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Exploring the Understanding of Epistemic Beliefs and Approaches to Teaching of In-Service University Teachers in Colombia, South America.

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Exploring the Understanding of Epistemic Beliefs and Approaches to Teaching of In-Service University Teachers in Colombia, South America.

by

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ACKNOWLEDGEMENTS

As Dan Lortie (1975 p. 65) said in his work “Schoolteacher: A sociological study”- “*Teaching is unusual in that those who decide to enter it have had an exceptional opportunity to observe members of the occupation at work; unlike most occupations today, the activities of teachers are not shielded from youngsters. Teachers-to-be underestimate the difficulties involved, but this supports the contention that those planning to teach form definite ideas about the nature of the role*”. Through my journey writing this thesis I had these continuous images, recurring memories of those wonderful teachers that, during every step of my academic life, captured me with their ways of teaching / teachings.

I was thinking about how at some point in my live as student I have felt inspired by these teachers, by their unique and personal way of teaching and as a consequence, it may be that I have had adopted their teaching styles. This comes so naturally. Those teachers at that point in my live did not have any labels for their teaching processes or about their beliefs, which today are referred to as “epistemic”; they did not have any labels or rubrics whatsoever. I just felt the desire to teach the way they taught me, my only desire was to inspire others just as they inspired us. Olafson et al., (2010 p.110) stated: “*the kind and type of instruction that pre-service and in-service teachers receive can be one of the factors influencing teacher development*”. Yes, this is possible, it may be a certain truth, yet other factors also have an influence on the process.

In real life and not just in stories, our teachers go to school every day to carry out their daily assignments. A large number of them do it in answer to their calling (if not it could be really painful - a real nightmare to get through everyday adversity in this profession) but others do it because of the benefits they obtain from it. Anyway, I just want to express our deepest respect for the humanitarian and educational work that every teacher accomplishes every single day. This is the same respect and admiration that I feel for every single teacher I have had throughout our life and a very special thanks goes to those teachers who participated in this study and in one way or another contributed in the results of this thesis.

I have tried to express my respect and admiration through my own points of view and I truly hope that every teacher feels this respect in all of my opinions. The work of a teacher is not an easy task, in fact, it is extraordinarily complex, and they just go out there every day and give it the best they can, and give the students all that they have to give.

I want to thank to God in first place, to Alejandro my adorable husband who I love so much and, my beloved children Samuel and Diego, they are my life. To my mom and my dad+, to my brother and my sister, my grandparents, my supervisors Dr. John Fazey and his beautiful family and Dr. Anne-Marie Smith, Dr. Janet Pritchard, Dr. Colin Baker, Dr. Jean Ware and to all my former RIEL collegues at Bangor University, to my Sponsor in EU Alßan Programm, to my people at Universidad del Norte in Barranquilla, Colombia and to all my family and friends in Colombia, Spain and Wales.

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ABSTRACT

To promote a change in epistemic beliefs in in-service university teachers and a consequent improvement of their teaching methods to encourage students to take a more sophisticated approach to learning their subjects, I explored the relationships between epistemic beliefs and approaches to teaching in a group of 111 lecturers across different disciplines at the University, Colombia, South America. This correlational research is based on epistemic metacognition research (Hofer & Pintrich, 1997) and phenomenography research (Marton & Booth, 1997). The methodology comprised quantitative and qualitative research techniques including the participation of a selected sample in face-to-face and online interventions. I also conducted two questionnaires, the Discipline-Focused Epistemic Beliefs Questionnaire (DEBQ) (Hofer, 2000) and the Approaches to Teaching Inventory (ATI) (Trigwell & Prosser, 2004). Furthermore, I carried out interviews that were later analysed according to phenomenographic principles.

Based on the findings, I concluded that the DEBQ and the ATI are suitable in measuring epistemic belief and approaches to teaching in a university setting. As I found correlations between epistemic beliefs and approaches to teaching, I concluded that epistemic beliefs do play an important role and influence the way in which teachers approach their own teaching. Additionally, as there was a statistically significant decrease in the Information Transmission/Teacher-Focused Approach through the online intervention, and as epistemic beliefs and approaches to teaching are correlated, the results indicate the possibility of a change from naive to more sophisticated epistemic beliefs. The results also indicate the possibility of changing epistemic beliefs and approaches to teaching through an online intervention or facilitated by online learning environments. The results also indicate the possibility of changing approaches to teaching through short-term interventions as well.

Regarding disciplinary differences, lecturers did have different perceptions. I concluded that discipline did have an influence and an impact on epistemic beliefs and approaches to

teaching. There was no statistically significant difference between genders or the number of years of experience. Finally, there were variations in lecturers' ways of experience learning, teaching, Information and Communication Technologies (ICTs), and knowledge. The description of lecturers' experiences of learning, teaching, ICTs, and knowledge shows 13 qualitatively distinct categories of descriptions. Also 13 holistic views, in a form of outcome space, were derived from their various ways of experiencing those phenomena.

CHAPTER ONE

INTRODUCTION

SETTING THE SCENE

1.1. The Educational Context in Colombia for the Study

Colombians are living through a significant time of peace processes. The Colombian Government and the country's largest left-wing rebel group, the Revolutionary Armed Forces of Colombia (Farc, in Spanish), are trying to end an armed conflict spanning more than more than five decades. According to the National Centre for Historical Memory (2013), more than seven million people have registered with the Government's Victims' Unit. The vast majority have been internally displaced because of the violence, but many have also been kidnapped, threatened, injured by landmines or victims of enforced disappearances. In accordance with the National Department of Planning (2014) (DNP, acronym in Spanish), after a peace deal is signed in Havana, Cuba, we will hopefully have the mission to rebuild our country and that will be done through education. Education is a fundamental tool that can help Colombians to not only reconstruct and transform our country but to also help us develop as people and as citizens. The social, economic and educational gaps in Colombia will close when we educate Colombian people on equality, equity, fairness and respect. For this reason we must make every effort to improve the quality of our education system.

Colombia's has passed laws that helped to improve the quality of education, and this will provide the country with the opportunity to compete on the international arena. According to the Ministry of National Education (MEN, acronym in Spanish) (2006), in the last two decades, Colombia has made significant progress in the access to education and the internal efficiency of the educational system. However, Colombia is far from achieving universal access to quality education for all children, youths and adults.

According to the National Administrative Department of Statistics (2014) (DANE, acronym in Spanish) in Colombia there are 28 million people living in poverty and 8 million in indigence. Given that 2014 data state there are 48 million Colombians, this means that 58% of Colombians live in poverty, with 16% living in extreme poverty or indigence[1]. Although in recent years there have been slight improvements to these two indicators, the poverty gap continues to widen especially between rural and urban areas. Income distribution has not improved, but has rather worsened, and Colombia continues to be one of the Latin American countries with the poorest social indicators.

In accordance with The World Bank Colombia (2009 p. 24), adults in rural areas have an average of only 4.8 years of schooling, while adults in urban areas average a schooling of 9.3 years. The difference is partially related to the political and criminal violence that still prevails in some rural areas of the country. Besides this, the illiteracy rate is 6%, as indicated on the last census carried out in Colombia in 2005. According to UNESCO (2010), illiteracy-free countries are defined as those that achieve a rate of below 4%. We are making progress but illiteracy is still far from being eradicated. Colombians from low-income families have little chance of receiving a good education and in the worst-case scenarios they receive no education at all. According to the same study, although progress has been made in recent years, the quality of public educational institutions in Colombia remains poor, lacks resources, and has poor education coverage and high attrition rates. It is worth noting that this situation depends upon the region of Colombia, because there are large economic disparities between the various regions in Colombia. For example, according to Bonet and Meisel (2007), the per capita income of Bogotá D.C. is 8.3 times higher than that of Chocó, the poorest region in Colombia. In accordance with Meisel and

[1] According to The National Administrative Department of Statistics (DANE in Spanish) in 2014, a person is considered indigent when their monthly income is below $120,588 COP (30 GBP). A household consisting of four members, whose monthly income is below $1,125,536 COP (304 GBP) is also considered poor. That same household is classified in the indigent category if its monthly income is less than $482,352 COP (130 GBP).

Romero (2007), public educational institutions in the most dynamic and most developed regions perform better than those in the most under-developed regions.

As indicated by The World Bank Colombia (2009), there are rural areas that lack basic elementary education. Children and young people who want to access it have to each day travel to other and further away places, with their own resources, in order to receive education, putting themselves in countless dangers, starvation and exposure to being recruited by Colombian guerrillas. On the other hand, the urban public schools also have many limitations; their academic quality depends greatly on the area or region they are located in. There are very poor, marginalized urban areas, in which the Government invests very little. Public educational institutions in these areas have a very low academic quality; and students also have to live in the midst of social conflict. Many children and young people are lost along the way towards overcoming these barriers; many do not finish school nor have access to university. Indicators reveal that on average one of every two students do not complete their studies (Source: MEN, 2009). According to this study, private schools in cities tend to outperform public schools. Even though many Colombian students advance to secondary schooling, few graduate, especially due to the high cost of education, the poor quality of education received at previous levels and the little relevance of their learning, that in one way or another influences their progress so that students at this level drop out of their training.

Barrera and Ibanez (2004) hold that violence has a negative impact on school enrolment figures for all age groups in Colombia. Towns with homicide rates above the national average have lower enrolment rates than those towns with homicide rates below the national average. The negative effect of violence is considerable and overshadows any good deeds that the Government attempts to implement in education or health within these areas. According to Sánchez and Díaz (2005), between 1995 and 2002 enrolment at primary and secondary levels were considerably lower in towns with illegal armed groups. The authors demonstrated that the internal conflict in Colombia has affected enrolment and has led to higher dropout rates, as students of both primary and secondary schools are often recruited by illegal armed groups or forced to leave school because of the violence situation (e.g. public order problems, forced displacement, threats, deaths of family members and difficulties in recruiting teachers). In recent years, however, violent tendencies have shown signs of reversal, and there has been an increase in enrolment among students who were displaced because of violence.

On the other hand, Melo, Ramos and Hernández (2014) claim that Higher Education in Colombia faces major challenges, which include the expansion of coverage levels and improving the quality of institutions offering educational services at this level. Over the past two decades, the number of enrolled students has grown significantly but the coverage rates remain low (45.5% in 2013) in comparison to developed countries or other Latin American countries such as Argentina, Chile, Cuba, Uruguay and Puerto Rico. Besides, the quality of the higher education system is heterogeneous because institutions that are well-organized and recognized for their excellence coexist with institutions that are characterized by low levels of quality. By 2014, there were 288 higher education institutions in Colombia and only 34 have a high quality accreditation from the Ministry of Education (which represents 11.8% of the total number of HE Institutions). Moreover, in 2014, of the 10,596 academic programmes at higher education institutions in Colombia, only 798 (8.1%) are accredited with high quality. Attention should also be drawn to the low percentage of teachers in Colombia with Ph.D. degrees (5.8% in 2013), who are also concentrated across only a small number of universities. Additionally, there is no clear connection between the needs of the productive sector and vocational training, which is a constraint on the economic development of the country. It is also worth mentioning that much of the recent increase enrollment, with regards to the level of training, has its origin in the growth of admission for technical and technological education, which increased from 24.7% in 2005 to 32.7% in 2013, in comparison to professional studies education that decreased from 70.4% in 2005 to 61.4% in 2013 (Melo et al., 2012).

Another study by the OECD, IBRD and The World Bank (2013), found that the public higher education sector universities have had economic and structural problems dragging on for decades, such as very low budgets, very few resources, a financial model in crisis, having obsolete, out-dated and poor quality standards, weak curricula, poorly trained teachers, internal corruption and mismanagement of funds, and among the many other difficulties is the fact that society does not identify the public university as being an engine of development, employment and prosperity for the country. To receive an education of a certain standard in Colombia it is necessary to go to a private institution. In 2014, the tuition growth rates at private educational institutions was 9.9% and tuition growth rates at public educational institutions was 5.8% (Source: ICFES, 2014). In accordance with the study by Iregui, Melo and Ramos (2006), in terms of efficiency, the results show that private institutions could be benefiting from more favourable environments, taking into account that these, on average, admit higher-income students. Quality indicators show that the best centres in the country are not public institutions and the percentage of public institutions located in high, superior and very superior categories is very low. While the best education in the country is offered at private institutions, a high percentage of private centres have poor results. With regard to public education between 1997 and 2003, over 90% of the public centres ranked in the middle, low and very low categories. For the same categories in the private sector, this percentage was about 70%, suggesting that education in the private sector is not always a guarantee of quality.

