         │        │              │        │ not'.                    │
│ V35                      │        │              │        │ V10                      │
└──────────────────────────┘        └──────────────┘        └──────────────────────────┘
```

Fig. 18. Communication with family and others.

Studies

Students had both negative and positive experiences during the course of their studies. They indicated that their studies were acceptable, and that the educational level was good or reasonable. Others regarded the courses as challenging and interesting. A few considerably enjoyed the courses and were impressed with the methods presented by the instructors. Some of the students also indicated disappointment with professors, difficulty of the courses, and not having been provided with an accurate picture of the field. Some of the courses were viewed as either enjoyable or dull. A few identified useful and interesting, but excessively technical courses. The excessive theoretical nature of some of the courses was likewise pointed out, and programming courses were generally considered excessively difficult. Altogether, 22 students were satisfied with their grades and 11 were dissatisfied. Nonetheless, grades were not identified as a reason for dropping out. Figure 19 shows the illustrative statements that formed the open codes of selective coding for studies. Most of the students mentioned (21/34) that their expectations were satisfied, although none of them elaborated on why they evaluated the studies as such. Eleven students stated that their expectations were not met because of the lack of practicality and the excessive theoretical nature of the courses. Most of the students (25/34) did not progress in their studies at the same pace as their classmates; only nine kept pace with their peers. Twelve students were able to attend classes full-time, whilst the rest (18/34) were unable to do so primarily because of work.

Fig. 19. Studies.

Connections between selected codes in the study environment category

Communication with organisations and with family and friends demonstrates that no direct relationship exists between dropout and support and counselling. The results also show no connection between dropout and social connections. For the

most part, the students received adequate support from family and friends. Communication between organisations and communication with family and friends are therefore unrelated. The only association is that the students received assistance from both parties. Additionally, I found no relationship between selective codes, such as studies and communication between organisations. These factors are largely related to counselling issues/communication with organisations, and affect student performance in certain courses. This observation is evident in problems such as the lack of counselling and support for programming courses and practice activities. These aspects are related to communication with family and friends because relationships were a source of support during the respondents' studies.

4.3.3 Dropout student profile

The results indicate that different student profiles can be extracted from educational backgrounds. These are important because they enable the determination of whether the differences in such attributes influence dropout decisions. They also provide in-depth information on the research population. I extracted two different dropout profiles: sixth form school students and students with different degrees. The students were 19 to 52 years old. These profiles reflect information about gender, student status (full-time, working, part-time student), marital status, motivation status, and reasons for dropping out at different periods throughout the programme. Twelve of the women and five of the men were sixth form school students. Three and fourteen men and women had obtained degrees from other fields. Ten women and one man were pursuing a master's programme. Fourteen men and nine women were original students of the programme. Students who have acquired a degree from other fields typically work and study at the same time. The sixth form school students provided different reasons for their pursuit of the IS/SE programme. These were ease of entry into the programme, non-requirement for mathematics, novelty of the field, and admission into the school; other students viewed the programme as a hobby, a popular field, and an acceptable and interesting discipline that presents promising employment prospects.

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Sixth form school students

Students go through many stages before they finally decide to drop out. The desire to drop out becomes clear after one year. After this time, students begin to realise that the field is uninteresting, possibly motivating them to switch majors. Some others receive job offers after year one, so that their studies are interrupted.

In the period between the beginning and end of second-year studies, the reasons students drop out are the same. In this stage, some students recognise that the field is not a fit for them, and personal issues, such as moving to another town, illness, loss of a family member, and love arise. Two students pointed out that they could not keep up with their classmates and that they felt left behind.

After studying for three or more years, students indicate work-related challenges as determinants of dropout decisions, indicating that when student are compelled to give up an aspect of their lives, studies are not seen as equally important as family and work. All the students felt no need for a degree, even when they have not previously obtained a diploma.

Previous degree holders

The reasons for entering the IS/SE programme were interest in the field, interest in computers, desire for higher education, appropriateness of courses, pursuit of a hobby, desire for credentials for a teaching post in the field, goal of completing post-graduate studies, search for employment opportunities, acquisition of benefits from work. These students also go through stages before the final dropout decision is made.

After year one, the students begin to view coding and the field itself as uninteresting. Students who have families forgo studies, even before they begin, to prioritise their loved ones and their work. Some do not believe that studies benefit their professional lives, whilst others perceive overqualification as a risk that stems from studying. The rest of the students attended only the courses that they believed to be useful to their work, indicating as well that they did not find any interesting courses.

After the second year, the following factors are identified as the drivers of dropout: students attend courses that will facilitate admission into another programme; increasing work demands; proximity from the campus; unrelatedness of the courses to the degree programme; shifting to other majors; fear of

unemployment in the field; moving to another city; family issues; and lack of time for studying.

After year three or more, reasons vary amongst students. Students drop out because of lack of time and the fact that they do not actually need the degree. For some, a bachelor's degree is sufficient, making a higher degree unimportant. Moving to another locality is also a factor.

Table 13. Student profiles.

Sixth form students	Previous degree holders
12 men and 5 women	3 men and 14 women
Full-time student	Usually working
8 students are single and 9 are married, live with someone, or have children at the beginning of studies	16 students already had a family at the beginning of studies; only 1 is single
1 man and 1 woman were not motivated to study. The other 15 were motivated to study at the beginning.	Only 2 were not motivated at the beginning of studies. Reasons were the student viewed studies as a hobby; other stated the she studied too soon after she obtained her first degree. 15 were motivated to study at the beginning.

Comparing the two different profiles shows that students who have previously earned a degree are confronted with social issues at an earlier than are sixth form students. In addition, previous degree holders often have busy professional lives. Many such students (n = 16) already had families (husband/wife and/or children) in the beginning of their studies. Only one of them is single. Amongst the secondary school graduates, 8 are single and 9 are married, live with someone, or have children. This family situation may be the reason why some students encounter issues related to social variables earlier than do others. Previous degree holders also prefer not to study at the expense of family time.

I created nine different student profiles from the data on the second case study. These profiles contain information on gender, student status (full-time, working, part-time student), starting year, credits, education, marital status, motivation status, emotions during and after decision making, and reasons for dropout at different periods. These profiles are listed in Tables 1–9 in Appendix 1.

Dropouts can also be categorised according to reason: itinerant students, fillers, working students, family-centred students, students with safety needs, and appellants.

Itinerant students

This category includes students who realise notice that they are not suited for the field. In seeking out the lives that they desire, they enter different schools or explore which courses interest them. The factors that drove these students to drop out are exacting demands, such as coding, and the absence of interesting courses.

Fillers

These are the students who have decided in the beginning of their studies that they will not attempt to obtain a degree or will attend courses that facilitate admission into another programme. One of the students views the courses as unrelated to the degree, whilst another does not see the need to complete the programme given that she is already a previous degree holder.

Working students

Working students dropped out because of issues related to their current jobs. They had began attending classes, but work is an essential precondition for engaging in studies and the two responsibilities began conflicting with each other. Work duties and time demands were stated as the factors that drove dropout decisions.

Family-centred students

These students hold family with considerable reverence and their desire to spend more time with their loved ones ultimately brought about the decision to withdraw from the programme.

Students with safety needs

These students were concerned about safety issues, such as employment, aging, health, and loss in the family. Employment affords people security. Some students feared unemployment after graduation, impaired bodily functions or aging, and losses in the family. These factors were sufficiently compelling to bring about the decision to drop out.

Appellants

These students are those that were confronted with personal changes. The most commonly stated reasons for dropping out were moving to another locality, poor level of education, proximity to the campus, and lack of time.

4.3.4 Attitudes towards the field and reasons for entering the IS/SE programme

The results of the second case study data highlight women's positive impression of the IT field. The case one (essays) results suggest that although many of the girls do not consider IT to be their future profession, they nevertheless have positive attitudes towards the field. They view it as a constantly developing and respected realm, and labelled it the field of the future. Case one also demonstrates that the desirable employment prospects and benefits encouraged the girls to choose the IT field. In case two (interviews), the women similarly regard an IT background as crucial in the employment market and that numerous employment possibilities are available in the industry. The men have primarily positive images of the IT field, seeing it as dynamic and encouraging of making one's own mark. Programming is considered representative of this discipline.

Table 14. Women's views of the field.

Field	
Positive, field of future 1 V22	Know-how of the field is needed in employment markets 1 V12
Easy 1 V5	
Technology-based 1 V26	No problems, have previously worked in this field1 V7
Shortage of women, guaranteed employment 1 V14	
Guaranteed employment and meaningful work 1 V36	Employment opportunities are broad 1 V38
	Interesting 1 V30
Familiar field (via previous education) 1 V32	Education expected to be modern and interesting 1 V31
Clear understanding of the field 1 V21	
No impression 1 V20	Popular field and good working opportunities 1 V16
Quite positive and interesting 1 V4	Useful even if not actual profession 1 V24
Good insight 1 V41	Opportunities to go forward and quite interesting 1 V10

Table 15. Women's reasons for entering the programme.

Reasons for entering the programme	
FIELD	WORKING LIFE
Interesting 4 V24, V30, V36, V10	Useful in work life 2 V12, V4
Interesting, appropriate courses 1 V21	Presumed guaranteed employment 2 V20, V3
	Shortage of women, guaranteed employment, nothing better came up 1 V14
STUDIES	Good working opportunities 2 V26, V38
Related to previous education 1 V41	Widen know-how, better employment opportunities 1 V16
	Interest in postgraduate studies, frustrated over work duties 1 V31
	OTHER
	No need FOR mathematics 1 V5
	Popular in the beginning of 2000 1 V11
	Interest in postgraduate studies 1 V7
	Training for teaching position 1 V32

Unlike the girls, the women provided more wide-ranging reasons for entering the IT field, whether in terms of academics or career. Examples include the possibility of attending postgraduate studies, training for a teaching position, and broadening of horizons. Both groups highlighted the advantage of having varied employment opportunities. An interesting aspect was mathematics. One of the women stated that she was attracted to the field because it did not require mathematics skills; by contrast, four girls were discouraged from pursuing the programme because they perceived a premium on mathematics and physics. The perspectives of these respondents are clearly contradictory—an issue that will be resolved by providing truthful, in-depth information about the IT field. Meanwhile, both groups view the discipline as interesting.

The perspectives amongst the men were more similar than those amongst the women. To the former, programming is regarded as a central component—an observation that was more prevalent amongst the men than amongst the women.

Table 16. Men's views of the field.