It is worth mentioning that higher education in Colombia is regulated by the Law 30 of 1992, which defines the character and autonomy of higher education institutions. Law 30 of 1992 enshrined freedom of education and recognized education as a right and a public service that can be provided by the state or by a private entity. Law 30 of 1992 guaranteed universities autonomy and established that universities could issue their own regulations, but to ensure the quality of the education system, the State undertakes a duty of inspection and surveillance. However, according to a study by Melo et al., (2014), this Law 30 of 1992 went against the same purposes it was trying to encourage. Universities in Colombia were established as autonomous entities but, sheltered under the statute of autonomy, new private higher education institutions were created from independent heritages with their own legal status, academic, administrative and financial autonomy and the power to develop and manage its own budget, and as a result created an avalanche of private higher education institutions, many of them providing low quality education.

As indicated by the Institute for Educational Evaluation (ICFES, acronym in Spanish) (2012 p.3), in Colombia, not all students have equal opportunities to access higher education and achieve a satisfactory performance. There is a huge social and economic gap between the vast poor majority that cannot afford a good education and the wealthy, who make up only 10% of the entire Colombian population, who have access to quality private institutions or travel abroad to be educated at the best educational institutions in the world. Between the rich and poor there is a middle class that has to pay huge sums of money and remain in debt for most of their lives in order for their children to go to quality private schools and private universities. The difference is huge - in short, it is an unequal struggle.

Statistics from The National System of Higher Education Information (SNIES, acronym in Spanish) (2013) indicate that the coverage rate of higher education in 2013 was 45.5%, which is low compared to other Latin American countries like Cuba and Puerto Rico, which reach 95%, or Argentina and Uruguay with 75%. On the other hand, not all students complete their studies: in 2013, the annual dropout rate for higher education was 10.4%. The number of professionals is increasing every year, albeit very slowly. Those who succeed are so in debt that the prospect of becoming a professional who holds a Masters or Ph.D. is completely faded because of the economic uncertainty, employment and the high interest rate of student loans.

It is true that there are well-organized institutions recognized for their excellence, quality and very high standards of performance. Unfortunately there are only a few of these, and they remain unaffordable for many.

As indicated by the DNP (2014), the key performance indicators like coverage, effectiveness, efficiency and quality of the educational system indicate that any advancement made over the last few decades in Colombia has been insufficient. Although it is true that over the last few decades the Colombian Government has made a huge effort to overcome the obstacles at the different educational levels, there is still much to be done. In the coming years, the educational sector will have to actively work on those indicators if Colombian students are to be internationally competitive.

Accordingly, any project that we undertake in Colombia must consider its social and cultural realities. We suffer from a kind of learned helplessness (Galindo and Ardila, 2012), we are skeptical and have a lack of confidence but we also have a great spirit of overcoming. So, it is important to know where the inequalities lie in order to identify where to best direct effort. Inequalities lie in the lack of opportunities. In this context, how can we contribute to achieving quality higher education? We can ensure that an important instrument for change is the teacher. Strengthening his/her management skills of teaching is a crucial and decisive way to achieving quality standards in higher education. Our teachers need to be better prepared for the challenges of education in the XXI century. We cannot change our reality from one day to another, but by creating quality training programmes for our teachers we are –in some way- contributing to changing Colombian society and closing the gap that separates us from the most advanced societies. It does not matter if they teach at a private or public institution; what matters is that change is in our hands. I believe that our efforts must focus on this. Our task is to identify the weaknesses of the current teacher training programmes and improve them to reduce inequalities in the system. We want our students be able to learn in a more in-depth, and less superficial way, but for this we need our teachers to change the way they approach teaching.

To enhance teacher quality and capacity, the Government of Colombia, through the Ministry of National Education and with the collaboration of the various governmental and non-governmental bodies that promote education in Colombia, has proposed several plans, programmes, projects, actions and strategies through the 2006-2016 Ten-Year National Education Plan. Amongst the specific programmes we should highlight:

-The professionalization of teachers, which includes demonstrating proficiency in Information Technologies skills and achieving a deeper understanding of teaching and learning processes.

-Improving the quality of higher education through an emphasis on pedagogy, didactics, epistemology, ethics and research.

-Implementing pedagogical strategies that enable self-learning, collaborative learning, deep learning and creative thinking, using Information and Communication Technology.

-The National Agenda of Information and Communication Technology to promote digital teacher competences, in which we can find the "Professional Development for Educators schema", whose objectives are to present the status of new technologies, e-learning and blended-learning methodologies, their implementation into the curricula and application in the instructional design of the subject matters and, finally, to redefine the role of educators looking towards the potential of technology, virtuality and online collaboration.

These are just some of the main goals of our National Government to promote quality higher education. The Universidad del Norte ("The University" from now), in Colombia, South America, is not far removed from this reality. In line with the development plans of our region and our country, the University, which for reasons of confidentiality we will refrain from naming, has proposed in its institutional development, promoting education with quality which are, in part, reliant on strengthening its plans for professorial development in order to provide itself with a larger and better prepared body of qualified teachers, equipped with innovative tools in its institutional development project strategies. Such a pool of teaching faculty is expected to contribute to the development of quality education by acting as role models in the construction of the values and competences that the institutional leaders want to develop in the students.

Although both the public and private universities invest enormous economic efforts creating programmes to improve teacher training, these programmes have little impact on their work and no influence on their professional practice. It is not enough to just increase the number of teachers with a Ph.D. Although this is a significant advance, improving the quality of teaching that they transmit to their students is also needed. For example, Iregui, Melo and Ramos (2006), found that the educational level of Colombia's official teachers has improved in recent years. However, this has not resulted in a better quality of public education as reflected in the state exam conducted by the Government. In my experience of

17 years working in higher education, I have seen how many universities boast about equipping their teachers with the best techniques and newest teaching approaches. However, all these techniques are imposed from the outside. In reality, the Heads tell the teachers how to teach, but these programmes fall short, and do not go beyond that. A greater deepening of efforts in this area is required. It is necessary that the need for change starts with the teachers themselves, from the inside, teachers first need to recognize their own beliefs, which should be modified in order to change the way they focus their teaching, so their students can learn their subjects in a deeper way. For this reason I feel motivated to undertake this study and implement a strategy to improve the quality of teaching at my university.

As stated by Brownlee, Schraw and Berthelsen (2011), within a social constructivist framework, teachers do not merely transmit knowledge to students; rather, they facilitate student learning by supporting students to actively construct knowledge. However, while it is important that teachers have an understanding of constructivist teaching practices, it is also critical that they have beliefs that support these pedagogical approaches. For this reason, a greater more in-depth change is required. It is necessary for the change to begin with the approaches of the teachers, from the inside, they need to first recognize their own beliefs, which should be modified in order to change the way they focus their teaching in order for their students to learn their subjects in-depth. For this reason I feel motivated to perform this study and implement a strategy to improve the quality of teaching at my university.

1.2. Background to the study

This research is an exploratory study on university teaching. A sample of 111 in-services teachers at a University, in Barranquilla (Colombia, South America) participated in the study. The research focused on two main areas of inquiry. There is a focus on epistemic beliefs, which can be conceptualized as an individual's belief about knowledge. The second area of enquiry is about how epistemic beliefs of individuals might influence, or be related to, approaches to teaching which can be conceptualized as different strategies adopted by teachers to transmit the contents of their subjects.

My hypothesis is that teachers hold a variety of epistemic beliefs (Hofer, 2001). At the same time, they experience the various teaching and learning situations in a certain way (Marthon & Booth, 1997). These beliefs and these experiences influence their conceptions about teaching and learning (Trigwell & Prosser, 1999). These conceptions of teaching and learning, in turn, have an impact on the approach the adopt to teaching (Trigwell & Prosser, 1996). Therefore, in order to change the way they conceive teaching and learning (Trigwell, 1995; Trigwell & Prosser, 1996), and to consequently change how teachers teach, we have to first understand how they conceive teaching and learning and then we have to understand the way in which they experience those things.

I designed and implemented a methodology to discover the epistemic beliefs and the approaches to teaching of in-service teachers. This methodology comprised multiple research techniques that were administered in progressive phases over a specific period of time to develop a shared group understanding of complex issues such as teaching and learning. By using multiple techniques the learning of the participants is improved within the study group by allowing them to be privy to the understanding of other participants and to see issues from different perspectives. My methodology implied research and pedagogical action through a sequence of structured stages with the purpose of extracting or constructing the understanding of the group, which effectively is greater than the sum of the parts of the individuals' understanding of an issue (Fazey, 2005). I carried out a pilot test to try out the functionality of the actual questionnaires, the items, the instructions and the analysis of the data, and to test the viability of the strategy.

The methodology was carried out in four phases. The first stage was to select the population of lecturers that would participate in the study. During the second stage I selected a stratified sample from among the lecturers who completed the two tests. With this stratified sample I carried out two interventions. The sample was divided into two groups, with which I performed a face-to-face and an online intervention. The intervention consisted of focus groups where they discussed three topics - teaching, learning and Information and Communication Technology. I used these topics because my research subjects were exploring their epistemic beliefs about teaching and learning processes and approaches to teaching to support changes that encourage students to adopt a deeper approach to understanding their subjects, and because interventions were developed across two environments: face-to-face and an online environment. During the third stage I produced a graphical representation of distinct categories of descriptions found and an outcome space from various ways of experiencing teaching, learning and Information and Communication Technology. Feedbacks from interviews and focus group discussions were presented as a graphical representation depicting the key elements and concepts identified by all participants and their critical relationships. In the fourth stage we gave the sample group two tests: the Approaches to Teaching Inventory (ATI) and the Discipline Focus Epistemic Beliefs Questionnaire (DEBQ). Next I compared the scores before and after the intervention and checked whether there were any changes produced afterwards. A process of verification involving the participants was employed at each level to ensure that the researchers' interpretation of the understanding of the participants was correct.

As my objectives were varied, that is to say, I not only studied the teaching approaches but also the epistemic beliefs of the teachers, it was necessary to use two different, but perfectly compatible, approaches. The foundation of this methodology was based on phenomenography and epistemic metacognition; two different approaches, but related in their view of the teaching and learning process (Cano, 2005; Hofer, 2004a; Moore, 2002). In section 1.3 Study Purpose and Aims, I go into greater depth about the objectives of the research.

This strategy was originally applied in a research project at the Australian National University, Canberra (Fazey, 2005) and later in further research project at Bangor University (Lawson, 2009) as a way of exploring the understanding of experience of a complex issue, as expressed by individuals and groups. It was also used to develop an understanding of environmental issues, first used on a dynamically complex wetland system to attempt to generate ecologically valid insights into serious and immediate environmental and social problems and to provide a means for gathering perspectives on an issue as understood by a particular group (Fazey, 2005). I mention this to show that this strategy was successfully used in the past, and have served, as an appropriate model for what I was looking for from my research in Colombia.

Phenomenograpy is a method of qualitative research that aims to identify the qualitatively different ways in which people experience, conceptualize, perceive, and understand various kinds of phenomena (Marton, 1981). From the phenomenographic approach (Marton, Hounsell & Entwistle, 1997), different studies were developed whose target was to study the relationship between teaching and learning from the student and teacher's perspective. Trigwell, Prosser & Taylor (1994) carried out a phenomenographic research, it was found that teachers adopted different strategies or approaches to teaching the contents of their subjects. The two strategies were: an Information Transmission/Teacher-Focused Approach (ITTF) and a Conceptual Change/Student-Focused Approach (CCSF). As a way to measure these two strategies of teaching Trigwell, Prosser & Taylor (1994) developed the Approaches to Teaching Inventory (ATI), which I used in this body of research.

On the other hand, I am going to use the epistemic metacognition approach to study the epistemic beliefs of university teachers. According to Hofer (2004a) epistemic metacognition refers to the metacognitive employment of epistemic beliefs, this is, epistemic metacognition is a process in which we use the beliefs about knowledge called epistemic beliefs to understand how we came to know. According to this view, epistemic beliefs are considered as a metacognitive process, an epistemic metacognition because they are kind of a meta-knowledge or knowledge about knowledge process. Epistemic beliefs are part of an underlying mechanism of metacognition. Epistemic beliefs are a variety of beliefs about knowledge whose nature tends to change from objectivist to relativist or, in other words, from naive beliefs to more sophisticated beliefs and they influence understanding, learning and teaching (Hofer, 2000). They are called naive beliefs because of predisposes to the learner toward a rigid thinking, simple, certain, dualistic, limited to memorizing and routine action. Otherwise, they are called sophisticated beliefs because the individual that holds this type of belief is able to question the knowledge and sources to achieve a constructive stance in which subjects can be considered active builders of meaning.

According to Hofer & Pintrich (1997) this is the general consensus. When it is said that is the general consensus is because researchers in epistemic beliefs (Khine, 2008; Hofer & Pintrich, 2004) are doing an attempt for unifying the differents teories about epistemic beliefs and build bridges between the various models. Of course, this enterprise has its nuances, ie, it is the general consensus but no universal consensus because this paradigm is diverse. Some researchers include learning as an epistemic belief, others believes that individuals are not necessarily sophisticated or naive in all their beliefs at the same time. It is also known that an individual can hold sophisticated beliefs in one discipline but hold naive beliefs in another discipline concurrently. Also is important to distinguish between general beliefs and particular beliefs. In basic sciences, physics for instance, there are absolutes knowledge and certain knowledge (Newton's laws are certains). If a student consider it as uncertain this student is lost. On the other hand, the opposite happens in humanities where many concepts can be considered as relatives and where absolutist stances are considered naive.

Placing the epistemic beliefs theory within a developmental framework will help us to much better understand the concept and to provide the construct with greater clarity and precision.

The paradigm of epistemic beliefs has a heterogeneous conceptual framework (Schraw & Sinatra, 2004). Many theories have been proposed to clarify the concept; therefore there is no single theoretical framework for the conceptualization. These authors have also emphasized all the different ways they have been named, depending on the theoretical framework in which they are contained, so there is again, no single or unique term to name them. I am going to use in this thesis the terms “epistemic beliefs” and “personal epistemology” as they both, according to Hofer (2001), enjoy the greatest agreement. Although these terms have their own limitations, they are, in accordance with Hofer (2001), the most suitable because they embrace the entire body of research undertaken that relates to the individuals' conceptions of knowledge and its acquisition.

Inside the epistemic metacognition paradigm, Hofer (2000) developed the model of "epistemological theories" or, as they were later called, "epistemic theories" or "personal epistemology" (Hofer, 2004), which state that the individual beliefs about knowledge and knowing are organized into personal theories, as structures of interrelated propositions (Hofer & Pintrich, 1997). According to Hofer (2000), epistemic beliefs are theories that individuals have about knowledge and its acquisition. They are individual assumptions that a person is aware of and recognizes and can be general, specific or focus on a discipline. The dimensions of epistemic beliefs are clustered into two areas: the nature of knowledge (what one believes knowledge is) and the nature or process of knowing (how one comes to know). Within these two areas, there are two subdimensions. Under the nature of knowledge category there are two dimensions: the certainty of knowledge, and the simplicity of knowledge. And under the nature of knowing umbrella there are also two dimensions: the source of knowledge, and the justification of knowledge. To examine the epistemic beliefs of teachers I used an adapted version of the DEBQ by Hofer (2000).

Although approaches to teaching and epistemic beliefs emerge from different perspectives, a growing number of research papers support the connection between them. Epistemic beliefs came of interest to educational psychologists in the 1990s, particularly in the United States. This interest resulted from the development of various models of beliefs about knowledge. Parallel qualitative phenomenographic studies in Europe have focused on the development of approaches to teaching. These areas of research and their potential for application in higher education teaching form a key area of focus for the research described in this study. Research has shown that teachers hold a variety of epistemic beliefs (Hofer, 2001), which act as a filter and play a key role in the decisions that teachers make concerning the importance they assign to knowledge. These beliefs influence their conceptions about teaching and learning (Trigwell & Prosser, 1999), for example, a teacher with a simplistic epistemic believes that knowledge is simple, clear and specific and the ability to learn it is innate and pre-established. In contrast, a teacher who advocates knowledge being sophisticated will believe that learning is complex, uncertain and tentative and can only be achieved gradually and progressively. The conceptions, in turn, have an impact on the adopted approach to teaching (Trigwell & Prosser, 1996; Trigwell et al., 1999) i.e., teachers with more complex teaching conceptions adopted student-oriented teaching approaches and those with more limited teaching conceptions went for teacher-oriented approaches and information transmission. Therefore, in order to change how people teach we will have to change the way they conceive teaching and learning (Trigwell, 1995; Trigwell & Prosser, 1996).

Regarding the global state of this type of research, very little has been said about the role of teachers' epistemic beliefs and worldviews thus far, and how these worldviews affect classroom practice (Schraw & Olafson, 2002). On the state of research in Colombia, we can say that phenomenographic research is a relatively new approach. There has been little research undertaken in this area. In most Latin American countries there is also little known about this area but studies have already begun in Mexico, Chile and Venezuela (Larsson & Dahlin, 2010). On the other hand, the educational topics about teaching and learning in higher education have been studied in Colombia from mainly cognitive and behaviourist approaches. In recent decades studies on metacognition have emerged in force (Acosta, 2002, 2011; Lopez et al., 2012). Interest in the field of epistemic metacognition in Colombia is more recent (Aparicio et al., 2004; Aparicio & Herron, 2006; Herrón, 2010a, 2010b). Therefore, this thesis makes a significant contribution to knowledge and understanding in the field of epistemic beliefs and approaches to teaching in Higher Education in Colombia. Also the thesis will let, from a different and at the same time complementary perspective, regularly reflecting on what we are doing as professionals in higher education, improving our work and contributing to the development of the education system in Colombia. The thesis also lets me test a new methodological and educational model in e-learning, which can be applied at not only the Universidad where I work but also at other Colombian universities.

1.3. Study Purpose and Aims

The overarching purpose of this thesis was to gain an insight into the epistemic beliefs of university teachers and to examine how these might influence their approaches to teaching. The main idea of the thesis was to create a study and pedagogic tool for the professionalization of teachers at the University. What I aimed to do with this tool was to explore other ways of growing and continuous improvement processes for our teachers, and to contribute to educational innovation, to encourage changes to beliefs that lead to changes of attitude through a shared understanding of their knowledge and experience. For this reason, and in accordance with the development plans of our institution and the Colombian Government, I have developed this research, which seeks to explore alternative ways of inducing and continuing improvement for our teachers. Much of the focus was on making a contribution to stimulating innovation in teaching by creating conditions that lead to changes of attitude through a shared understanding of knowledge and experience.

The general objective was to establish whether a relationship existed between the epistemic beliefs and approaches to teaching of teachers at the Universidad del Norte in Colombia in order to support changes in teaching that encourage students to adopt a deeper approach to the understanding of their subjects.

By the end of the study I expected to:

1. Establish the relationship between the lecturers' epistemic beliefs and their approaches to teaching.
2. Develop a shared understanding of learning, teaching and information and communication technology that will lead to changes in epistemic beliefs through a peer-collaboration methodology, and;
3. Confirm whether changes in epistemic beliefs lead to changes in approaches to teaching.

Finding cause-effect relationships was not a purpose of this study. The style of this research was correlational. I was interested in exploring the relationship between epistemic beliefs about teaching and learning and the teaching approach of a group of lecturers in

Barranquilla, Colombia. As I will explain this in the instruments section, I aimed to explore and understand the experience of teaching and learning of a group of academics through their relationships between epistemic beliefs and teaching approaches.

The variables that I measured and correlated were:

1. Epistemic beliefs about certainty of knowledge
2. Epistemic beliefs about justification for knowing: Personal
3. Epistemic beliefs about source of knowledge: Authority
4. Approach to teaching: Information Transfer/Teacher-Focused Approach (ITTF)
5. Approach to teaching: Conceptual Change/Student-Focused Approach (CCSF)

1.4. Summary of the Focus of this Study

This study is relevant and timely for several reasons:

Epistemic beliefs provide the potential for developing a framework or model that could contribute to the understanding of how teachers view and evaluate knowledge in their individual worldview at a metacognitive level.

Approaches to teaching provide the potential for developing a framework or model that could contribute to the understanding of how teachers teach and what the best approach to developing a deeper learning in their students is.

There is limited educational research into the relationships between epistemic belief and approaches to teaching and no literature could be found in Colombia that was focused on these links. This thesis will contribute to, and stimulate the development of, literature about epistemic beliefs and approaches to teaching in in-service teachers in a Colombian context.

Epistemic beliefs and approaches to teaching are an emerging theoretical body of knowledge with some very apparent inconsistencies and issues of construct validity, yet there is potential for the further development of instruments and techniques to explore personal epistemologies and approaches to teaching of the teachers, and apply these findings to enhance and improve teaching and learning opportunities.

If what we want is to improve the teaching process and to change how lecturers teach, there must firstly be a change in the way of conceiving teaching and learning processes. As a consequence, these changes will improve the academic performance of students. This is a useful study because, in a way, it highlights the relevance of beliefs in the teaching processes, and secondly, it emphasises that if we, as teacher coach, are looking for an improvement in teaching quality standards, we are going to need take more seriously the study of epistemic beliefs in university teachers and deepen the understanding of these types of beliefs. When designing and applying an effective professional teacher development program, it is a requirement understanding how teachers conceive and experience teaching and being aware of their epistemic beliefs about teaching and learning processes.

This thesis propose a model of strategy into professional teacher development programmes. Not only do we seek a change to more sophisticated epistemic beliefs and teaching strategies but beyond that we also want our teachers to develop consistent and congruent attitudes to achieve real conceptual change despite any barriers and limitations. If the heads of the university want to enhance teaching and learning quality through teacher training, this research will prove helpful and should be taken into consideration.

The results make a contribution to the research on epistemic metacognition in university settings. They also act as a foundation to form research studies about phenomenographic research in Colombia. This is an innovative project which is based on a quantitative and qualitative methodology, which thanks to the results obtained, successfully comply the goal of this research and achieved with the aim of obtaining more reliable and durable.

Finally, when designing teachers' professional development programmes or courses aimed at effecting change in teaching processes, the centres of administration of e-learning at the universities, need to design teaching and learning experiences around the concept of variation. The educational institutions need to design experiences to help teachers to simultaneously distinguish and focus on fundamental aspects of the teaching process using variation. Upon knowing what belief varies, we can be able to create room for variation that persuades teachers' awareness, making the experience of all the variations about teaching process be possible. I will analysis this topic in the phenomenography section and in the results section.

By addressing these issues, the body of research presented in this thesis will contribute to the development of new knowledge about this underdeveloped area of Higher Education.

1.5. Thesis Structure

The thesis is structured as follows:

Chapter one put into context the research. Sets the scene highlighting the cultural and educational perspective and foregrounds the Colombian context. The chapter explains the background of the study, the study's purpose and aims.

Chapter two constitutes the literature review. The chapter is divided into two sections: One dedicated to epistemic beliefs and a second part dedicated to approaches to teaching and phenomenography.

Section one includes all theoretical aspects related to the epistemic beliefs. First, I review the main research studies conducted in recent years on metacognition that are related to epistemic beliefs; after a conceptualization from a psychological and educational perspective of epistemic belief and various epistemics models are presented. Alternative conceptions of epistemic beliefs are reviewed. Finally, I review personal epistemology theory by Hofer and Pintrich (1997), the dimensions of epistemic beliefs, how beliefs are changed, how beliefs are measured, what kind of epistemic beliefs university lecturers hold, how epistemic beliefs operate and what is it about the Discipline-Focused Epistemic Beliefs Questionnaire (DEBQ).

Section two includes the theoretical aspects of Phenomenography. I review the main researches conducted in recent years on Phenomenography and approaches to teaching. I I review the origins of phenomenography, the early and current developments, and the concepts categories of description, outcome space and theory of variation. I continue with a review of Phenomenograpy as research technique. I end the chapter with a review of Phenomenography and its relation with teaching and learning, that is, students' conceptions and approaches to learning, conceptions and approaches to teaching and what is the Approaches to Teaching Inventory (ATI).

Chapter three describes the methodology behind this research. Two types of research methods are used: quantitative and qualitative. I present the research objectives, research approach, style of research, participants, ethical issues, instruments and design and procedure.