Field	
You can work in Nokia V28	Dynamic field, opportunities for different kinds of work 1 V33
No clear view 3 V15, V35, V34	
Different in practice V42	Programming, narrow picture 1 V39
Quite realistic, long days, programming 1 V2	Programmes should be done 1 V1
Programming, quick and dynamic field 1 V23	Technical side 1 V6
	Programming 1 V40
	Good salary, no demands, nice studies 1 V18
	Normal 1 V37
	Interesting field, career development depends on individuals, many opportunities V27

Views do not match and the field was uninteresting

Nine students indicated that their expectations were not satisfied. Such a situation highlights the necessity of providing a comprehensive awareness programme for students to thoroughly understand what the programme and associated professions entail. Unclear perspectives regarding the field can cause problems that may eventually induce dropout decisions.

Seven students did not have a clear understanding of the field and the courses offered in the programme at the time they applied for admission. They later dropped out because they found their studies uninteresting.

'...different from practice'.

V76

'not really, no perspective...I just waited nervously for what was to come'.

V35

Two students thought the courses would be easily completed as they applied to the school. Their initial views did not match actual situations. Hence, they dropped out because they found the courses excessively demanding. An exhaustive information campaign can also serve as a preventive measure for this problem.

'What kind of view did you have of the computers science field and of the courses at the time you applied to our school'??

'I thought that in the beginning, the studies were a little easier, or that we would start from the basics, but it was quite demanding right away'.

V14

'Easy'.

V5

Entry into university

One student attended the programme because he found it easy to acquire admission. He eventually withdrew because the programme did not stimulate him.

'Why did you apply'?

'It was easy to get in'.

V2

This result may mean that the IS/SE programme may be regarded merely as a means of entry into university. After admission, students may switch majors, indicating the assumption that entry into any programme is a guarantee that students can change their academic directions at any time.

Reasons students did not initiate studies

The reasons students did not pursue studies at all revolve around personal and work–related issues. A student moved to another locality, and seized the opportunity to study at another university.

'.. I applied to Tampere and got in. Change of locality. There was no other reason'.

V22

One student wanted to live in south Finland and was annoyed because he did not obtain of the letter of admission for school. It was delivered to a different address and it was too late when he received it.

'...the papers were delivered to my earlier place and they asked me what to do with it. I was in Helsinki and the papers arrived one year later. I am familiar with the metropolitan and I am studying physics there'.

V25

Four students stated that they decided to forgo studying even after being accepted into the programme. One of them was offered a promotion at work and another got a new job. One of the students was assigned different responsibilities.

'Work duties was the reason'.

V17

'I got a promotion and my workload grew. I had no time for studies'.

V19

Table 17. Reasons for not initiating studies at all.

Personal reasons	Work
Moving 1	Work 4
Locality 1	

4.4   Construction of the categories

Table 18. Construction of categories.

Category	Selective codes	Open codes
Motivation	safety, love and belonging, and esteem needs	Health
		Work
		Family
		Field and studies
	Personal issues	Time, moving, locality
	Emotions	Stability
		Certainty
Study environment	Communication with organisation	Support and counselling status
	Communication with family and others	Support status, friends
	Studies	Negative and positive experiences, grade, academic progress, study activities

The categories were grouped to determine the emerging theory. The two main categories and their relationships that were formulated in the previous coding phases were used as bases. A framework for understanding the dropout process of IS/SE students was developed. Two main categories emerged: (1) motivation and

(2) study environment. The theory type can be classified as explanation theory, which explains 'what is', rather than predicts issues (Gegor 2006).

According to Glaser (1978), theoretical coding is the process of examining the relationships between categories. These are introduced in the succeeding section.

4.5   Case two: Discussion

The categories were constructed, and the core findings are discussed. The core findings derived through the proposed process theory are discussed as follows. First, motivation was affected by the need for safety, love and belonging, and esteem, as well as by personal issues and emotions. Needs may direct dropout decisions. Second, the main emotions that arose during the dropout process were stability and certainty. Students are usually confronted with different emotions at the time dropout was decided and after the process ended. Third, students dropped out primarily for work-related reasons. Fourth, many students realised they were in the wrong field, demotivating them from continuing their studies. Some feared the possibility of unemployment. Fifth, moving to a different city or studying at a distant university were obstacles to some students. Personal issues, such as lack of time, was also a because academics drew the students' attention from other responsibilities. Sixth, social issues, connections to family, and loss in the family drove some students to withdraw from the programme. Seventh, most of the students were unable to attend classes full-time. Finally, some students did not progress at the same pace as their classmates.

4.5.1 Ways of preventing dropout

In Chapter 1, I provided a glimpse as to how student dropout can be prevented. The curriculum of the University of Oulu (2011) features different steps during the course of academic study, which can be included in the information provided to incoming students:

– Admission into university
– Acceptance in campus residence
– Orientation
– Study design (personal study plan)
– Career planning

- Studying abroad
- Training in Finland or abroad
- Thesis
- Graduation
- Employment

The most effective measures for preventing student dropouts is the provision of comprehensive information about the programme, and the provision of sufficient counselling and support, not only by the department but also by students' employers. Motivation status and views should be checked at the beginning of the school year, a task that can be accomplished through interviews. This approach enables educators and policymakers to understand what drives students to apply and enter a programme. More information should be provided to sixth form students so that they are fully aware of what to expect from their academics. A tour of a university can be offered, in which students can visit the campus and sit in classes to help them determine whether a particular discipline fits their preferences and goals. The number of admitted students emerges as a critical issue given that students tends to use a certain programme as a stepping stone to another academic route. Are the admission requirements too flexible or lenient? This issue is prevalent in other fields as well, indicating that it is a problem worth pursuing in future research and policy discussions amongst university heads.

Study planning in universities should be more precise. Students are reluctant to share their problems in a group setting; thus, individual counselling is an effective alternative because such a setting will enable students to discuss their study plans at length. On the part of counsellors, they should exert more efforts towards monitoring student performance. This monitoring scheme can be implemented over a six-month period, after which low-performing students can be interviewed to identify critical problem areas. Self-regulation skills can be taught at the beginning of the semester; these can include time management and goal setting skills. More support for programming courses is needed because such classes are typically regarded as difficult.

An orientation designed to explain the importance of studies and time should be held. Educators should clearly explain that university studies require commitment because they are full-time work. For students who work whilst studying, specially designed education programmes can be offered. Coursework that does not entail prerequisites should be part of the curriculum to enable individual completion of each class. This issue should be considered from a

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departmental point of view. Retaining working students necessitates a more flexible programme, one that will permit studying during evenings and weekends. Although a department cannot ensure that such programmes will provide students the optimal environment that they require, considering their needs may be a way of projecting that educators are genuinely invested in student progress. Through such programmes, the university can foster attitudes that are encouraging of achievement.

External factors are a constant issue. Educators cannot completely eliminate the effects of such elements, but they can provide an academic environment that enhances the motivation to pursue academics. We can fulfil belonging needs by offering avenues in which students can form friendships, such as group activities and social events. In terms of academics, coursework that is accomplished in groups can encourage collaboration. Universities should consider the possibility of initiating joint efforts with employers. Activities, such as internships, are an effective way to train students to cope in real-world settings. A partnership between enterprises and universities may also be a way of reminding students of their commitment to their work and their studies. There should be an incentive scheme intended to improve academic progress. Universities can offer courses that can be accomplished at different stages so that students can gain study points and then decide course to attend next. Pair-programming can resolve the difficulties encountered in programming exercises. This measure provides academic support and enables the establishment of social connections. Time allocation for studies can be scheduled in such a way that students perform tasks at the same time (an approach implemented in medical schools); group members working together can motivate one another.

4.5.2 Limitations of the study

Similar to any other study, the current research has its limitations, specifically of a statistical nature. One limitation can be that no earlier research has been found to validate that students drop out of IT courses more than other courses. A small sample size was chosen, but I believe the interview data are sufficient given that saturation was achieved (Seale 1999). The study environment can also be viewed as a limitation, but the fact that actual settings (which reflect in the university's culture and high-technology nature of society) were chosen diminishes the effect of such a limitation. Students were randomly selected because Myers and Newman (2007) suggested that researchers should avoid interviewing only certain

groups (e.g. employees in an organisation). The interviewees were selected from all listed dropout students that have not engaged in studies or were not enrolled in the school for two or more years. This list was used to ensure the sample included actual dropouts. The sample comprises 140 students (70 women and 70 men), and I obtained the phone numbers of 77 students. From these, I interviewed 40: 37 did not return my calls or did not want to answer my questions.

4.5.3 Implications for research

Although extant literature has aided our understanding of the reasons students drop out of CS courses, university studies, and online learning programmes, I found no study that presents the trajectory of the dropout decision making process. A process standpoint is significant because dropping out is a dynamic process that develops through a number of stages.

On the basis of the findings, I highlight some areas that require further investigation. A direction worth exploring is determining the effect of courses on final dropout decisions. Do certain courses impose a stronger effect than others on dropout decisions (e.g. programming). Is pair-programming an effective measure for enhancing academic performance and can it influence dropout decisions? I also recommend a longitudinal study, in which students are observed from the beginning of the programme to ascertain whether there are differences in motivation during the course of study and in the final dropout decision. Scholars can also conduct studies similar to the current work in other countries and compare results – are there cultural differences?

4.5.4 Implications for practice

I outline implications for practice on the basis of the empirical results. As discussed in Subsection 4.5.1, some of the practical implications have to do with providing in-depth information regarding the programme, as well as adequate support and counselling services. Students' motivation status and views should be determined upon admission. Study planning should be more precise. Students tend to keep their problems to themselves; thus, one-on-one counselling is the best route to ensure performance monitoring and identification of problem areas. Self-regulation skills should be fostered to equip students with the capacity for efficient time management and goal setting. Universities can also create an environment that enhances motivation by initiating activities such as group work

and pair-programming. Educators should consider putting in place different or specialised programmes for working students. One recommendation is to establish joint efforts with employers for practical work and internships. Incentives are likewise crucial to improving academic progress. Accomplishing courses in different stages, for example, will enable students to earn study points and decide which course is next on their priority list. Scheduling study times in such a way that promotes group work enhances academic performance and promotes socialisation. Finally, because external commitments are a constant, universities can help students cope with the demands of both academics and professional life by fostering the right attitudes.

4.6   Case two: Conclusion

This study provides exhaustive information on the factors that affect dropout from IS/SE studies, and offers recommendations on preventing student dropout. Some key findings are related to motivation, which was affected by the need for safety, love and belonging, and esteem, as well as by personal issues and emotions. The occurrence of such needs and issues are barriers to studying. Two primary emotions arose from the dropout process: stability and certainty. Students indicated feelings of disappointment, anger, frustration, annoyance, as well as relief and satisfaction. A frequently cited factor is work, whilst some students realised that they were in the wrong field. Some were required to move to a different city or study at distantly located universities, thereby prompting the decision to abandon the programme. The other issues that emerged were lack of time, social issues and familial connections, loss in the family, failure to attend classes full-time, and divergent levels of progress amongst students.