Chapter four presents the quantitative and qualitative results of the study. Factor Analysis used to test the validity and the internal consistency of the two questionnaires is presented. The results of this analysis support the use of the two factors of ATI as separate scales, as suggested by the authors (Prosser & Trigwell, 1999). The two factors represent the following dimensions: (1) Information Transmission/Teacher-Focused Approach (ITTF) and (2) Conceptual Change/Student-Focused Approach (CCSF). In general, the scales have a good internal consistency and can be considered reliable with the sample (n=111). Also the results of the analysis support the use of the three factors of the DEBQ as separate scales, as suggested by Hofer (2000). These factors represent the following dimensions: (1) Certainty of Knowledge; (2) Justification for knowing: personal and (3) Source of knowledge: Authority. The scales have a good internal consistency and can be considered reliable with the sample. I present descriptive statistics. A total of 111 lecturers responded to both questionnaires. I present the correlations found. Differences by discipline in Approaches to Teaching and Epistemic Beliefs are also presented. I show Paired Sample T-

Test performed to evaluate the impact of the face-to-face and online intervention on teachers' scores on the Discipline Focus Epistemic Beliefs Questionnaire (DEBQ) and the Approaches to Teaching Inventory (ATI). Finally, a Phenomenographic analysis of the interviews and focus groups is produced. Categories of descriptions and outcome space are revealed.

Chapter five is dedicated to discuss and analyze the principal findings. First, I summary the principal findings and then I analyze and discuss the study findings: Factor analysis and internal consistency of ATI and DEBQ, correlations, impact of the interventions, disciplinary differences and the variations and outcome space founded.

Chapter six presents the conclusions, contributions and implications of the research. Contributions of the research for Higher Education are considered. Finally, chapter seven is devoted to examine the limitations and recommendations for future research and for Higher Education context.

CHAPTER TWO

REVIEW OF RELEVANT LITERATURE

SECTION ONE

EPISTEMIC BELIEFS

2.1 Introduction

The purpose of this chapter is to explore the main themes of epistemic beliefs in current literature and establish the theoretical basis on which this research is sustained. Firstly, in Part One, I define epistemic beliefs and explain their relationship with the metacognition approach. Afterwards, epistemic beliefs are defined through a critique of the conceptual basis and current developments in models of epistemic beliefs and their relationship with teaching and learning processes.

2.2. Defining the term epistemic beliefs

2.2.1 What are epistemic beliefs?

According to Hofer (2004), epistemic beliefs are individual assumptions that a person knows and recognizes. They are personal beliefs or personal theories about knowledge and knowing, that is, how individuals perceive knowledge and how we get to know. It suggests that individuals hold a variety of beliefs about knowledge and knowing whose nature tends to change from objectivist to relativist, from naive beliefs towards more sophisticated beliefs. It is the general consensus.

2.2.2. Variety in terminology

It is important to say that the paradigm of epistemic beliefs has a heterogeneous conceptual framework (Schraw & Sinatra, 2004). Many theories have been proposed to clarify the concept (Alexander & Sinatra, 2007); therefore there is no single theoretical framework for the conceptualization (Hofer, 2004). Researchers have emphasized that they have been labelled differently depending on the theoretical framework in which they are contained, so there is no single or unique term to name them. I concur with Mason & Boldrin (2008 p. 378) that the adjective "epistemological" is more popular in literature but as they say: *"epistemological beliefs should be conceived in terms of beliefs about epistemology, that is, beliefs about the study of knowledge. In contrast, epistemic beliefs refer to personal beliefs about knowledge". So,* as this study is focused on personal beliefs about the nature, source, and justification of knowledge, I am going to use the label "epistemic" instead of "epistemological". Besides, according to Hofer (2001), the terms "epistemic beliefs" and "personal epistemology" enjoy the greatest consensus in this literature; for this reason, I am going to use both throughout this study. Although these terms have their own limitations, they can be appropriate because they encompass all the research that has been undertaken that is related to individuals' conceptions about knowledge and its acquisition.

2.3. Epistemic beliefs as a metacognitive process

2.3.1 What is metacognition?

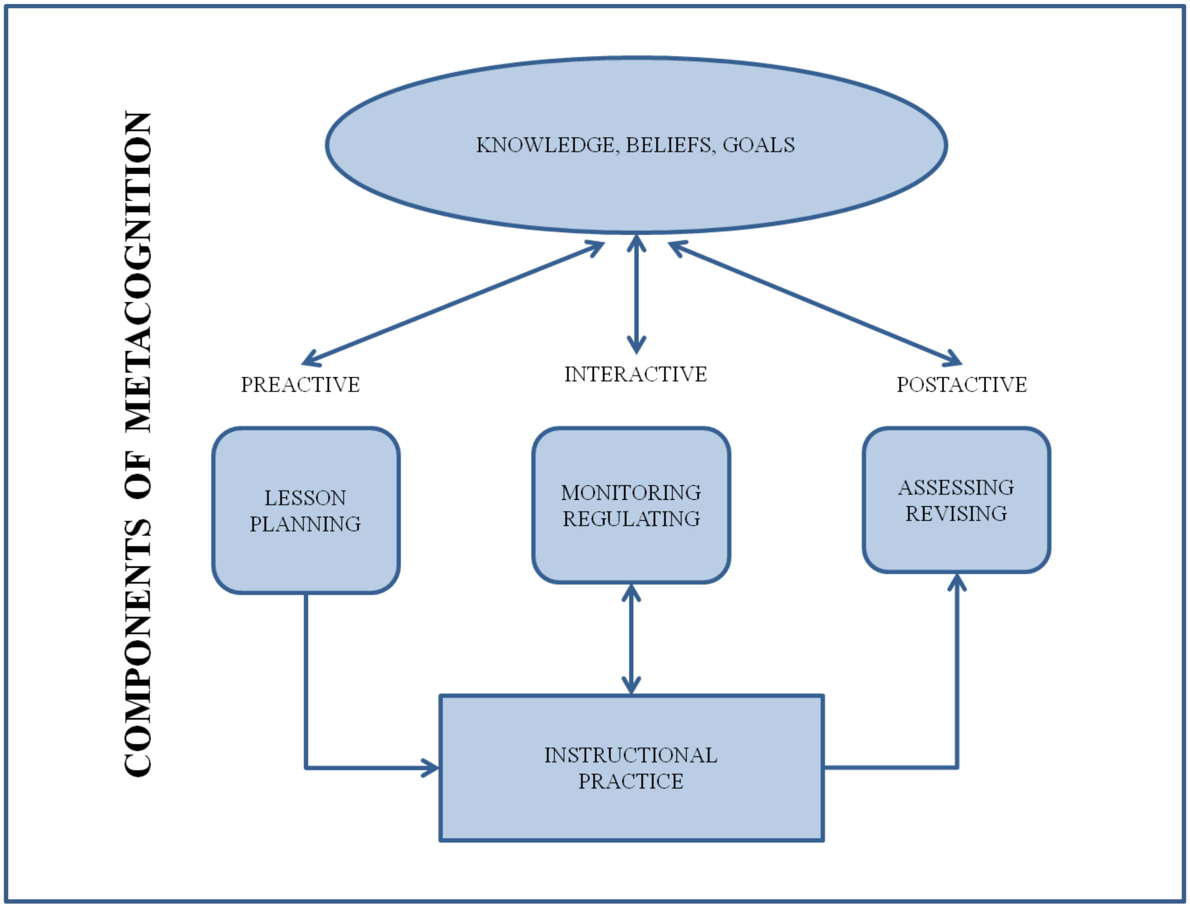
It is worth mentioning, very briefly, that metacognition refers to thinking about thinking, and has two components: Knowledge about cognition, and the regulation of cognition. Metacognition is the consciousness and manager of our thoughts. Weinert (1987) describes it as "second-order cognitions: thoughts about thoughts or reflections about actions". It is also defined as a mental process used by people to control and monitor their own cognitive activity (Nelson & Narens, 1994). Its historical roots came from the United States of America. The American psychologist, John Flavell, defined metacognition as cognitive monitoring, as cognition about cognition or knowledge about knowledge (1979). Hartman (1998) state that metacognition is especially important because affects the acquisition, comprehension, retention and application of what is learned, in addition to affecting learning efficiency, critical thinking, and problem solving. Metacognition encompasses the concepts of epistemic belief about knowledge, how knowledge is constructed, how knowledge is evaluated, where knowledge resides, and how knowing occurs (Hofer 2008a). According to Kuhn (2004) metacognition is a complex concept requiring more studious inquiry. The reason is that although there is abundant literature on metacognition, it is a concept that remains in force and its implication with other areas of knowledge, for example, theories of learning and instruction, makes it appealing and relevant to new research.

There is no evidence about whether metacognitive knowledge appears when one is born or if it is innate (Schraw, 1998). But it is known that metacognition develops (Kuhn, 1999). It becomes explicit, efficient and effective with age. Thus, it more often and increasingly operates under the individual's conscious control. However, it is during adolescence or as young adults that metacognition processes about knowledge really start (Hofer, 2004). It is during these ages that, for example, epistemological comprehension and beliefs about knowledge and about knowledge building get more sophisticated (King & Kitchener, 1994; Kuhn, 2004). However, this does not mean that young adults acquire an optimal level of metacognition. Some young people have less sophisticated beliefs than others. This is why training in metacognition, with the help of teachers that foster metacognitive activities around learning processes, is very important to develop metacognitive competencies. This training should involve every subject and all levels of instruction (Sperling, Howard, Staley, & DuBois, 2004). Metacognitive strategies can be successfully taught (Brown and Campione, 1990). Effective results have been found when metacognitive strategies are taught in an explicit way, explaining to the students when and how to use them (Schneider and Pressley, 1989). It is more probable that these students maintain and transpose this learning to other areas (Mathan & Koedinger, 2005).

Adults have a higher level of maturity in their intellectual development, which enables them to achieve a more superior metacognitive level than children. Adults have a greater knowledge of their own cognition and a better ability to describe this knowledge than children and young adults. However, not every adult reaches the expected metacognitive level (Baker, 1989). For example, not all adults are able to explain their expertise knowledge and how they execute operations. In addition, sometimes, by not being able to put into practice what they know they even fail to transfer knowledge from a specific area to a new situation (Butler & Winne, 1995). Some causes could include a lack of training, lack of experience or cultural and familiar context (Carpenter, 1999). These adults are also poor at self-evaluating their reading comprehension and at self-evaluating their readiness for a test (Baker, 1989).

Teaching is an activity that demands a high level knowledge of metacognition. Every day teachers face situations demanding metacognition adaptation to their students' learning and class performance. Artzt & Armour-Thomas (1998) found that the metacognition of teachers plays a well-defined role in classroom practice. They state that metacognition directs and controls the instructional behaviours of teachers in the classroom (See Figure 1: Components of Metacognition). The metacognitive elements that have the greatest impact on teaching are: planning the learning activities, monitoring and regulation during class, and evaluating and checking after the class has taken place. Teachers with metacognitive abilities treat teaching as a process of building knowledge with students as the builders of their own knowledge. According to Artzt & Armour-Thomas (1998), the teaching provided by these kinds of teachers is characterized by well-structured planning activities. During these activities teachers made sure they created an intellectually and socially motivating atmosphere so that students considered it as stimulus for learning. They also made sure that these activities fostered an interaction between students so that they could share the responsibility of their own learning process with their teachers, thus assuming a more active role overall. On the other hand, teachers that did not show these metacognitive abilities presented poorer planning activities. Thus, these activities were not conducive to their students' learning or to the understanding of content or the involvement of students in the learning process Artzt & Armour-Thomas (1999).

Figure 1 Components of metacognition



As noted in Figure 1: Components of Metacognition (Adopted from Artzt & Armour-Thomas, 1998 p.8). Beliefs emerge as a metacognitive element that influences the instructional practice of teachers.

2.3.2. Epistemic beliefs as a metacognitive process

According to Hofer (2004) epistemic beliefs are found in a territory wider than cognition (see Figure 2: Types of cognition and types of metacognition). They are part of an underlying mechanism of metacognition that activates a set of beliefs organized around dimensions. Epistemic beliefs are viewed as a metacognitive process (Kuhn, 1999). Epistemic beliefs are a kind of a metaknowledge, knowledge about the knowledge process or knowing about knowing. These beliefs about scientific knowledge form part of what has been called "prior knowledge". Epistemic beliefs influence learning processes such as reading comprehension, metacomprehension, the interpretation of controversial issues, ill-structured problem solving, transfer of learning and conceptual change. Epistemic beliefs also influence teaching processes, e.g., the way that teachers approach their teaching (Prosser and Trigwell, 1999).

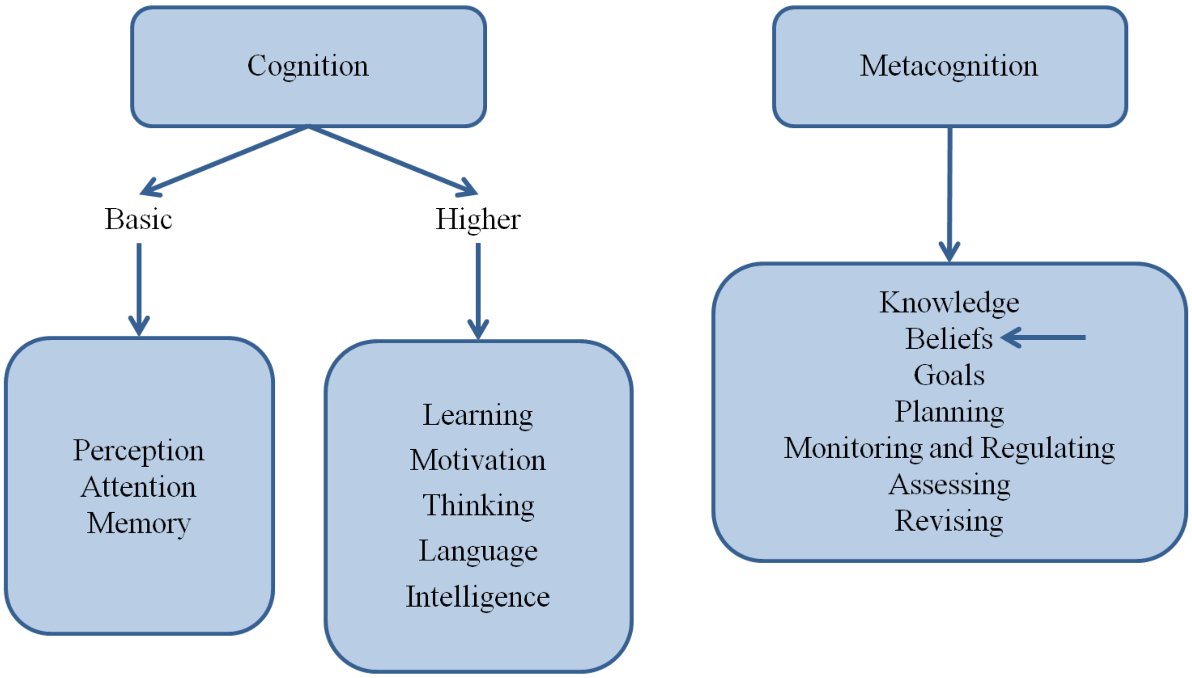


Figure 2: Types of cognition and types of metacognition. This figure was made by the author of this thesis to display where beliefs fit into a larger scheme of cognition.

Epistemic metacognition, on the other hand, refers to the metacognitive employment of epistemic beliefs. Epistemic beliefs are activated as an epistemic metacognition in people during knowledge acquisition and the construction process in everyday situations, and represent a level or stage of cognitive development (Hofer, 2001). This epistemic thinking is seen as situated metacognitive activity, that is, beliefs about knowledge and knowing are activated in a particular context of inquiry. For instance, in accordance with Mason & Boldrin (2008), when students are in the process of finding information on the Internet, epistemic beliefs are activated, they are put into operation. This research found that students who surf the net to find information on unfamiliar topics not only required to perform efficient search or proper revision, but also an assessment of the veracity of what they have found. Making judgments to validate conclusions and applying learned knowledge during the search process involves the activation of epistemic beliefs. Put another way, making efficient online searches requires a person to be active epistemically and to hold sophisticated beliefs. According to Hofer (2004) seeing epistemic beliefs within a broader paradigm like epistemic metacognition helps us to understand the construct more clearly and expand the frontiers of research and its application in teaching and learning situations.

The focus of epistemic beliefs in the field of metacognition is not new. Kitchener (1983) was the first to suggest this idea in her research on reflective judgment and her three-level system of cognition – cognition, metacognition and epistemic cognition. She distinguished epistemic cognition from metacognitive cognition to refer to a more general and abstract level of knowing about knowing. Epistemic cognition consists of thinking and decision making that cannot occur without reference to personal beliefs. Later, Kuhn (1999, 2000), with regards to the metacognitive nature of epistemological understanding, suggested that "meta-knowing" encompasses any cognition that has cognition as its object and it could be broken down into three levels: metacognitive knowing, metastrategic knowing, and epistemological meta-knowing.

2.4. Core components of epistemic beliefs

This study follows a model developed by B. Hofer (2000) called *"epistemological theories"*. Later, in Hofer (2004), she called it *"epistemic theories", "epistemic beliefs"* or *"personal epistemology"*. According to Hofer, epistemic beliefs are beliefs or theories that individuals hold about the nature of knowledge (what knowledge is) and its acquisition (how you come to know). Such beliefs about knowledge and knowing are organized into personal theories, as structures of interrelated propositions (Hofer & Pintrich, 1997). They are individual assumptions that a person knows and recognizes and can be general, specific or focused on a discipline. The dimensions of epistemic beliefs cluster into two areas: the nature of knowledge (what one believes knowledge is) and the nature or process of knowing (how one comes to know). Within these two areas, there are two subdimensions.

Under nature of knowledge, are the following dimensions:

Certainty of knowledge: The degree to which one sees knowledge as fixed or more fluid appears throughout the research, again with developmentalists likely to see this as a continuum that changes over time, moving from a fixed to a more fluid view. At lower levels, absolute truth exists with certainty, truths are absolute. At higher levels, knowledge is tentative and evolving, fluid, provisional, evolving gradually and maturing across the course of the time. Openness to new interpretations is a key element (King & Kitchener, 1994), which will permit modification of the beliefs about knowledge and its acquisition and the advance towards a new level, the highest stage of reflective judgment (Hofer & Pintrich, 1997).

Simplicity of knowledge: As conceptualized by Schommer, knowledge is viewed as a continuum, as an accumulation of facts or as highly interrelated concepts. Within other schemes, the lower-level view of knowledge is as discrete, concrete, knowable facts; at higher levels individuals see knowledge as relative, contingent, and contextual (Hofer & Pintrich, 1997).

And within the area of nature of knowing, are the following dimensions:

Source of knowledge: At the lower levels of the majority of the models, knowledge originates outside the self and resides in an external authority from where it can be transmitted. The evolving conception of the self as a knower, with the ability to construct knowledge in interaction with others, is a developmental turning point of most of the models reviewed. Perry (1970) described this awareness as one of the shifts in his model, when "the person, previously a holder of meaning, becomes a maker of meaning" (p. 87), (Hofer & Pintrich, 1997).

Justification of knowledge: This dimension includes how individuals evaluate knowledge claims, including the use of evidence, the use they make of authority and expertise, and their evaluation of experts. As individuals learn to evaluate evidence and to substantiate and justify their beliefs, they move through a continuum of dualistic beliefs to the multiplistic acceptance of opinions as reasoned justification for beliefs (Hofer & Pintrich, 1997).

As stated by Hofer (2004) it is possible that the four dimensions of the epistemic theories (simplicity, certainty, source and justification of knowledge) fit into the wider scheme of cognitive development. Although there are many cognitive models most of them share common assumptions. Pintrich et al., (2000) suggested a three-component model of metacognition. According to this, metacognition is comprised of three components: (a) metacognitive knowledge, (b) metacognitive judgments and monitoring; and (c) self-regulation and control of cognition and learning. Hofer (2004) employed this three-component model of Pintrich et al. (2000), and she suggested that the four dimensions can be located within this model as follows:

The first component of the model, the "metacognitive knowledge", can also be expanded to include the two epistemic dimensions about the nature of knowledge relating to what one believes knowledge is or knowledge about knowledge in itself, which is the certainty of knowledge (to what extent knowledge is considered static and stable rather than dynamic and evolving) and the simplicity of knowledge (to what extent knowledge is considered a set of discrete elements rather than a web of interconnected elements).

The second component of the model is “metacognitive judgments and monitoring”. This aligns the two dimensions related to the nature or process of knowing (how one comes to know), namely, source of knowledge (to what extent knowledge is considered to be based outside the self and transmitted, rather than constructed by reason) and the justification for knowing (to what extent observation or omniscient authority, rather than shared rules of critical inquiry, are considered to accept claims). Epistemic processes at this level of metacognition include, for instance, evaluating information sources, weighing up evidence in support of knowledge claims, integrating contrasting information and reconciling one’s own point of view with that of experts (Mason & Boldrin, 2008).

Finally, according to Hofer (2004), the third component is "self-regulation and control of cognition". It can be expanded to include epistemic aspects and regulatory processes for knowledge construction namely when the individual is constructing the understanding of a subject or when reflecting metacognitively on one's knowledge in which volition, interest, motivation, thinking dispositions, intellectual values and beliefs are influential.

2.5. Lines of research into epistemic beliefs

As indicated by Mason and Boldrin (2008), at least three major lines of research can be identified in the literature about epistemic beliefs. The first deals with the development of epistemic thinking. The second addresses the influence of epistemic beliefs on learning processes such as reading comprehension, metacomprehension, interpretation of controversial topics, ill-defined problem solving, transfer of learning and conceptual change. The third line of research into epistemic beliefs, namely, personal beliefs about knowledge and knowing, can be identified as general epistemic beliefs, and as discipline-specific beliefs, such as mathematics or science. This study fits into the third line of research concerning epistemic beliefs focused on discipline-specific beliefs.

2.6 Overview of models of epistemic beliefs

As said by Hofer & Pintrich (1997) and Mason & Boldrin (2008), epistemic beliefs can be organized into three broad areas:

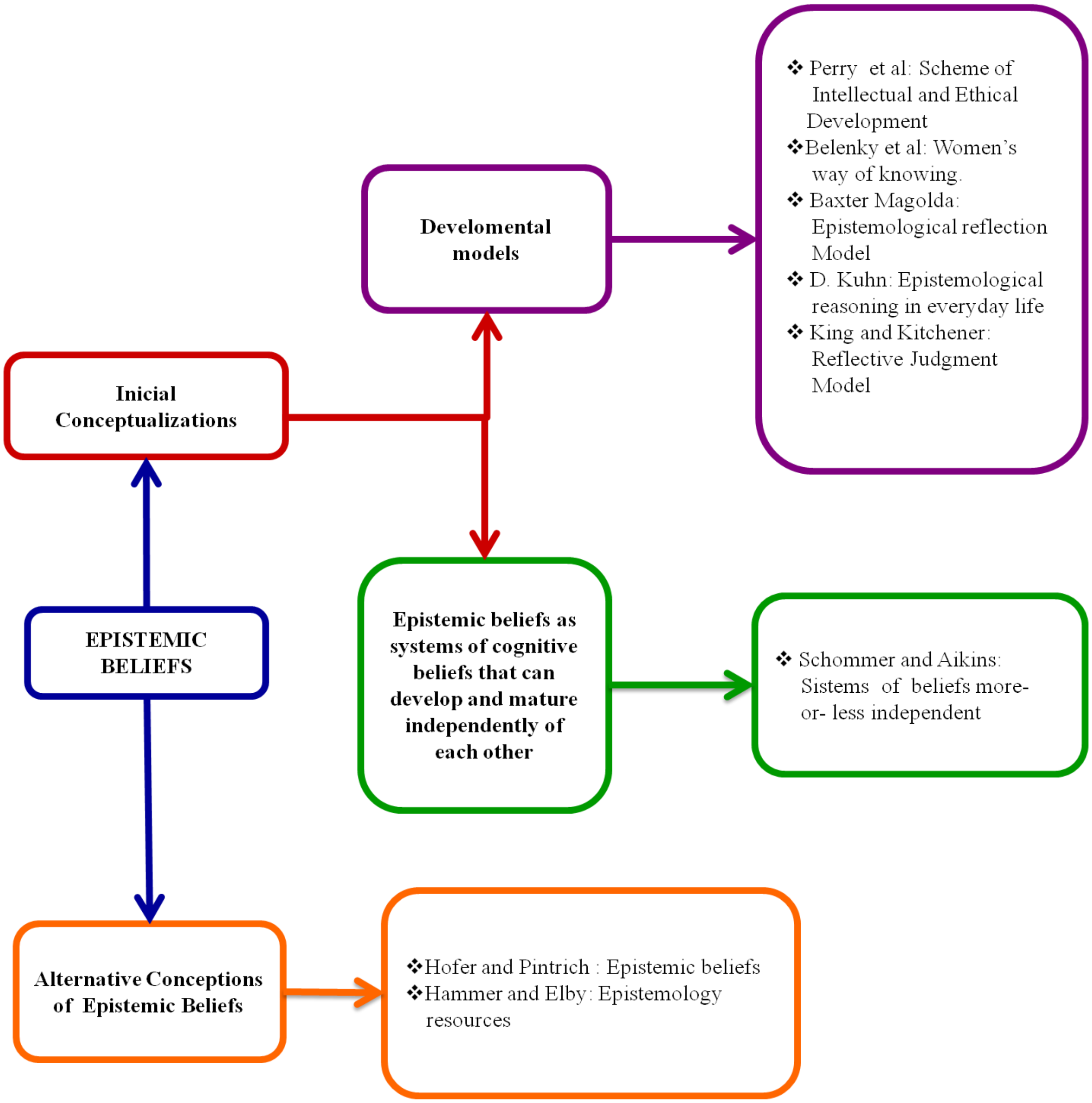
1. Developmental Models of epistemic beliefs as systems where individuals move along pre-determined trajectories from 'naive' or dualist to more sophisticated positions: Perry (1970), Belenky et al. (1986), Kuhn (1991), Baxter Magolda (1992), King and Kitchener (1994), Greene et al. (2008).