4.7   Building the theoretical framework

This chapter presents the theoretical framework that is constructed on the basis of the categories and findings. The main categories are motivation and study environment. A summary of the profiles of dropout students is also provided.

4.7.1 Summary and conclusions for motivation and study environment

The summary and conclusions for the motivation category are presented in Table 19. The table also introduces the main findings for the motivation category. The study environment category is illustrated in Table 20.

Table 19. Summary and conclusions for the motivation category.

Motivation
-Motivation was effected by safety needs, love and belonging needs, esteem needs, as well as personal issues and emotions.
-Needs may direct dropout decision making. When safety needs arise, students cannot concentrate on studies because there are other needs that require addressing.
-Two primary emotions arose: stability and certainty. Stability includes disappointment, anger, frustration, annoyance. Certainty includes emotions that are related to relief and satisfaction.
-Students faces a range of emotions during decision-making time and after the decision has been made.
- Emotions affected the decision-making process. Many students felt annoyed and angry when they had to drop out. The positive emotions were those related to relief, particularly when a student perceives the decision to be the right one.
-Motivation usually drops during decision-making time. Motivation has a direct effect on dropout decisions.
-The main motivation for continue studying stemmed from the field and studies, work-related issues, personal reasons, and social reasons.
- Students dropped out primarily because of work-related factors, such as changes in work responsibilities.
- Many students realised that they are in the wrong field, diminishing the desire to continue studying. Some students feared unemployment.
-Some students had to move to a different city or studied from a distantly located university. Personal issues, such as lack of time, were other reasons.
-Social issues and connections to family were mentioned. The loss of a family member was another reason for dropping out.

Study environment

Table 20. Summary and conclusions for the study environment category.

Study environment
-Most of the students were satisfied with the support and counselling from department.
-Eight students were dissatisfied with support and counselling. One of them stated that no counselling and support were provided for programming courses. More counselling was required for study planning; half an hour was insufficient for drawing up a personal study plan. One mentioned that too many students

Study environment
were assigned to a single group, so that not enough time was devoted to individual questions.
-There was no direct relationship between dropout and support and counselling.
- Most of the students received support from family or friends.
- Most of the students had friends.
- There was no connection between dropout and social connections.
-Students had negative and positive experiences, and their expectations did not correspond with actual experiences.
- Most of the students were satisfied with their grades.
- Most of the students were unable to attend classes full-time.
- Progress amongst students differed.

The summary of the profiles of student dropouts is shown in Table 21.

Summary of the profiles of dropouts

Table 21. Summary of dropout student profiles.

Summary of the profiles of dropouts
-Two main profiles were used: sixth form school students and previous degree holders.
- These profiles contain information about gender, student status, marital status, motivation status, reasons for dropping out at different periods.
-Previous degree holders were confronted with social issues (e.g. need for more time with family) at an earlier time than were sixth form students. Previous degree holders often struggled with work schedules.
- Dropouts can be categorised by reason for dropping out: itinerant student, fillers, working students, family-centred student, students with safety needs, and appellants.

4.7.2 Towards a process theory

Process theory explains all the findings on the reasons for dropout decisions, and how motivation-related issues are central to the dropout process. Dropout decision making emerged as a central theme. A process model that explains the entire process of dropout decision making is shown in Figure 20. The main categories affect the decision process.

Process theory elucidates the manner by which students make the decision to drop out of the IS/SE programme (Figure 20). The process begins with the decision to enter the programme. In this phase, students have decided to apply for admission and explain why they want to major in this discipline, as well as the views that they holds towards IS/SE. Between phase 1 and 2, the students decide on the University of Oulu as the school of choice. Phase 2 is the period at which

they decide whether to engage in IS/SE studies; that is, the students have chosen a university but have not yet made up their minds about whether to push through with entering the school. In this phase, some students decide not to pursue studies after all, which brings them to phase 5, the period at which the students decide to drop out. They then make other plans. Students who decide to enter the programme proceed to phase 3, in which they observe the context within which they are studying. Students have expectations when it comes to their academics, and at this period they determine whether such expectations match actual experiences. They meet new people and either form friendships or not. They either receive support and counselling or not. They acquire experiences during the course of their studies, which they either find enjoyable or not. Between phases 3 and 4, the students will face motivation-related issues, which they have to cope with specifically in phase 4. The motivation-related issues that confront them are classified into two classes: (1) safety, love and belonging, and esteem needs; and (2) personal issues. Emotions arise in phase 5. Between phases 4 and 5, the students continue to endeavour to complete the programme, but they increasingly feel the constraints of factors, such as limited time and familial responsibilities. In phase 5, the students ponder over whether to drop out or carry on studying. If they decide to persist, they return to phase 3. If they opt to drop out, they abandon the programme and experience a range of emotions in the process. Some will experience relief, others will experience anger. The emotions vary depending on a student's reaction to the decision to drop out. It is not always an easy decision for students. After the emotions have subsided, students come to terms with the decision and make future plans.

The process theory model presented in Figure 20 is a lifecycle theory based on van de Ven & Poole (1995). It features stages/phases that occur in a specific sequence. The theory proposed in the current work has elements identical to the lifecycle theory: The proposed process model can also be viewed as stage theory because it contains elements that Weinstein *et al.* (1998) have observed as central to stage theories. These elements are listed in Tables 22 and 23.

Table 22. Theoretical elements of the model (modified from van de Ven & Poole 1995 and Weinstein 1998).

Element	Description	Theoretical background	Description in the current research
Stage	Stages are theoretical constructs.	Weinstein *et al.* (1998)	Dropout process stages: Decision to enter the field and pursue studies; decision to start or forgo studying; studying, facing obstacles; decision to drop out or persist; confronting emotions.
Barrier	People face the same barriers in the same stage before they can progress to the next stage.	Barriers (Weinstein *et al.* 1998) occur in stage.	Obstacles occur in stages. If obstacles occur and students cannot overcome it, they decide to drop out.
Transition	Movement between stages	Movement from stage to the following stage (van de Ven 1992)	Transition from each stage to another.
Trajectory	Trajectory is usually prefigured in the lifecycle model.	Description of stages and transitions from stage to the following stage (van de Ven 1995)	Trajectories are based on study trail and dropout process stages
Unit of change	There are two different angles for studying change in the organisational level: single entity and multiple entities.	van de Ven and Poole 1995	The current work focuses on a single entity—the student.
Mode of change	Sequence of change events is prescribed a priori or progression is constructed and emerges as change process opens.	van de Ven and Poole 1995	Proposed process model operates in a prescribed modality, similar to how lifecycle and evolutionary theories operate.
Progression of change	The progression of change (events) occurs.	van de Ven and Poole 1995	Progression of change events is unitary, which is cumulative and conjunctive

Table 23. Theoretical elements of the model based on Weinstein *et al* (1998).

| Element	Description	Theoretical background	Description in the current research
Stage	Stages are theoretical constructs.	Weinstein *et al.* (1998)	Dropout process stages: Decision to enter the field and pursue studies; decision to start or forgo studying; studying, facing obstacles; decision to drop out or persist; confronting emotions.
Sequence of stages	There is one prevalent path through stages. Still, other paths towards action are possible.	Weinstein *et al.* (1998)	Student goes through dropout process stages, but some students drop out even before starting to study. Their path is different.
Common barriers to changes (same stage)	People face the same barriers in the same stage before they can progress to the next stage.	Weinstein *et al.* (1998)	Student faces motivation-related barriers.
Different barriers to changes (different stages)	Some barriers are more important at certain stages than others.	Weinstein *et al.* (1998)	In phase 4, student faces motivation-related issues that are classified into two classes: (1) safety, love and belonging, and esteem needs; (2) personal issues. These barriers are more important than others, and drive students to drop out.

The Process model
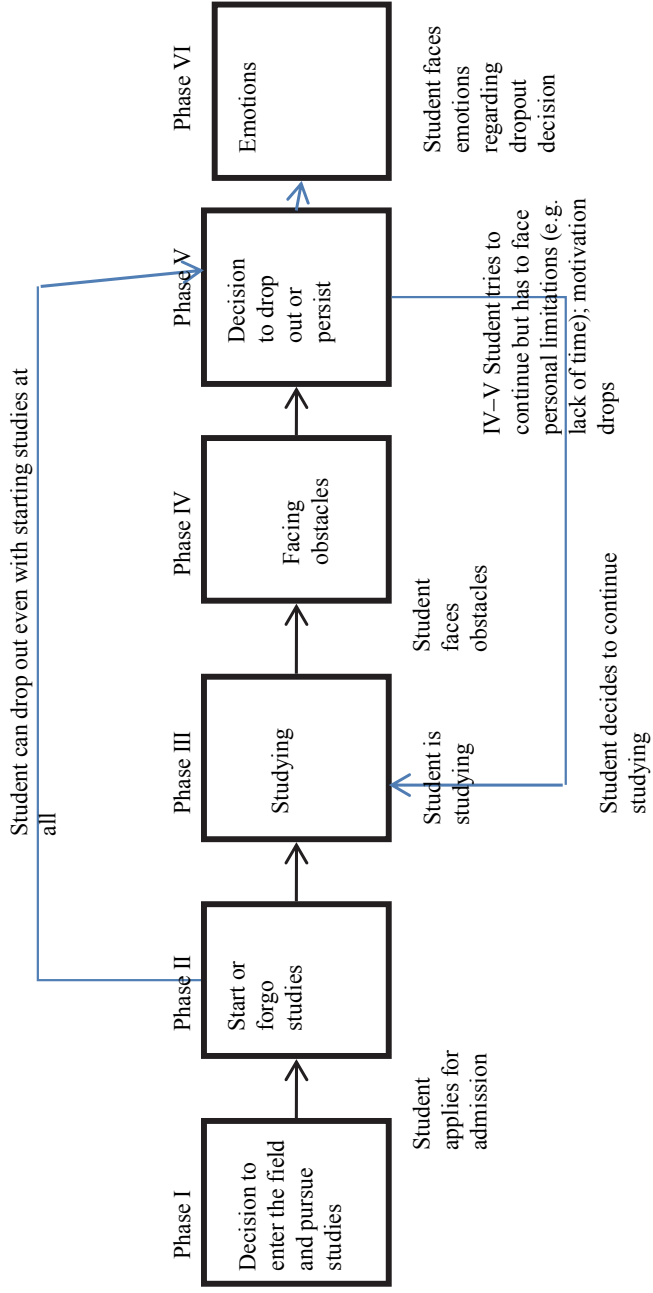
Fig. 20. Process model of a student's dropout decision-making process.