2. Epistemic beliefs as systems of cognitive beliefs that can develop and mature independent of each other: Schommer (1990), Schommer-Aikins (2004), Qian and Alvermann (1995), Kardash and Scholes (1996).

3. Contextually activated and constructed epistemological resources: Hammer and Elby (2002), Louca, Elby, Hammer and Kagey (2004), Hofer & Pintrich (1997), Hofer (2000), Niessen (2007).

The first two areas, developmental models and epistemology as a system of independent beliefs, are considered by Hofer & Pintrich (1997) and Mason & Boldrin (2008), initial conceptualizations. The models of the third perspective are alternative conceptions of epistemic beliefs based on the latest research on cognitive psychology and learning (Hofer, 2001). Figure 3 summarizes the models of epistemic beliefs based on Hofer & Pintrich (1997). I offer in the following pages an analysis of all this models.

Figure 3: Models of epistemic beliefs based on Hofer and Pintrich (1997)



Models of epistemic beliefs based on Hofer & Pintrich (1997)

2.6.1 Initial conceptualizations

2.6.1.1 Developmental models

These models originated from the traditional cognitive approaches, which suggest that personal beliefs of individuals move through a developmental sequence (Hofer & Pintrich, 1997), in a constructivist way and that intellectual growth is provoked by a cognitive imbalance (Bendixen & Rule, 2004).

2.6.1.1.1 Perry´s Scheme of Intellectual and Ethical Development

A review of literature by Hofer & Pintrich (1997) suggested that the current developmental models of epistemic understanding have some connection to the work of William Perry and his associates, whose annual interviews with longitudinal samples of Harvard students in the late 1950s and early 1960s led to a scheme of intellectual development during their college years.

To continue with this research, Perry (1970) examined two separate four-year studies at Harvard. He developed and used an instrument called a Check List of Educational Values (CLEV) and a series of open-ended interviews. At the beginning, Perry did not intend to study epistemic beliefs, but to understand the development, experiences and transformation of college undergraduates during the four years of their courses.

Perry focused on the social aspect of the undergraduates because he intended to find differences in personality; this aspect, as well as the extracurricular activities were included in his scheme. He did not focus his attention on aspects of knowledge, although these were implicit in the different perspectives proposed (Hofer & Pintrich, 1997).

After a thorough qualitative analysis of the description of the transformations and experiences of these undergraduates, Perry and his colleagues found that their personalities did not have a great influence on the way they constructed new meaning during this new period of their lives as much as their cognitive development did (Hofer & Pintrich, 1997).

In their own words, this was “an intellectual Pilgrim’s Progress” (1974, p.3), a metaphor used to compare the educative journey a student takes when starting their degrees, just as a traveller does, when traveling. It is a difficult journey in which the most meaningful change is the way in which the traveller sees the world (Moore, 2002).

After the analyses, Perry and colleagues proposed a hierarchical scheme to organize the different perspectives of the students about knowledge and learning. Then, they categorized these based on the students’ own beliefs and ordered them ranging from dualism to relativism (Hofer & Pintrich, 1997).

Perry identified nine positions that describe the steps that move students from a simplistic, categorical view of knowledge to a more complex, contextual view of the world and of themselves. Perry and his colleagues used the term “position” instead of “stage” because there are no chronological or maturing boundaries implied and the word position does not imply a specific length of time. Piaget’s cognitive development scale did imply this specific length of time, by including a range of years, for example the concrete operational stage spans from seven to eleven years and, also, because the term “stage” implied a point of view or an attitude at a specific moment (p.48). “Stage” refers to patterns, stable structures, persevering and is long lasting in time, acquired in the same order, without the ability to skip any phase (Perry, 1970).

These 9 positions were regrouped into 4 categories: dualism, multiplicity, relativism, and commitment within relativism, where a personal commitment is established and where the individuals construct their own knowledge (Hofer & Pintrich, 1997). According to Hofer (2004), this last stage has been given many other names by the followers of this scheme: reflective judgement (King & Kitchener, 1994), constructed knowledge (Belenky et al., 1986), contextual knowledge (Baxter Magolda, 1992), and evaluativism (Kuhn, 1991).

Perry found that the dualists' view of any information was as either right or wrong and that their idea was that knowledge came from a figure of authority. On the contrary, the students with relativism beliefs about knowledge questioned the certainty of that knowledge and recognized its contextual nature and complexity. It was much more probable to find that students with relativism beliefs would see themselves deducing meaning from information they had found (Hofer & Pintrich, 1997). It is important to mention that Belenky et al. (1986) replicated the study with women, finding some differences in authority conception, truth and knowledge (Hofer & Pintrich, 1997).

What follows is a brief description of each position:

Positions 1 and 2: Dualism (or the knowledge received)

It is the most naïve and simple position. Individuals see their world dualistically; this means that for them there are only two positions: true or false, right or wrong, good or bad. They hold that knowledge is absolute, unchanging and universal. There are no alternatives. Authority is always right, for example, the teacher is the person with all the right answers and gives them out to their students. These individuals use absolute and concrete categories to understand people, values and knowledge. Those tasks involving multiple choices or points of views are confusing to them; they cannot even accept the idea of having different perspectives. Value judgments are viewed like true ones, more like obvious judgments without the need of verification or justification (Hofer & Pintrich, 1997).

Positions 3 and 4: Multiplicity (or subjective knowledge)

Individuals in this position view knowledge as absolute, but they are able to acknowledge that they do not have all the answers to some questions or subject areas, and that it is possible that the authority might be wrong. It is a less simplistic point of view. The students viewing the world multiplicitly acknowledge the multiple perspectives of a problem. These students do not view people with different beliefs from theirs as being wrong. However, the individuals in this position think that without correct answers, all that is left are opinions, so one opinion is just as good as another and everybody is entitled to their own opinion. A wrong way to solve this nihilism is presenting a documented opinion, but only in order to satisfy the desires of authority, who could be a teacher or an expert (Hofer & Pintrich, 1997).

Positions 5: Relativism (or procedural knowledge)

In this position the individual acknowledges that knowledge is contextual and relative. The dualistic conception of right-wrong could be appropriate, depending on the context. The next step requires personal commitment to establish an identity and to organize the chaos that emits from the divergence of opinions, but these individuals are not capable of assuming this commitment. At this level students are able to think analytically and to evaluate the ideas of others and even their own. Authority is not challenged nor resisted, but valued for its experience (Hofer & Pintrich, 1997).

Positions 6 to 9: Commitment within relativism (or the construction of knowledge)

In this position, individuals acknowledge the implications and responsibilities of commitments (degrees, marriage, and children) in this pluralist world, establishing their identities in the process. This is the most meaningful transition in the scheme. In this position individuals are able to have different point of views while understanding their role in the world and creating their own identity and lifestyle. In this position, the individual is an active builder of knowledge and meanings. They are capable of acknowledging that any act of knowing requires assuming a point of view for better or for worse (Hofer & Pintrich, 1997).

How does Perry's Scheme work? Individuals move from one stage to another in a progressive way. They begin with dualism and move on to multiplicity and, from multiplicity to relativism and, from relativism to commitment within relativism. Individuals move from a dualist perspective, from viewing truth in absolute terms of right and wrong, good or bad and having the belief that authorities hold the truth, to multiplicity where individuals recognize diverse point of views, where they understand that an uncertainty of knowledge exists. They then understand that everybody is entitled to their own opinion and that knowing is relative. What follows then is a confrontation of their own crisis of personal commitment.

Perry (1970) observed that the students moved from their dualistic position when confronting their peers on college norms because of the diversity in opinions and pluralistic ideas. This was practically the first challenge to their dualistic position. Then, at the end of this phase, individuals see contradiction and opposition as something worthy. The movement from multiplicity to relativism is characterized by the acknowledgement of the superiority of some point of views over others. Finally, individuals reach the final stage, commitment within relativism, where they are able to assume a point of view, take responsibility for it and its consequences. This transition implies the development of mature approaches and submission to a position and its consequences (Hofer & Pintrich, 1997).

Perry is considered a pioneer in the analyses of epistemic beliefs of college students (Puerdie et al. 1996; Duel & Schommer, 2001). His research found that academic trouble in students could be related to their theories about knowledge (Perry, 1970). It showed that some college students did not learn because their ideas about knowledge differ from those of their teachers. Perry also identified three methods students use to refrain from the evolution of stages: trying to be nice, escaping or isolating themselves (Hofer & Pintrich, 1997).

Perry's research studies revealed that college students went through evolutive and sequential stages. This evolution implied moving from simple and naïve positions during the first stages to complex and sophisticated positions during the later stages. More formal reasoning is required when moving on to the next position. His work, like Piaget's, also showed that knowledge is acquired in stages in a hierarchical way (Kurfiss, 1983).

Although this study was criticized because the sample was composed of mainly men, and because the context and socioeconomic class was an elite one, the basic underlying structure remains viable. There is no dispute about many of the other work that Perry's research has generated. Many subsequent models of intellectual development, such as Kitchener and King (1981), Belenky et al., (1986) and Baxter Magolda (1992) have their conceptual roots in Perry's (1970) model. It has been almost 40 years since Perry's study, and his legacy still continues today. It has made great contributions to the epistemic beliefs studies of teachers and students, as well as to the learning and teaching processes.

2.6.1.1.2 Women's way of knowing: Belenky et al., 1986

Belenky et al. proposed a model entitled Women's Ways of Knowing (1986). It includes the perspective of women, which was left aside in Perry's predominantly male and elitist research in 1970. It was also influenced by Lawrence Kohlberg's studies in 1981 on the stages of human evolution in learning, as well as by the work by Carol Gilligan (1982) on the gendered nature of perceptions of learning and development.

Belenky et al., (1986) interviewed adult women with various degrees of education and different experiences and personal stories about their gender, personal relationships, ways of knowing and their moral dilemmas. Then 135 interviews were analysed and classified using phenomenological methodology. These not only contained academic questions but were directed at different aspects of women's lives.

From this cross-sectional study arose the belief model Women's Ways of Knowing. It was structured around the metaphor of "voice" and identified five positions on the way we view knowledge and its acquisition. This study showed that there were differences between the genders in the vision of learning, teaching, authority, truth and self-perception of women (Buehl et al., 2001).

Belenky et al., (1986) and Perry had no intention to study epistemic beliefs, however, their work has been quoted in almost all studies related to epistemic beliefs (Hofer & Pintrich, 1997). Here is a brief summary of the five positions found in Belenky's study:

1. Silence:

It is a position in which women experience themselves as mindless and voiceless and subject to the whims of external authority.

2. Received knowledge:

Similar to Perry's dualism, it is a perspective from which women think of themselves as capable of receiving, including reproducing, knowledge from omniscient authorities but not capable of creating knowledge on their own.

3. Subjective knowledge:

Similar to Perry's multiplism, it is a perspective from which truth and knowledge are viewed as personal, private and subjectively known or intuited.

4. Procedural knowledge:

It is a position in which women are interested in learning and applying objective procedures for obtaining and communicating knowledge, and;

5. Constructed knowledge:

It is a position in which women consider all knowledge as contextual, experience themselves as creators of knowledge, and value both the subjective and objective strategies of knowing.