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Motivation is the main factor that causes dropout, and study environment is the experiential element that affects motivation. Study environment covers experiences from organisational communication with the department and support from family and friends, as well as experience from academics and social connections. These components provide individuals with experiences throughout the course of studies up to the period at which these individuals decide to drop out or persist. All student experiences influence the decision-making process (Figure 21).

Study environment

Motivation

Decision making
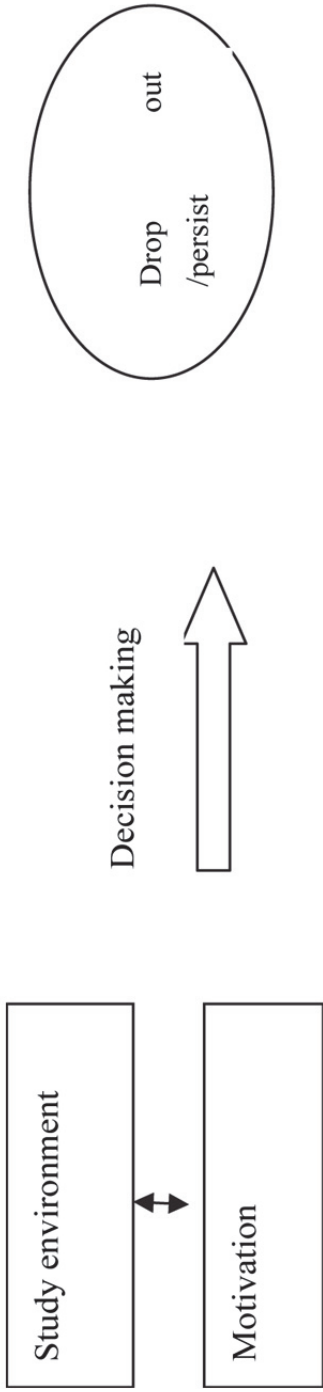
Drop
/persist
out

Fig. 21. Theme of dropout decisions is characterized by study environment and motivation.

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4.7.3 Relating the theory to the literature

Dropout

According to Glaser (1978), the core category must be central, must occur frequently in the data, will take longer to saturate because it is related to many other categories, is related meaningfully and easily to other categories, and is in a substantive study. Grouping high-level categories into higher level core categories (or themes) can be useful practice in scaling up the substantive theory. Scaling up a theory involves (1) rewriting the theory to omit specifics; (2) comparing it to the data from other substantive theories; and (3) putting the theory into the context of other theories in the field (Urquhart *et al.* 2010). Given these steps, I have placed the proposed theory into the context of other theories that are related to the dropout process and the IS/SE discipline. I also compare the proposed theory to other theories regarding this discipline.

Researchers have reached no consensus on the influence of learner characteristics on adult learners' decision to drop out of online courses (Park *et al.* 2009). In some studies, individual characteristics are concluded as central to dropout decisions (Packham *et al.* 2004), whereas others dispute this claim (Willging & Johnson 2004, Park 2009). The current work supports the latter, with our results indicating that individual characteristics (age, gender, educational level) vary and that these attributes do not affect dropout decisions. Willging and Johnson (2004) pointed out that external factors, such as family issues, lack of organisational support, job changes job, and workload are the principal factors that affect the decision to drop out of online courses. Park *et al.*'s (2009) research shows that dropouts significantly different from persistent learners in terms of external factors (i.e. family support and organisational support). In the present study, needs are the key aspects that influence the decision to drop out of school. Family and work are also identified as influencing variables. In this thesis, the external dimension of the model also comprises the same kind of external factors that Park (2007) has in her theoretical framework. According to Park (2009), adult distance learners may drop out of a course (e.g. because of increased workload or job changes that occur during the course), but some learners may drop out of a course even before they start studying because of such external reasons. The same was observed in the current research. Some students have not even begun

studying before deciding to drop out because of work-related issues, such as increased workload and job changes. Additionally, internal and external factors are likely to interact with each other. In our study, learner characteristics did not affect dropout decisions. Such characteristics are cited in most studies and are, in turn, affected by students' previous experiences. Park *et al.* (2009) indicated that adult learners easily decide to drop out of online courses when they do not receive support from their family and/or organisation, regardless of their academic preparation or aspirations. In the present study, support from family and other entities (department) did not emerge as a reason. I did not examine support from the workplace; this aspect may prove to be highly important.

No study has presented a process model of dropout decision making. The current research fills this gap. Motivation emerged as a significant determinant of dropout decisions, and students underwent a process as they decide on whether to drop out or persist. Non-employment gave rise to safety issues (employment), which also drove the decision to abandon the programme. Some students fulfilled their need for esteem through their work responsibilities, eliminating the need to pursue the programme. Another factor that satisfies esteem needs is previous degrees. As for belonging needs, the students opted to enter different fields because of disinterest in the IS/SE programme. Motivation was therefore directed elsewhere. Five students dropped out because of family-related reasons, which also fall under belongingness. Most of the students had friends; hence peer support was not a factor in the decision-making process.

Motivation theories

The results of this study correspond with the observations of Maslow. Motivation was influenced by the need for safety, love and belonging, and esteem, as well as by personal issues and emotions. Needs may direct dropout decision making. If certain needs arise, one cannot concentrate on academics because there are lower level needs that require addressing. These elements are similar to those presented by Maslow in his hierarchy of needs. Numerous times, motivation was identified as the reason for dropping out.

Process theories

The proposed process model is based on van de Ven and Poole's (1995) lifecycle theory, which indicates stages/phases that occur in a specific sequence before the

dropout process takes place. Change is imminent, as asserted in lifecycle theory. A developing entity changes, thereby enabling it to progress from a given point of departure towards a subsequent end. These same observations are evident in my process model. External environmental events and processes influence the manner by which an entity expresses itself, but these are mediated by (for example) rules. Again, the same holds true for the present work. The typical progression of change events is of unitary sequence, which is cumulative and conjunctive. Thus, different stages have the same characteristics in the beginning and in the end. The final stage is prefigured and requires a specific historical sequence of events. Every event contributes to the final product, and they occur in prescribed order. They set the stage for the next phase (van de Ven & Poole 1995). The current research also focuses on a single entity, the student. Evolutionary and dialectical theories are applied to multiple entities, whilst lifecycle and teleological theories are applied to a single entity. The proposed process model operates in a prescribed modality in the same manner as lifecycle and evolutionary theories operate (van de Ven & Poole 1995).

Our process model counts as a type of stage theory given the similarity of its components to those observed by Weinstein *et al.* (1998) as central to stage theories. The author indicated that these stages are theoretical constructs. We can define a prototype for each stage, but few people precisely match this ideal. Health behaviour stages are categories in which people differ in a relatively minimal manner, but individuals can have relatively large differences in various stages. Stage theory is accurate provided that most people follow a specified sequence. Nonetheless, different paths towards an action can exist. People need to resolve certain issues before they can proceed to the next stage. Therefore, people encounter the same obstacles to change within the same stage. Predictions of concrete behaviour should be verified to determine the accuracy of the model. Validation is carried out by describing the barriers between the stages of this behaviour (Weinstein *et al.* 1998). In the proposed model, most of the students go through the same stages. Only a few differences are observed, and these revolve around students who have not engaged in studies at all. Students are confronted with the same impediments within a single stage.

5   Evaluation

Evaluation of the research from a hermeneutical perspective

A hermeneutical cycle was used in this thesis. All the related principles and the manner by which they were used are listed in Table 24. I also present other evaluation issues in this chapter. The summary of the principles for interpretive field research are presented in Table 1; I also include the manner by which these principles are used. These principles are typically applied to the evaluation of interpretative research characterised by a hermeneutic nature (Klein & Myers 1999).

Table 24. Summary of principles of Interpretive Field Research and our study's principles. (Klein and Myers 1999).

Principle of the Hermeneutic Circle	Cases 1 & 2
1. The Fundamental Principle of the Hermeneutic Circle This principle suggests that all human understanding is achieved by iterating between considering the interdependent meaning of parts and the whole that they form. This principle of human understanding is fundamental to all the other principles.	Case studies were conducted to understand the participants and acquire a complete picture of research issue. Two different case studies were used. Case 1 underlined all relevant parts (essays) and formed the connections between these parts. Content analysis was used for abstraction.
Example: Lee's (1994) study on information richness in e-mail communications iterates between the separate message fragments of individual e-mail participants as parts and the global context that determines the full meanings of the separate messages to interpret the message exchange as the whole.	In case 2, transcribed interviews were used as data sources for coding data items. These items are incidents, and many incidents can be classified into categories. Theoretical saturation was achieved because all new incidents in the data were incorporated into the existing categories of the model; no new information arose after this process.
2. The Principle of Contextualization Requires critical reflection of the social and historical background of the research setting, so that the intended audience can see how the current situation under investigation emerged	The case studies introduced context from students' points of view. The researcher is familiar with the subject matter because she has studied in the university. Case 1 introduced the girls' views during the competitions. Case 2 introduced the entire study trajectory, providing their experiences during the course of studies.
Example: After discussing the historical forces that led to Fiat establishing a new assembly	

Principle of the Hermeneutic Circle	Cases 1 & 2

plant, Ciborra *et al.* (1996) showed how old Fordist production concepts still had a significant influence despite radical changes in work organisation and operations.

3. The Principle of Interaction Between the Researchers and the Subjects
Requires critical reflection on how the research materials (or 'data') were socially constructed through the interaction between the researchers and participants

Example: Trauth (1997) explained how her understanding improved as she became self-conscious and started to question her own assumptions.

I endeavoured to be self-aware and questioned all the assumptions as best I can. I introduced the entire process of data categorisation. I included the original statements from the respondents to show the analysis path visible. Many rounds of analyses were conducted to verify the assumptions.

4. The Principle of Abstraction and Generalization
Requires relating the idiographic details revealed by the data interpretation through the application of principles one and two to theoretical, general concepts that describe the nature of human understanding and social action

Example: Monteiro and Hanseth's (1996) findings are discussed in relation to Latour's actor–network theory.

In case 1, I discussed findings in relation to previous research. Conceptual understanding of the findings was also presented.

In case 2, I used analytical memos and discussed findings in relation to motivation theories and process theories. Conceptual understanding was presented.

5. The Principle of Dialogical Reasoning
Requires sensitivity to possible contradictions between the theoretical pre-conceptions guiding the research design and actual findings ('the story which the data tell') with subsequent cycles of revision

Example: Lee (1991) described how Nardulli (1978) came to revise his pre-conceptions of the role of case load pressure as a central concept in the study of criminal courts.