A new contribution not present in Perry's scheme is the identification of the position of "silence" and of the "ability to find their voice" as a particular feature of the group of women interviewed. This was interpreted by Belenky and colleagues as the influence of the relationships of power, based on gender in learning. For example, women from the study revealed that they felt they were unable to speak after a scholar did. They also felt it was better to keep silent because of the disparity of power between the genders across cultural and social aspects (Hofer & Pintrich, 1997).

Comparing Belenky's categories and Perry's stages, a match was found between the "received knowledge" (Belenky) and "dualism" (Perry) categories. Another match was found between "subjective knowledge" (Belenky) and "multiplicity" (Perry). Although both models are structured by stages, research has found that in an academic context, for example, students could join the categories in a non-linear way (Hofer & Pintrich, 1997).

Another characteristic of this model is that the stage of procedural knowledge presents two forms: separated knowledge and connected knowledge. Researchers found that connected knowledge was a typical characteristic of women, while separated knowledge was related with the subordinated relativism stage in men (Buehl et al., 2001).

Although the work of Belenky and colleagues (1986), based only on the female perspective, was criticized by scholars, their study, because of the inclusion of female perception, expanded the field of personal epistemology. Even though there were some similarities found between Belenky's and Perry's studies, these do not offer enough resources to evaluate the nature of the findings related with gender (Hofer & Pintrich, 1997).

2.6.1.1.3 Epistemological Reflection Model by Baxter Magolda

Baxter Magolda's epistemological reflection model (1992) was developed from a longitudinal study of five years based on interviews with female and male college students. This research focused on discovering how beliefs affected the interpretation of educational experiences of students in the classroom (Buehl & Alexander, 2001).

This model proposed that there are qualitative differences in ways of knowing and that these have their own characteristics. This model consists of four different "ways of knowing" or stages. At the same time, every stage has patterns that could be transformed through individual experience (Hofer, 2001). These ways of knowing are:

a. Absolute knowledge:

Knowledge is viewed as certain. Teachers have complete authority and learning is based on the repetition of concepts, facts or ideas. The two patterns in this stage are receiving knowledge and mastering knowledge. This way of knowing is typical of first year college students.

b. Transitory knowledge:

It refers to knowledge as partially certain or partially uncertain. In this stage authority does not hold complete knowledge of everything and so students try to understand, instead of memorize, knowledge. The two patterns are interpersonal knowledge and impersonal knowledge. Transitory knowledge is more common in second year college students.

c. Independent knowledge:

Defines a stage where knowledge is seen as uncertain and where alternative points of view can be justified. Individuals in this stage act more independently of the textbook; they think there are more opinions and they believe the teacher does not have all the answers. The knowledge patterns in this stage are inter-individual knowledge and individual knowledge. This type of knowledge is more common in graduates.

d. Contextual knowledge:

In this stage knowledge is judged on evidence and depends upon context.

Baxter Magolda found that "ways of knowing" and "patterns of knowing" are socially constructed. She also found that patterns are related to, but not dictated by, gender. For example, she found some differences by gender in the development of beliefs that students had about knowledge, one of these included men adopting more impersonal and individualist ways of knowing than women, who adopted more personal and inter-individualists ways of knowing (Hofer, 2001).

As with all research, Baxter Magolda's work had its limitations, because, although in her study she included men and women in equal proportions, she lacked diversity, as she explained, because there were a large number of white students. This made it difficult to infer or make generalizations from the study. However, the study had big implications for student themes, for example: how to relate with peers and with authority, how to promote leadership attitudes, how to strengthen self-confidence, how to promote autonomy and decision making, and how to value our own opinion as a source of knowledge (Evans, Forney & Guido-DiBrito, 1998). Baxter Magolda was also interested in the intellectual development of college students.

2.6.1.1.4 Epistemological reasoning in everyday life - the Skills of Argument by Deanna Kuhn

D. Kuhn (1991) was a pioneer in the application of the epistemological development into informal reasoning (Weinstock, 2006). In her book The Skills of Argument (1991), Kuhn identified a relationship between the levels of epistemological understanding and the skills of argument (Kuhn & Park, 2005) after studying how people reasoned about reality and important complex social issues that they probably had the opportunity to think and talk about in their daily lives.

Kuhn and her researchers found that people were able to communicate their thoughts on different topics effectively and in full detail. Furthermore, it was clear that the participants had thought about, and were able to dismiss, some quite complex theories on the causes of these problems. However, the results indicated that most people are unable to exhibit their basic argumentative skills with confidence. When asked to justify their opinion (provide any evidence to support their theories) more than half of the population hesitated. A lot of their answers supported the evidence but what they said was not evidence, or at least not good evidence.

Kuhn's work (1991) on informal reasoning was an attempt to study how individuals respond to ill-structured everyday problems lacking conclusive solutions. Although the primary purpose of the study was to investigate argumentative thinking, efforts were made to understand how and why individuals reasoned beliefs about knowledge, and a part of the study was approached especially from an epistemic perspective (Hofer, 2001; Buehl et al., 2001).

Kuhn's study was completed by 160 participants with a very large sample of subjects. Participants belonged to 4 different age groups, ranging from adolescence to adulthood. Another feature was the level of education: secondary schooling, tertiary education and non-university. The technique used for data collection was through individual interviews but with a different component: they were carried out in familiar places such as their homes or workplaces.

The interview questions focused on three actual urban social problems. In the methodology, subjects were asked to give an explanation of the cause for each of these topics:

(a) What is the cause that leads delinquents in prison to commit crimes again, even after they are set free?

(b) What is the cause of school failure?

(c) What is the cause of unemployment?

Kuhn (1991) expected individuals to explain how they could sustain a particular viewpoint and to justify their position with supportive evidence. She also asked participants to give an opposing view with an argument that was contradictory to their position and then offer a solution to the problem. Finally, at the end of the interview, they were asked to reflect on the reasoning presented.

According to Kuhn (1991), this study identified multiple dimensions of epistemical beliefs which were similar to other forms of epistemic thinking that were initially reported by Perry (1970), and continued by other researchers on epistemic theories such as King et al. (1983, 1994); Belenky et al. (1986) and Baxter Magolda (1992, 1998).

The three levels of epistemological understanding found by Kuhn (1991) were: absolutist, multiplist and evaluator.

1. Absolutist:

People who are part of the absolute level view knowledge as something certain and absolute that comes from an external source. Arguments are facts that can be right or wrong (Kuhn, 1991). Absolutists rely on expertise as a basis to reach knowledge and to express a deep certainty of their own beliefs.

2. Multiplist:

People who are at a multiplist level view knowledge as uncertain and generated by the human mind. They deny the possibility of certainty produced by the expert and are skeptical about expertise in general. Arguments are only opinions freely chosen by them. People at this level are very subjective, they do not place much value in an expert’s opinion or facts but rather give more weight to their own ideas. In this framework, beliefs take the position of personal property, to which the individual is entitled. The result is that all views can have equal legitimacy, and their own view can be as valid as that of an expert (Kuhn, 1991).

3. Evaluator:

People at the evaluator level also view knowledge as uncertain, just like the aforementioned level, and reject the expert's opinion and the facts, too. However, for them, arguments are judgments that may be evaluated and compared following a criterion of argument and evidence. They accept the possibility of a genuine exchange with those who hold opposite views. They also accept the possibility of a modification of theories as a result of the exchange. Kuhn states that argument is at the heart of this process as it provides a means to influence the thinking of others (Kuhn, 1991).

In her study, Kuhn found no significant difference in gender or age, but found a relationship between educational level and epistemological level; those in groups with a higher educational level were more likely to be an evaluator and less likely to be an absolutist. It was also more likely to find people showing argumentative skills at the evaluator level (Hofer and Pintrich, 1997).

Kuhn's ability to argue is based on an epistemological level of understanding that requires contemplation, evaluation, and a judgment of alternative theories and evidence (Hofer and Pintrich, 1997). These cognitive processes, according to Kuhn, require the metacognitive ability to reflect on one's thinking. In previous work, Kuhn, Amsel & O'Laughlin (1988) stated that such metacognitive skills begin before early adolescence, a finding consistent with Piaget's stage of formal operations.

A subsequent study by Kuhn (1992) also indicates that the development of argumentative skills is not present in all academic contexts. Kuhn suggests that the ability to consider reasoned judgments part of "good thinking" is because knowledge could be seen as an on-going process of review in which changes in conclusions are due to the emergence of new evidence and new arguments, and not to a mere change of opinion (Aleixandre, 2003).

One criticism of Kuhn's work is that the elements forming epistemic theories are not very clear. Yet, they concede that the study is distinguished because of the theories' connections with reasoning, its emphasis on ill-structured problems of daily life and because of the use of a large sample of participants across different age groups. This larger population sampling in non-academic matters removes epistemic beliefs from the classroom domain and separates the issues of knowledge from those related to teaching and learning processes (Hofer and Pintrich, 1997).

2.6.1.1.5 Reflective Judgment Model by King and Kitchener.

Backed by 20 years of research on epistemic cognition research and cross-sectional and longitudinal research, which include interviews with individuals aged from adolescence to adulthood, King & Kitchener (1983, 1994, 2004) developed the Reflective Judgment Model focusing directly on how epistemic beliefs affect thinking and reasoning (Hofer, 2002).

The model emphasizes the epistemic claims of the thinker, which deals with what a person may be able to know and how a person may be able to know something. It is a metacognitive skill in which the reflective thinker investigates and evaluates relevant information and views that are available to build a viable solution to an impending problem. This solution becomes an individual's belief, which is subject to change as the individual gathers more information. A reflective thinker uses all available information to build their own system of beliefs, which is subject to change (King and Kitchener, 1994).

King and Kitchener wanted to understand the process used in an argument; to accomplish this, they interviewed 1700 people for 15 years, among them were high school students, college students, and adults who were not students. The findings of this study revealed several ideas, among them, that an individual's arguments and beliefs about knowledge were related to the way people justified their personal beliefs. From the data obtained from the interviews, they developed a 7-stage model called the Reflective Judgment Model, one that was very similar to that proposed by Perry (1970), although initially its purpose was not to develop an epistemological theory but to understand the process used to create interpretative arguments (Buehl et al. 2001).

The methodology of the study consisted of taking a cross-sectional sample of individuals with diverse educational experiences. The subjects were presented with four different ill-structured problems and asked a series of questions designed to assess their beliefs about knowledge and their justification for these beliefs. The problems used to create this model were not based on academic knowledge but on contemporary social problems. King and Kitchener developed the Reflective Judgment Model based on the participants' responses to describing the views of an individual about their knowledge and conceptions about justification and argumentation (Buehl et al. 2001). According to Buehl et al. (2001), the Reflective Judgment Model focuses on the development of the process of getting to know and reason. Although it is often compared to critical thinking, the Reflective Judgment Model is different in terms of the emphasis placed on the intellectual tasks involved in solving problems, which have open rather than closed questions, in the attention given to epistemic assumptions, and in the articulation of some stages of development. This seven-stage model consists of three levels: pre-reflective, quasi-reflective and reflective. Table 2 defines the stages developed by King & Kitchener (1981, 2004).

One criticism of the model is that the theme of epistemology, which shows a fragmented and disconnected point of view on the conception of knowledge of individuals, is not well developed. The importance of this study lies in its extensive database, collected across over 20 years of research. The information increased the theoretical framework and allowed others to carry out more research studies on the development of the beliefs of individuals over time and on transformations the individual experienced with age and education. Finally the researchers corroborated the idea that the beliefs of individuals progress through stages depending upon the age and experience of each individual (Buehl et al., 2001; Hofer & Pintrich, 1997).