I set my pre-conceptions aside in both cases and tried to find new ideas.

6. The Principle of Multiple Interpretations
Requires sensitivity to possible differences in interpretations amongst the participants as are typically expressed in multiple narratives or stories of

In case 1, I took all the available essays to show the analysis path and provide more detailed information.
In case 2, I interviewed 40 people and

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Principle of the Hermeneutic Circle	Cases 1 & 2
the same sequence of events under study; similar to multiple witness accounts even if all tell it as they saw it	interviewed nine of them twice to obtain precise and deeper understanding of the issue at hand.
Example: Levine and Rossmore's (1993) account of the conflicting expectations for the threshold system in the Bremerton Inc. case	
7. The Principle of Suspicion Requires sensitivity to possible 'biases' and systematic 'distortions' in the narratives collected from the participants	I believe I successfully filtered the 'real story' in case 1 by offering tables and new insights into the issue. I also successfully filtered the 'real story' in case 2 by introducing every step of the entire decision-making process. I tried to uncover all important information from the entire data set.
Example: Forester (1992) looked into the facetious figures of speech used by city planning staff to negotiate the problem of data acquisition.	

The First Fundamental Principle of the Hermeneutic Circle

In this thesis, case studies were carried out to obtain a thorough understanding of the issue at hand. Two different case studies were conducted. Case one was conducted by underlining all relevant data components (statements from the essays written by the participants) and forming the connections between them. Content analysis was performed in extracting and summarising principal information. Case two features transcribed interviews as data, for which items were coded. These items are incidents, and numerous incidents can be classified into categories. Theoretical saturation was achieved because all new incidents in the data were incorporated into existing model categories; further analysis yielded no new information.

The Second Fundamental Principle of the Hermeneutic Circle

The case studies introduced context from a student's point of view. I am familiar with the research area chosen for case two because I studied at the University of Oulu. Case one introduced the girls' views during the competitions, whilst case two introduced the entire academic trajectory; thus, experiences during the course of study were also presented.

The Third Fundamental Principle of the Hermeneutic Circle

I endeavoured to be self-aware and questioned all assumptions as best I can. I introduced the entire trajectory as in accordance with the categorization of data. I also included the original statements of the respondents to clearly illustrate the path of analysis. Many rounds of analyses were performed to verify my own assumptions.

The Fourth Fundamental Principle of the Hermeneutic Circle

In case one, I discussed the findings in relation to previous research. I also formulated a conceptual understanding of the findings. In case two, I used analytical memos and discussed the findings in relation to motivation theories and process theories. Conceptual understanding of the findings was also provided for this case.

The Fifth Fundamental Principle of the Hermeneutic Circle

I set my pre-conceptions aside for both cases and endeavoured to search for new ideas. These tasks were very challenging, but I believe I accomplished what I set out to achieve.

The Sixth Fundamental Principle of the Hermeneutic Circle

In case one, I analysed all the essays to obtained more detailed information. In case two, I interviewed 40 people and subjected nine of them to two rounds of interviews to acquire a precise and deeper understanding of the issue at hand.

The Seventh Fundamental Principle of the Hermeneutic Circle

I believe I successfully filtered the 'real story' in case one by providing numerous tables and new insights into this research topic. The same was achieved for case two, in which the 'real story' regarding dropout decision making by introducing every step of the entire process. I attempted to extract all important information from the entire data set.

Evaluation of the entire research

All the research methods used have been shown directly to the readers. Content analysis was introduced throughout the entire process, and the readers can easily observe the different classes and conclusions revealed by the respondents' statements. The sample for the first case included all the essays (64) so that the sampling would be sufficient. The analysis can be seen as comprehensive because it is not based solely on random selection, and saturation of the material was reached. The relevance of the material was ensured, and the results show information on the subject matter. Previous research of a given topic also strengthens results (Mäkelä 1990).

I chose qualitative content analysis because the aim of the study is to elucidate how the girls perceive IT in reality. It also explores the girls' attitudes without any particular theory in mind, and contextualise their initial perspectives as they emerged from the essays. Content analysis is appropriate for these purposes. It likewise enables theory creation and the abstraction of key information from a rich set of materials.

As previously discussed, Orlikowski's (1993) grounded theory was chosen because it is useful in areas where no theory has previously been proposed, it incorporates the complexities of organisational contexts into the understanding of the phenomena, and it is suitable for studying process and change (Urquhart 2007). In particular, the third justification corresponds to the purpose of this study. The analysis path taken with grounded theory was introduced next. The transcribed documents were then analysed with coding, specifically of data items. Coding was carried out as follows. An incident was coded by assigning it a descriptive category, and then compared to other similarly coded incidents. This procedure yields the distinctive theoretical properties of the categories (Glaser & Strauss 1967). The categories were then compared, and the emerging theory was identified. The number of categories was reduced. After this, the theory was formulated and the conceptual categories were identified (Glaser & Strauss 1967). I included all the (for example) coding and memos in this thesis to provide the readers with a clear idea of how the categories were combined and how the results were introduced.

The semi-structured interview questions may have directed the conversation towards a certain direction, but I endeavoured to avoid this situation by providing the students an opportunity to express any idea or opinion during the interview. I chose semi-structured questions because the interview was conducted by phone.

The interviewees were able to explain their own experiences in their own words (Myers & Newman 2007). Although face-to-face observation was not possible, the interviews were recorded. I have personal experiences and conceptual structures of the phenomenon (Sarker *et al.* 2001), but I attempted to avoid any holding any preconceptions as I collected and analysed the data. Theme interview was used to support only data collection, not data analysis.

I chose random selection following Myers and Newman's (2007) suggestion to avoid restricting sampling to only a specific group of people. I selected my respondents from the list of dropouts, who have not initiated academic study or have not been enrolled in the school for two or more years. Every interviewed student stated that he/she had no plans of carrying on with the IS/SE programme. I sampled every tenth student, and chose equally amongst men and women. Telephone numbers were acquired from a number telephone directory service. A list of the names of drop-out students was acquired from faculty. Confidentiality was also a very important aspect of this study. The participants were immediately informed of the purpose of the study to provide them a guarantee that the information collected will not be used against them (Myers & Newman 2007) should they decide to return to the programme. This approach is also important in ensuring that the participants are comfortable enough to answer questions. I sought the respondents' permission in recording the conversation before each interview was initiated (Walsham 2006).

An in-depth literature review was not carried out before the interview sessions because I wanted to avoid making assumptions on incoming data. A preliminary review was conducted, but the main literature search was done after the data had been collected and analysed. Relevant literature was chosen after I had identified the theory (e.g. Urquhart *et al.* 2010). According to Urquhart (2007), previous studies do not prevent a researcher from being theoretically sensitive in evaluating the relevance of a theory to actual data. The analysis path in this thesis follows the direction data > open codes > selective codes > categories > theme.

All of the above-mentioned details are included for evaluation of this work. The limitations and other issues have been introduced in earlier chapters.

6 Conclusion

6.1 Contributions

This dissertation contributes to literature in a number of ways. First, the proposed process model provides new information on the dropout decision process. Second, it also contributes by developing a process model in which emotions are considered, a feature that no other previous study has introduced. Previous studies end the analysis at the period of dropout decisions, but the lifecycle process model in the current work includes the next stage in this process; that is, the emotions and perspectives of the students as they made the decision are considered. Third, the proposed process model is based on van de Ven and Poole's (1995) lifecycle theory, which holds that stages/phases occur in a specific sequence, after which the dropout process takes place. The process model I developed has the same elements as those found in lifecycle theory. It can be regarded as stage theory because it includes aspects that are key to stage theories. Fourth, this study shows the entire decision-making trajectory, beginning from the period at which students decide to apply for and enter a programme to the point at which they decide to drop out and come to terms with resultant emotional consequences. Fifth, this study elucidates why girls shun the possibility of becoming computer or IS professionals, and what attitudes they have towards CS and IS. According to the findings, girls view occupational diseases as a negative aspect of the field. The study also reveals the girls' reasons for not wanting to choose IS or CS as a profession.

6.2 Implications for practice

Recommendations for improving female entry into the field of IT are also presented in this thesis.

Stereotypes affect entry into the computing field; thus, introducing female role models who can be a positive influence on girls is necessary.

Given the perceptions on the requirement for extensive skills in the natural sciences, educational institutions should provide thorough information on the different types of work in the IT industry. There is a particular need to inform students that not all IT positions require extensive skills in mathematics and physics. Certain IT-related disciplines, such as Information Systems and MIS,

benefit from a humanities or social sciences background (Dhillon & Backhouse 2001).

Introductory classes for sixth form female students can be offered. Female students majoring in IT can visit schools to share their views. These events can create a positive and realistic picture of IT studies. The same suggestion applies to university-level studies, in which female role models can teach certain IT courses.

At the beginning of the academic year, universities should provide comprehensive information on the IT discipline and what to expect from studying under this programme. Educators should determine the motivation status and views of the students at the beginning of the admission process. A more exhaustive scheme for study planning should be in place given the reluctance of students to share their problems in a group setting. One-on-one consultations and a sixth-month monitoring period are imperative to identifying key problem areas and providing necessary assistance. Initiatives devoted to equipping students with self-regulation skills can be designed, and universities can foster an environment that enhances the motivation to study. More group exercises and pair-programming should be included in the curriculum to ease the difficulty of completing certain courses. Working students should be provided different forms of guidance and assistance. An effective measure is establishing a partnership with employers so that real-world training, such as internships, can be included in the programme. Furthermore, incentives are an excellent measure for improving academic performance. Universities can offer courses that can be completed in stages, in which the completion of each stage would earn students points. The option to choose the next course of study should also be made available to students. Scheduling is another are for exploration; that is, schools can arrange study times in such a way that students will be able to complete coursework in groups. This feature enhances both academic performance and socialisation. Finally, the external environment will always be a factor in students' lives. Although educational institutions cannot provide learners with every requirement that they may need, these institutions can create an environment where students cultivate the right attitudes in managing their personal, professional, and academic lives.

6.3   Future work

On the basis of the findings, I highlight areas that present potential for further investigation.

First, future research can focus on the influence of positive role models in encouraging females to pursue IT programmes. Educational events where female role models share their educational backgrounds and perspectives of their work can be helpful. Questionnaires can be distributed before and after the events to determine existing pre-conceptions about the field, and determine whether such views have changed after the events. Workshops are another promising avenue because these would provide girls with a comprehensive picture of the work that IT professions entail. Questionnaires can also be used during these sessions. Female role models can be enjoined to teach IT courses in sixth form schools so that female role models could teach the subjects.

Female high school students perceive that IT professions require extensive skills in mathematics and physics. Educational intervention can help correct this preconceived notion. Intervention can be provided through a pre- and post-study study setting, in which the pre-study is conducted to determine baseline results. After the intervention programme has been concluded, a post-survey is conducted. The results of the studies can then be compared.

Researchers can also consider carrying out a study similar to the current work, but with interviews as the primary instruments. Interviews are advantageous in that they offer a wide range of results and the opportunity to probe deeper into students' attitudes. Another research direction would be to study the effect of computers use on girls' attitudes towards IT studies and careers. The results can be compared with those obtained for boys. The effect of specific IT courses on final dropout decisions is also worth exploring. Do certain courses, such as programming, impose a stronger effect on such decisions? Can pair-programming enhance academic performance, and consequently influence dropout decisions? Finally, a longitudinal study can monitor this process, beginning from the time of admission and entry, to determine any differences in motivation status during the course of studies and at the period the decision to drop out is made.

References

Abell P (1987) The Syntax of Social Life: The Theory and Method of Comparative Narratives Clarendon Press, Oxford.

Abbott A (1988) Transcending General Linear Reality. Sociological Theory (6): 169–186.

Adam A (2002) Exploring the gender question in critical information systems. Journal of Information Technology 17: 59–67.

Adam A, Griffiths M, Keogh C & Moore K et al. (2006) Being an 'it' in IT: gendered identities in IT work. European Journal of Information Systems 15(4): 368.

Adam AE, Howcroft D & Richardson HJ (2004) A decade of neglect: reflecting on gender and IS. New Technology, Work And Employment, 19(3): 222–240.

Adya M & Kaiser KM (2005) Early determinants of women in the IT workforce: a model of girls' career choices. Information Technology & People, 18(3): 230–259.

Ahuja M., Ogan C, Herring S & Robinson J (2006) Gender and Career Choice Determinants in Information Systems Professionals:A Comparison with Computer Science. In: Niederman F & Farrat T (eds) IT Workers: Human CapitalIssues in a Knowledge-Based Environment. Greenwich, CT, Information Age Publishing: 279–304.

Allardt E (1993) Sosiologia. Juva, WSOY.

Allen J, Robbins S, Casillas A & O I-E (2008) Third-year College Retention and Transfer: Effects of Academic Performance, Motivation, and Social Connectedness. Res High Educ 49:647–664.

Araque F, Roldan C & Salguero A (2009) Factors influencing university drop out rates. Computers and education 53.

Bean J (1981) The synthesis of a Theoretical Model of Student Attrition. Paper prepesented in annual meeting of American Educational Research Association.April 13–17, Los Angeles, USA.

Bean J P (1990) Why students leave: Insights from research. In Hossler D, Bean J P & Associates. The Strategic Management of College Enrollments. San Francisco, CAJossey-Bass:170–185.

Bean J P & Eaton S B (2000) A Psychological Model of College Student Retention. In Braxton J M (eds) Rethinking the Departure Puzzle: New Theory and Research on College Student Retention. Nashville, TN, Vanderbilt University Press.

Bean J P & Metzner B S (1985) A Conceptual Model of Nontraditional Undergraduate Student Attrition. Review of Educational Research 55: 485–540.

Beaudry A & Pinsonneault A (2005) Understanding User Responses to Information Technology: A Coping Model of User Adaptation. MIS Quarterly 29(3): 493–524.

Belloc F, Maruotti A & Petrella L (2010) University drop-out: an Italian experience. High Educ 60: 127–138

Bennett R (2003) Determinants of Undergraduate Student Drop Out Rates in a University Business Studies Department. Journal of Further and Higher Education 27(2).

Boehm (1981) Software Engineering Economics. New Jersey, Prentice-Hall, Inc., Englewood Cliffs.

Boeree G (2006) Personality Theories. URI: http://webspace.ship.edu/cgboer/maslow.html Cited 2011/11/1

Brunsden V, Davies M, Shevlin M. & Bracken M (2000) Why do HE students drop out? A test of Tinto's model. Journal of Further and Higher education 24(3).

Burton-Jones A, McLean E & Monod E (2011) On approaches to building theories: process, variance and systems. MISQ working paper 2011 in review. Sauder School of Business, UBC.

Butler J (1990) Gender trouble: feminism and the subversion of identity. New York : Routledge.

Charmaz K (2000) Grounded Theory: Objectivist and Constructivist Methods. In: Denzin NK & Lincoln YS (eds) Handbook of Qualitative Research (2nd Edition). London, Sage: 509–536.

Chyung Y (2001) Systemic and systematic approaches to reducing attrition rates in online higher education. The American Journal of Distance Education, 15(3): 36–49.

Chyung Y, Winiecki D J, & Fenner J A (1998) A case study: Increase enrollment by reducing dropout rates in adult distance education (ERIC Document Reproduction Service No. ED 422 848).

Clarke V & Teague G J (1996). Characterizations of computing careers: Students and Professionals disagree. Computers Education. 26(4): 241–246.

Denning P, Comer E, Gries D, Mulder M, Tucker A, Turner A & Young P (1988) Computing as a discipline: preliminary report of the ACM taskforce on the core of computer science. ACM SIGCSE Bulletin ,Proceedings of the nineteenth SIGCSE technical symposium on Computer science education, February, 20(1).

Dhillon G & Backhouse J (2001) Current directions in IS security research: toward socio-organizational perspectives. Information Systems Journal 11(2).

Di Pietro G & Cutillo A (2008) Degree flexibility and university drop-out: The Italian experience. Economics of Education Review 27: 546–555.

Doo M. & Kim Y (2000) The effect of relevance-enhanced messages on learning in Web-based training. Korean Association for Educational Information and Broadcasting, 6(2): 73–90.

Dunderfelt T (1992) Elämänkaaripsykologia. Neljäs painos. Porvoo, WSOY.

Durkheim E (1961) Suicide. Spaulding J & Simpson G (trans). New York, Free Press. Education encyclopedia 2012. State university.com. URI: http://education.stateuniversity.com/pages/1863/College-Student-Retention.html Cited 2012/3/22.

Elkins SA, Braxton J & James G (2000) Tinto's Separation Stage and Its Influence on First-Semester College Student Persistence. Research in Higher Education 41,(2): 251–268.

Fincham R (2002) Narratives of Success and Failure in Systems Development. British Journal of Management 13(1): 1–14.

French S & Richardson H (2005) Opting out?: women and on-line learning. ACM SIGCAS Computers and Society 35(2).

Georg W (2009) Individual and institutional factors in the tendency to drop out of higher education: a multilevel analysis using data from the Konstanz Student Survey. Studies in Higher Education 34(6): 647–661

Glaser B & Strauss A (1967) The discovery of grounded theory. Chicago, Aldine.

Glaser BG (1978) Theoretical Sensitivity: Advances in the methodology of grounded theory. Mill Valley CA, Sociology Press.

Graham S & Latulipe C (2003) CS Girls Rock: Sparking Interest in Computer Science and Debunking the Stereotypes. SIGCSE, February 19–23: 322–326.

Green C (2000) Classics in the History of Psychology. URI: http://psychclassics.yorku.ca/Maslow/motivation.htm Cited 2011/12/1

Greenhill A, von Hellens L, Nielsen S & Pringle R (1997) Australian women in IT Education: Multiple meanings and Multiculturalism. Proceedings of the 6th International IFIP Conference, Bonn, Germany.

Gregor S (2006) The Nature of Theory in Information Systems. MIS Quarterly 30(3): 611–642.

Harré (1986) The Social Construction of Emotions. Oxford, Blackwell.

Keltner D & Kring AM (1998) Emotion, social function, and psychopatology. Review of General Psychology 2(3): 320–342

von Hellens LA, Nielsen SH & Trauth EM (2001a) Breaking and Entering the Male Domain: Women in the IT Industry. Proceedings of the ACM SIGCPR Conference. San Diego, CA :116–120.

von Hellens LA & Nielsen S (2001b) Australian women in IT. Communications of the ACM. ACM Press.44(7).

Hiltunen L (2009): Gender issues in the Faculty of Information Technology. Maaraportti, UPDATE-projekti, WP5. Jyväskylän yliopisto, Tietojenkäsittelytieteen laitos.

Howcroft D & Trauth EM (2004) The choice of critical IS research. In Kaplan B, Truex D, Wastell D, Wood-Harper AT & DeGross JI (eds.). Relevant Theory and Informed Practice: Looking Forward from a 20 Year Perspective on IS Research. pp. 195–211. Kluwer Academic Publishers, Boston, MA.

Howcroft D & Trauth E M (2008) The implications of a critical agenda in gender and IS research. Information Systems Journal 18 : 185–202.

Howles T (2009)A study of attrition and the use of student learning communities in the computer science introductory programming sequence. Computer Science Education 19(1): 1–13.

Hägglund T-B, Pylkkänen K. & Taipale V (1978) Nuoruusiän kriisit. Jyväskylä, Gummerus.

Iivari J (1991) A paradigmatic analysis of contemporary schools of IS development. European Journal of Information Systems 1(4): 249–254.

Iivari J(2003) Tietojärjestelmäteoria: Johdanto. Lecture notes in finnish. Univeristy of Oulu.

Jousranta A (2002) Opiskelen tietotekniikkaa. Vaasalaisopiskelijain kertomaa alan valinnan syistä ja opetuksen laadun kriteereistä. Vaasan yliopiston julkaisuja, Selvityksiä ja raportteja 97. In Finnish.

Kaufman M. & Creamer D (1991) Influences of student goals for college on fresh- man year quality of effect and growth. Journal of College Student Development, 32:197–206.

Keltner D & Kring AM (1998) Emotion, social function, and psychopatology. Review of General Psychology 2(3): 320–342.

Kinnunen P & Malmi L (2006) Why students drop out CS1 course. ICER'06 september 9–10, 2006, Canterbury, United kingdom.

Klawe M (2002) Girls, Boys and Computers. SIGCSE Bulletin 34(2): 16–17.

Klein HK & Myers M (1999) A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems, MIS Quarterly (23)1: 67–93.

Kvasny L, Greenhill A & Trauth EM (2005) Giving voice to feminist projects in management information systems research. International Journal of Technology and Human Interaction1: 1–18.

Kvasny L, Trauth EM & Morgan A (2009). Power relations in IT education and work: the intersectionality of gender, race, and class. Journal of Information, Communication & Ethics in Society, 7(2/3): 96–118.

Lassibille & Gomez (2008) Why do higher education students drop out? Evidence from Spain. Education Economics 16: 89–105.

Latham G P & Pinder C C (2005) Work motivation theory and research at the dawn of the twenty-first century. Annual Review of Psychology 56: 495–516.

Leever S, Dunigan M & Turner M (2002) The Power to Change is in our Hands." JCSC 18(2): 169–179.

Leiviska K & Siponen M (2006) Attitudes of sixth form female students towards the IT field. Ljungberg J& Dahlbom B. (eds) 14th Europena conference on information systems, Grand challenges, ECIS2006, Göteborg June 14–14 2006.

Leiviskä K & Siponen M (2010) Attitudes of sixth form female students toward the IT field. ACM SIGCAS Computers and Society 40(1):34–49.

Liljander J-P (1996) Statusvoittojen ja –tappioiden tiet korkeakoulutuksessa. Keskeyttäminen ja koulutuksen vaihtaminen opintouran taitekohtina, Kasvatustieteiden tutkimuslaitos. Jyväskylä. Jyväskylän yliopistopaino. In finnish.

Margolis J & Fisher A (2002) Unlocking the clubhouse: Women in Computing. Cambridge, Massachusetts. The MIT Press.

Markus ML & Robey D (1988) Information Technology and Organizational Change: Causal Structure in Theory and Research. Management Science 34(5):583–598.

McCubbin I (2003) An Examination of Criticisms made of Tinto's 1975 Student Integration Model of Attrition. URI: http://www.psy.gla.ac.uk/~steve/localed/icubb.pdf Cited 2012/4/26.

McDermid JA & Bennett KH (1999) Software engineering research: a critical appraisal. Software, IEE Proceedings v146(4): 179–186.

Miner J B (2005) Organizational behavior I. Essential theories of motivation and leadership [Elektroninen aineisto] / John B. Miner. Armonk, N.Y : M.E. Sharpe, cop. 2005.

Mohr L.B (1982) Explaining Organizational Behavior Jossey-Bass, San Francisco.

Monge PR (1990)Theoretical and analytical issues in studying organizational processes. Organization Science 1(4): 406–430.

Moorman P & Johnson E (2003) Still A Stranger Here: Attitudes Among Secondary School Students Towards Computer Science. ITiCSE, June 30-July 2, Thessaloniki, Greece: 193–197.

McGrath Cohoon J (2003) Must there be so few? Including women in CS. IEEE. Precoodings of the 25th international conference on Software engineering: 668–674.

Mitchell, T. R., & Daniels, D. (2003) Motivation. In Borman WC, Ilgen DR, & Klimoski RJ (Eds.), Handbook of psychology 12: 225–254. New York: John Wiley.

Myers M & Newman M (2007) The Qualitative Interview in IS Research: Examining the Craft. Information and Organization 17(1): 2–26.

Mäkelä K (1990) Kvalitatiivisen aineiston analyysi ja tulkinta. Helsinki:Painokaari. In finnish.

Newman M & Robey D (1992) A Social Process Model of User-Analyst Relationships. MIS Quarterly 16(2): 249–266.

Nielsen SH, von Hellens LA, Greenhill A, Halloran P & Pringle R. (1999) IT Degree Studies and Skills Development for Learning Organisations. Proceedings of the 1999 ACM SIGCPR conference on Computer personnel research.

Nisbet (1970) Developmentalism: A critical analysis. In McKinney J & Tiryakin E (Eds.) Theoretical sociology:Perspectives and developments: 167–206.NY:Meredith.

Oechtering V & Behnke R (1995) Situations and advancement measures in Germany. Communications of the ACM. ACM Press. 38(1): 75–82.

Orlikowski WJ (1993) CASE Tools as Organizational Change: Investigating Incremental and Radical Changes in Systems Development. MIS Quarterly 17(3): 309–340.

Orlikowski WJ & Baroudi J.J (1991) "Studying Information Technology in Organizations: Research Approaches and Assumptions. Information Systems Research (2):1–28.

Ory J C & Braskamp L A (1988) Involvement and growth of students in three academic programs. Research in Higher Education, 28: 116–129.

Pace C R (1984) Measuring the quality of college student experiences. Los Angeles: University of California, Higher Education Research Institute.

Packham G, Jones G, Miller C & Thomas B (2004) E-learning and retention: Key factors influencing student withdrawal. Education & Training, 46(6/7): 335–342.

Papastergiou M (2008) Are Computer Science and Information Technology still masculine fields? High school students' perceptions and career choices. Computers and Education. 51(2): 594–608.

Pare G, Bourdeau S, Marsan J, Nach H. & Shuraida S (2008) Re-examining the Causal Structure of Information Technology Impact Research. European Journal of Information Systems 17: 403–416.

Park J & Choi H (2009) Factors influencing adult learners decision to drop out or persist in online learning. Educational technology & society 12 (4): 207–217.

Park J & Choi H (2007) Differences in personal characteristics, family and organizational supports, and learner satisfaction between dropouts and persistent learners of online programs. In Richards G (Ed.), Proceedings of World Conference on ELearning in Corporate, Government, Healthcare, and Higher Education 2007:6444–6450. Chesapeake, VA: AACE.

Pegher V, Quesenberry J, Trauth EM (2006) A Reflexive Analysis of Questions for Women Entering the IT Workforce. Encyclopedia of Gender and Information Technology: 1075–1080.

Porchea S, Allen J, Robbins S & Phelps R (2010) Predictors of Long-Term Enrollment and Degree Outcomes for Community College Students: Integrating Academic,Psychosocial, Socio-demographic, and Situational Factors. The Journal of higher education 81(6).

Quesenberry JL, Trauth EM & Morgan AJ (2006). Understanding the "Mommy Tracks": A Framework for Analyzing Work-Family Issues in the IT Workforce. Information Resources Management Journal. 19(2): 37–53.

Robertson MJ, Newell SM, Swan JA, Mathiassen L & Bjerknes, G (2001) The issue of gender within computing: Reflections from the UK and Scandinavia. Information Systems Journal 11: 111–126.

Rovai A P (2003) In search of higher persistence rates in distance education online programs. Internet and Higher Education, 6:1–16.

Sarker S, Lau F & Sahay S (2001) Using an Adapted Grounded Theory Approach for Inductive Theory Building About Virtual Team Development. Database for Advances in Information Systems (32)1: 38–56.

Scollary A, Craig A & Fisher J (2003) Overcoming the Adversity of Diversity. Proceedings of the 2003 Australian Women in IT Conference: 11–18.

Seale C (1999)The quality of qualitative research. London : SAGE.

Shea P J, Pickett A M, & Pelz W E (2003) A follow-up investigation of teaching presence in the SUNY learning network. Journal of Asynchronous Learning Networks, 7(2): 61–80.

Shin N. & Kim J.(1999) An exploration of learner progress and drop-out in Korea National Open University. Distance Education 20(1).

Sieverding M & Koch S (2009) (Self-)Evaluation of computer competence: How gender matters. Computers and Education 52(3): 696–701.

Smith J (1997) Different for girls: how culture creates women..London:Chatto & Windus, 1997.

Spady W (1970) Dropouts from higher education: An interdisciplinary review and synthesis. Interchange 1070(1): 64–85.

Steelman Draft (2001) The Joint Task Force on Computing Curricula, IEEE Computer

Society, Association of Computing Machinery, Computing Curricula 2001: Computer Science, August 1.

Strauss AL & Corbin J (1990) Basics of qualitative research: Grounded theory. Procedures and techniques. London. Sage Publications Ltd.

Suominen J (1999) Näkökulmia tietotekniikan historiaan. Tekniikan Waiheita 17(1999): 3, 5–23.
URI http://www.tuug.fi/~jaakko/tutkimus/nakokulmia_tietotekniikan_historiaan.hml. Cited 20011/5/11

Taylor S & Bogdon R (1998) Introduction to qualitative research methods: A guidebook and resource. New York. John Wiley & Sons.

Teague J (2002) Women in Computing: What brings them to it, what keeps them in it?, SIGCSE Bulletin 34(2) 147–158.

Terenzini PT & Pascarella ET (1980) Toward the validation of Tinto's model of college student attrition: a review of recent studies, Research in Higher Education 12: 271–282.

Thurstone LL (1959) The Measurement of Values. Chicago: The University of Chicago Press.

Tietotekniikan liitto ry (2011) IT-ura-tutkimus 2011. Espoo.

Tinto V (1975) Dropout from higher education: a theoretical synthesis of recent research,Review of Educational Research, 45(1): 89–125.

Tinto V (1987) Leaving College. Chicago, University of Chicago Press.

Tinto V (1988) Stages of student departure: Reflections on the longnitudinal character of student leaving. Journal of Higher Education, 59 (4): 438–455.

Tinto V (2006) Moving from Theory to Action: Action for student success. June 2006.
URI:
http://web.ewu.edu/groups/academicaffairs/IR/NPEC_5_Tinto_Pusser_Report.pdf
Cited 2011/1/2.

Trauth EM (1995) Women in Ireland's Information Industry: Voices from Inside. Eire-Ireland 30(3): 133–150.

Trauth EM (2002) Odd Girl Out: An Individual Differences Perspective on Women in the IT Profession. Information Technology and People, Special Issue on Gender and Information Systems 15(2): 98–118.

Trauth EM, Nielsen SH & von Hellens (2003) Explaining the IT Gender Gap: Australian Stories for the New Millennium. Journal of Research and Practice in IT 35(1): 7–20.

Trauth EM & Quesenberry JL (2007) Gender and the Information Technology Workforce: Issues of Theory and Practice. In Yoong P & Huff S (Eds.) Managing IT Professional in the Internet Age: 18–36.

Trauth EM, Quesenberry JL & Huang H (2008) A Multicultural Analysis of Factors Influencing Career Choice for Women in the Information Technology Workforce. Journal of Global Information Management 16(4): 1–23.

Trauth EM, Quesenberry JL, & Huang H (2009) Retraining Women in the US IT Workforce: Theorizing the Influence of Organizational Factor. European Journal of Information Systems. Special Issue on Meeting the Renewed Demand for IT Workers(18): 476–497.

Uimonen R. & Ikävalko E (1996) Mielikuvien maailma: Miten mediajulkisuus muokataan ja imagoja rakennetaan? Jyväskylä: Gummerus Kirjapaino Oy.

University of Oulu studying path (2011) URI: http://www.oulu.fi/yliopisto/opiskelu/opintopolku. Cited 2011/11/14.

Urquhart C (2007) The Evolving Nature of Grounded Theory Method: The Case of Informations Systems Discipline. In Bryant A & Charmaz K (Eds.), The Sage Handbook of Grounded Theory 311–331. London, UK: SAGE Publications.

Urquhart C (2001) An Encounter with Grounded Theory: Tackling the Practical and Philosophical Issues. In Trauth EM (Eds), Qualitative Research in IS: Issues and Trends: 104–140. Hershey, PA, USA: Idea Group Publishing.

Urquhart C, Lehmann H & Myers M (2010) Putting the Theory Back Into Grounded Theory: Guidelines for Grounded Theory Studies in Information Systems. Information Systems Journal 20(4): 357–381.

Varkila J (1992) Ammattioppilaitoksen oppilaiden käsityksiä tietotekniikasta. Ammatillinen opettajakorkeakoulu Hämeenlinna, Julkaisuja 82. In Finnish.

Vehviläinen M (2005) The Numbers of Women in ICT and Cyborg Narratives: On the Approaches of Researching Gender in Information and Communication Technology. In Isomäki H & Pohjola A (eds.) Lost and Found in Virtual Reality: Women and Information Technology, University of Lapland Press, Rovaniemi, 2005: 23–46.

Van de Ven & Poole (1995) Explaining development and change in organizations. Academy of Management review 1995. 20(3): 510–540.

Van de Ven A (1992) Suggestions for Studying Strategy Process. Strategic Management Journal 13(Summer Special Issue): 169–188.

Virtanen P (2000) Kuinkas heille kävikään? Kasvatustieteellisen tiedekunnan opiskelijoiden kertomaa opinnoissa viivästymisen ja opintojen keskeytymisen syistä. Kasvatusteellisen tiedekunnan julkaisuja 2. Hki.

Wajcman J (1991) Feminism confronts technology. University Park (Pa.) : Pennsylvania State University Press, Pennsylvania.

Walsham G (2006) Doing Interpretive Research. European Journal of Information Systems 15(3): 320–330.

Webb G (1997) Deconstruction deep and surface: Towards a critique of phenomenography. Higher Education 33(2): 195–212.

Weinstein N, Rothman A & Sutton S (1998) Stage Theories of Health Behavior: Conceptual and Methodological Issues. Health Psychology 1998 17(3): 290–299

Willging PA & Johnson S D (2004) Factors that influence students' decision to drop out of online courses. Journal of Asynchronous Learning Network, 8(4): 105–118.

Willcoxson L. (2010) Factors affecting intention to leave in the first,second and third year of university studies: a semester-by-semester investigation. Higher Education Research & Development 29(6) 623–639.

Wilson M (2004) A conceptual framework for studying gender in information systems research. Journal of Information Technology 19: 81–92.

Xenos M, Pierrakeas C & Pintelas P (2002) A survey on student dropout rates and dropout causes concerning the students in the course of Informatics of the Hellenic open university. Computers and Education 39: 361–377.

Yukselturk & Inan (2006) Examining the Factors Affecting Student Dropout in an Online Certificate Program. Turkish Online Journal of Distance Education-TOJDE 7(3) Article: 6.

Appendix 1

Profiles of nine dropout students.

Profile 1
Woman
University degree
Started in year 2001 (age 23), credits 41
Working
Was married at the beginning of her studies
She was motivated to study at the beginning. She was also motivated even during the period of decision making, but did not have enough time to study. She did not want to make academics her priority.
She was annoyed that she could not complete the programme, but she had no choice. She did not actually choose to drop out, but simply opted not to enter the programme.
Reasons for dropout after three or more years: • Field and study variables   • Personal variables

Profile 2
Man
High school
Started in year 1999 (age 23), credits 47
Full-time student
Living in cohabitation without marriage
He was motivated to study at the beginning. He was not motivated to continue his studies because he found his work highly interesting.
It was a difficult decision for him; he had already attended courses before the dropout decision.
Reasons for dropout after one year: • Work variables

Profile 3
Man
High school
Started in year 2000 (age 19), credits 76
Working
Single
He was motivated to study at the beginning. He was not motivated to continue studies at decision-making time.
He was excited to begin studies in a different field.
Reasons for dropout after three or more years: •   Field and study variables

Profile 4
Man
Three-year occupational examination
Started in year 2001 (age 25), credits 29
Full-time student
Single
He was relatively motivated to study at the beginning. He was not motivated to continue studies at decision-making time.
He experienced no problems as he decided to drop out.
Reasons for dropout after three years: •   Field and study variables

Profile 5
Woman
High school and computer mechanics education
Started in year 2003 (age 26), credits 95.5
Working
Living in cohabitation without marriage
She was motivated to study at the beginning.
She was not motivated to continue studies at decision-making time. She was interested in other fields.
She was happy to begin her studies in a different field.
Reasons for dropout after two years: • Field and study variables

Profile 6
Man
High school
Started in year 1986 (age 23), credits 130.5 tol (224.5)
Working
Married
He was motivated to study at the beginning.
He was not motivated to continue studies at decision-making time.
He experienced no problems as he decided to drop out of school.
Reasons for dropout after three years: • Work variables

Profile 7
Man
High school
Started in year 1996 (age 20), credits 41 tol (52.5)
Full-time student
Single
He was motivated to study at the beginning.   He was motivated to continue studies at decision-making time. His plan is to carry on with his studies at a later period.
No strong emotions were evident at decision-making time.
Reasons for dropout after three years: • Field and study variables

Profile 8
Woman
High school
Started in year 2000 (age 21), credits 117.5
Working
Dating
She was motivated to study at the beginning.   She was not motivated to continue studies at decision-making time.
She had mixed feelings, worrying over what will happen when she abandons the programme.
Reasons for dropout after three years: • Field and study variables   • Personal variables   • Work variables

Profile 9
Woman
High-school and Master of Health Sciences
Started in year 2004 (age 44). Credits 365.5
Working
Married
She was motivated to study at the beginning. She was motivated to continue studies at decision-making time.
She felt frustrated at decision-making time.
Reasons for dropout after five years: •   Personal variables

Appendix 2

Essay questions for case one

The data were collected from the Department of Information Processing Science's essay competition for sixth form students (1.2.-31.3.2000) and Techno Essay Competition (1.9.2003-31.12.2003). Both competitions included question 2, and a total of 54 essays were collected. From the second competition, I collected 10 essays (which included questions 3 and 4).

2. (54 essays) Go through your views towards IS/SE in terms of employees, salary, appreciation, field's value and work. Choose a title that is appropriate for you.

   IT as a profession

OR

    IT-not as my profession

You can also choose to make your own title.

3. Consider why girls do not want to enter the IT field? What kind of courses would interest girls? What kinds of views related to occupations do you hold? In what manner can these views be changed to encourage interest in the field? Create your own title or use 'The Reason Girls Enter the Field'.

4. What kind of views do you have regarding IT professionals? Consider what kind of stereotypes are prevalent in the field in terms of occupation and people. How can these be eliminated? Why do stereotypes arise?

Appendix 3

Background

Describe your previous education, family, parental education.
Why did you apply to the Information Processing Science studies?
Did your relatives/family support your application?
Did you get any information about the studies in advance?
Did you know anyone who worked in the field before the time you applied to school?
How often did you use computers before you applied to the IS/SE programme?
What views did you have towards the IS/SE programme when you applied?
Was IS/SE your first choice or did you want to enter another field? What was this preferred field?

Studies

How did you feel about the course of your studies felt in the Information Processing Science department?
Did the studies match your own views of IS/SE?
What expectations did you have towards IS/SE before you started studying?
Were some of the courses easy or difficult?
Did you receive enough advice and support throughout your studies? What kind of support and advice? If you received no support, why not?
Did you feel you were keeping pace with other students?
Are there some course-related issues that you would have changed?
Did you attend all the courses as a full-time student? If not, explain why. Were you working or was there another reason?
Did you think the course content or manner of teaching could be improved?
Did you receive support from relatives, family, or others during your studies?
Were you involved in students associations?
Did your studies proceed at the same pace as your classmates?
Did you have friends?

Were you happy with your study credits?

Did you receive enough advice in planning your studies?

Were your expectations of IS/SE fulfilled?

Did you like studying at the university?

Were you motivated at the beginning of the studies? Are you still motivated to study?

Dropout

What were the reasons you dropped out (or stopped studying actively) of the IS/SE programme?

Was there any way your dropping out could have been prevented?

What kind of feelings arose from your decision? Did you believe you made the right decision?

How did your close relatives and others feel when you decided to drop out?

What did you do after you dropped out and what are you doing now?

Have your views of IS/SE changed somehow after you ended your studies?

Would you recommend IS/SE studies to others? If so, why? If not, explain why.

Would you consider continuing your studies? If not, why?

How can your active studying be supported?

Appendix 4

Interview questions for the second interview, case two

What kind of feelings arose during dropout decision-making time?
Were you motivated to study when you decided to drop out?

583. Pakanen, Veli-Matti (2011) Linking demography with dispersal and habitat selection for species conservation

584. Hautala, Johanna (2011) Academic knowledge creation as a spatio-temporal process : The case of international research groups in Finland

585. Saarikettu-Känsälä, Mari (2011) Coevolution of male signals and female preferences in *Drosophila montana* and *D. virilis*

586. Leinonen, Päivi (2011) Local adaptation and its genetic basis in *Arabidopsis lyrata*

587. Rajanen, Mikko (2011) Applying usability cost-benefit analysis — explorations in commercial and open source software development contexts

588. Tervo, Heli (2011) Information technology incidents in the present information society : Viewpoints of service providers, users, and the mass media

589. Riipinen, Katja-Anneli (2011) Genetic variation and evolution among industrially important *Lactobacillus* bacteriophages

590. Lampila, Petri (2011) Populations and communities in human modified forest landscapes

591. Liukkunen, Kari (2011) Change process towards ICT supported teaching and learning

592. Segerståhl, Katarina (2011) Cross-platform functionality in practice : Exploring the influence of system composition on user experiences of personal exercise monitoring

593. Tiikkaja, Marjo (2012) Value creation in collaboration between software suppliers and customers: suppliers' perspective

594. Rousu, Timo (2012) Liquid chromatography–mass spectrometry in drug metabolism studies

595. Kangas, Teija (2012) Theoretical study of the oxidation of a pure and alloyed copper surface

596. Härkönen, Laura (2012) Seasonal variation in the life histories of a viviparous ectoparasite, the deer ked

597. Niinimäki, Sirpa (2012) Reconstructing physical activity from human skeletal remains : Potentials and restrictions in the use of musculoskeletal stress markers

598. Mandić, Vladimir (2012) Measurement-based value alignment and reasoning about organizational goals and strategies : Studies with the ICT industry

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