Table 1: Reflective Judgment Model (Seven-stage model) by King & Kitchener (1981, 1994)

Reflective Judgment Model King & Kitchener (1981 p.p. 92-102 and 1994 p.p. 3-5)	
Pre-reflexive Level (stages 1, 2, 3)	
Stage 1	"Knowledge is absolute, certain, limited and specific. It is acquired by direct observation. Individuals at this stage hold beliefs that do not need justification because there is no correspondence between what is believed to be true and what really is true. Alternative beliefs are not perceived"
Stage 2	"Knowledge is absolutely true or just true but is not immediately available. It is obtained through the senses by direct observation, as in the previous stage, or through a figure of authority. Individuals at this stage hold beliefs that are not evaluated or justified. If they are justified it is because they are related to the beliefs of an authority figure, which may be that of a teacher or a parent. Questions have only one correct answer, so there is no conflict in decision-making"
Stage 3	"Knowledge is true in some areas and uncertain in others. When there is uncertainty individuals may only rely on personal beliefs, which are seen as valid until the knowledge, also seen as absolute, is acquired. Individuals at this stage hold beliefs that absolute truth is acquired from an authority figure. Also hold beliefs that answers are correct because they are justified in terms of an authority"
Quasi-reflexive Level (stages 4, 5)	
Stage 4	"Knowledge is seen as uncertain and arguments of knowledge depend on the personality of each individual. Individuals at this stage hold beliefs that are

	justified by providing reasons and using evidence, but arguments and the choice of selecting evidence are idiosyncratic"
Stage 5	"Knowledge is uncertain and should be understood as within a specific context; therefore, it may only be justified by an argument within that context. Individuals at this stage hold beliefs that are justified within a particular context of research using the rules for that context"
Reflexive Level (stages 6, 7)	
Stage 6	"Knowledge is uncertain but constructed by comparing and coordinating evidence and opinion on different sides of an issue. Interpretations based on the evaluation of evidence depending on context are accepted and individual opinions although having an argument, are refutable. Individuals at this stage hold beliefs that are justified by comparing evidence and opinion from different perspectives on issues or through different contexts creating solutions evaluated depending on criteria, such as the weight of evidence or the validity of a solution"
Stage 7	"Knowledge develops probabilistically through a process of inquiry that is generalizable across domains. The effectiveness of the solutions to the problems at this stage is evaluated in terms of what is reasonable or what is aligned with current evidence. It is re-evaluated when new evidence, new perspectives or new research tools become available. Individuals at this stage hold beliefs that are justified on the probabilities of: a variety of considerations in the interpretation, the risk of developing wrong conclusions, the effects of alternative judgments or by the interaction of all of these concepts"

2.6.1.2 Models of epistemic beliefs as a system of independent beliefs

2.6.1.2.1. Epistemology as a system of independent beliefs by M. Schommer.

Marlene Schommer-Aikins presents a different approach to understanding personal epistemology (Schommer, 1990; Schommer et al., 1992). Schommer (1990) took into account previous work carried out by researchers about personal epistemology, especially work by Perry (1970), Dweck and Leggett (1988) and Schoenfeld (1983, 1985, 1988), who proposed a reconceptualization of epistemic beliefs. She suggested that epistemic beliefs were conceived as a system of more or less independent beliefs, and that beliefs were developed simultaneously, rather than being a one-dimensional concept or beliefs that could be organized into fixed positions or stages, as had been the view so far (Schommer, 2002). By the term “system”, she meant personal epistemology was composed of more than one belief and by “more or less independently”, she meant that those beliefs may or may not develop synchronously (Hofer & Pintrich, 1997).

Schommer (1990) considered that many personal epistemology researchers assumed that epistemic maturity is obtained by the tendency of learners to believe that knowledge is provisional and complex and that learning is gradual and controllable. Being in sync would mean, for example, that learners believe these four attributes. Meanwhile, approached asynchronously, it would mean that a person may strongly believe that knowledge is complex (a mature belief) while firmly believing that knowledge does not change (a less mature belief). Schommer’s idea when she says that beliefs are “more or less independent” is that learning may or may not be in sync or in agreement with their belief system. This means that there will be times during development where the individual will believe that knowledge is highly complex, while believing that it is highly true. Growth is determined, depending on the level of development at which everyone is, and it should be determined case by case (Hofer & Pintrich, 1997).

For Schommer, epistemic beliefs also have a direct and indirect effect. By indirect effect, she means the epistemological beliefs mediate learning. For example, a firm belief in isolated knowledge could forge a guideline about what it means to learn, which in this case would mean learning in order to be able to recall a list of facts. This rule guides the learner to select only memorized knowledge as a study strategy. This limited single study strategy would result in a very poor mental representation of a topic and as a direct effect, a firm belief that states that knowledge is true can be used as a filter for interpreting a provisional text as a definite one (Hofer & Pintrich, 1997).

Schommer states that development and change of epistemological beliefs are influenced by the experience of formal education, the relationship with family, friends, solving problems or experiences of everyday life (Hofer & Pintrich, 1997).

Originally, Schommer proposed five beliefs: beliefs about the structure of knowledge (ranging from very small isolated concepts to highly interrelated and integrated concepts); beliefs about the stability of knowledge (ranging from certainty to development); beliefs about the source of knowledge (ranging from transmission from an authority until being obtained as a result of reason and evidence); about the speed of learning (from quick or not, from all to gradual) and; about the ability to learn (intelligence is fixed vs. intelligence increases) (Schommer, 2005). This number of beliefs is not fixed, it may vary over time.

Schommer (1990) also designed a questionnaire called the Epistemological Belief Inventory using a Likert scale measuring five levels, where 1 was strongly disagree and 5 strongly agree. The inventory consisted of 63 short statements representing epistemological beliefs.

The questionnaire was used to evaluate four of the five beliefs proposed: knowledge structure, knowledge stability, learning speed and the ability to learn. For the questionnaire, Schommer adapted some items of the original survey that Perry (1970) had developed, as well as items from different lines of research related to this one: beliefs about intelligence and the speed of learning (Schoenfeld, 1983, 1985), beliefs about intelligence (Dweck and

Leggett, 1988), reflective judgment (Kitchener & King, 1981), and epistemology and understanding (Ryan, 1984). The sample consisted of college and high school students (Schommer, 2005).

According to Hofer & Pintrich (1997), Schommer's main contributions to personal epistemology can be broken down into three areas:

1. Suggesting that epistemic beliefs may be a system of relatively independent dimensions.

2. Starting a quantitative research study on epistemic beliefs. Research in this field had consisted of studies from a mainly qualitative perspective.

3. Initiating an intuitive line of research connecting epistemic beliefs with learning and performance in the classroom.

Schommer's approach to the study of personal epistemology, especially the development of the quantitative instrument pen-and-paper, has allowed researchers to more explicitly identify the relationship between epistemology and learning. There have been disagreements about the dimensions forming the epistemic beliefs, especially to the dimension on the ability to learn because it is related more to beliefs about intelligence rather than a part of the concept of epistemic beliefs. There have also been attempts to review the instrument or to design similar written measurements (Hofer, 2000; Schraw et al., 2002). However, this questionnaire, according to many researchers, is one of the major reviews written about personal epistemology (Hofer, 2002).

2.6.2 Alternative models of epistemic beliefs

So far I have discussed two different models of how to study epistemic beliefs. The first is the development model whose leading representatives, Perry (1970), Belenky et at (1986), Kuhn (1991), Baxter Magolda (1992) and King and Kitchener (1994), state that beliefs are organized and developed in stages or positions throughout life and knowledge progresses by following sequences in development. The second model is Schommer's who sees epistemic beliefs as a belief system that is generally independent of each other. The third is an alternative model and is based on the latest research on cognitive psychology and learning (Hofer, 2001). One of the lines of research suggests that an individual's beliefs about knowledge and its acquisition are organized into personal theories as structures of interrelated propositions interconnected in a consistent way (Hofer & Pintrich, 1997). Another alternative line is compatible with the research of Hammer and Elby (2002), who support the idea of an ontological approach in which personal epistemology is seen as a collection or network of "epistemological resources".

2.6.2.1 Epistemological Resources by Hammer and Elby

Hammer, D., & Elby, A. (2000) consider that an appropriate model of personal epistemology should consist of epistemological resources which are a similar concept to the "phenomenological primitives or p-prims" of diSessa's (1993). Andrea diSessa (2001), proposed a theory that emphasizes the continuity between naïve states to more sophisticated or advanced states of understanding in students. She proposes that the knowledge of learners is fragmented and conformed by phenomenological primitives (p-prims) which are entities with minimum knowledge, self-explanatory and have no relationship between them". Learning occurs when these knowledge entities are integrated into broader conceptual structures. Conceptual change from this point of view means the reorganization and refinement of intuitive knowledge. The perspective developed by diSessa is one of the most complete from a theoretical point of view because it defines, broadly, the nature of the concepts used, and tries to orchestrate mechanisms such as "reading strategies" and "causal networks" by which the elements of knowledge are developed or reorganized.

In the same way, Hammer & Elby (2000) have found that students have epistemological resources that can help them to better understand a discipline but that these are only activated in some contexts. It should be noted that the authors of this model inferred that epistemological beliefs are not necessarily consistent across contexts. For example, a person may think that knowledge is relative in a social studies context but believe that it is not in another context. Another important fact is that when speaking of resources the idea of progression by stages or positions as suggested by Perry (1970) is discarded. This means that the resources are available from the earliest ages and may be used as needed in different contexts and can even be used in combination with others.

According to Hammer & Elby (2002) naive understanding levels may be grouped into four categories of epistemological resources. The first category is about resources to understand the nature of knowledge and how it originates. The second category is to understand epistemological activities. The third category is to understand the epistemological forms and the fourth category is resources to understand epistemological positions. According to Hammer & Elby (2002), within the first category, resources to understand the nature of knowledge and how it is originated, you can find some of the following notions:

a. Knowledge as propagated stuff: Someone who appeals to this resource thinks of knowledge as something that may be passed from one person to another. Knowledge is not preserved. Knowledge is seen as something removed from individuals.

b. Knowledge as free creation: Invention is a common experience in children and it is the source of many of their ideas, stories, games and even fictional characters. The source of this knowledge comes only from the imagination.

c. Knowledge as fabricated stuff: This resource is about a kind of knowledge that comes or is deduced from other knowledge. Other resources in this category can be knowledge as a direct perception and knowledge as something inherent.

Within the second category, resources for understanding epistemological activities, are all the strategies that involve the creation, manipulation or application of knowledge. These may be: accumulation, formation, verification and application. Other resources are: comparing, sorting, naming, counting, and adding. Authors state that these are resources to understand activities, instead of being the activities themselves. I will describe the significant ones:

a. Accumulation: This is a resource used by individuals from an early age to understand activities like finding something or someone, searching or discovering, and it refers to the recovery of information accumulated through everyday experiences.

b. Formation: This resource is described as more of a collection of primitive and more specific resources like the formation of rules, the formation of stories, guessing, making crafts and adaptation/adjusting.

c. Verification: A resource that reflects the understanding of verifying something.

d. Application: A resource activated in situations that involves using a piece of existing knowledge.

Within the third category, resources for understanding the epistemological forms, it finds the following notions: stories, rules, facts, songs, lists, pictures, categories, statements, words, names and numbers.

Within the fourth category, resources for understanding epistemological positions, it finds the following notions: beliefs, disbeliefs, doubt, understanding and puzzlement.

One implication of this model for teaching and learning processes is that teachers recognize misconceptions in their students and learn how to confront them and replace such inaccuracies with more appropriate conceptions. Another purpose is for teachers to help their students to use their epistemological resources and activate them in a more productive way combined with other resources in different contexts (Hammer, 1996).

2.6.2.2 The Epistemic Beliefs Model by Hofer & Pintrich

The “epistemological theory” model (Hofer & Pintrich, 1997; Hofer, 2000, 2001; Burr & Hofer, 2002) or “epistemic theories” as later called in Hofer (2004), state that the individual beliefs about knowledge and knowing are organized inside personal theories as related proposition structures that are connected and articulated with others. According to Hofer (2000) people have theories about four essential dimensions of knowledge and knowing: certainty, simplicity, source and justification of knowledge. People's theories in each of these dimensions cover a scale that runs from a naive, objectivistic view of knowledge, to a sophisticated, relativistic view of knowledge. For example, those who tend to see knowledge as objective, believe it to be certain and clear that the source of knowledge is external or proceeds from an authority and that knowledge does not need to be justified because it is self-evident. In contrast, those who perceive knowledge as relative do not believe that anything can be known with absolute certainty; they see knowledge as admitting multiple perspectives and as complex. Moreover, they assume that the source of knowledge is individual or of a social construction and that it needs to be justified in order to reach the status of knowledge.

It is a different theory from the previously seen models, but incorporates various aspects and dimensions proposed from these models. Hofer & Pintrich (1997) state that this model is a good link between the models of “stages” and the models that see beliefs as a system. They suggest that individuals have different personal theories about a discipline (Hofer, 2000) rather than general beliefs about knowledge in these disciplines (Hofer, 2001). Epistemic theories do not operate as a sum of beliefs but as organized forms of knowledge on both a general level domain (domain-general) and domain specific (domain-specific). For example, a student may have a generalized theory of their knowledge about science and at the same time may also have a specific theory about their knowledge of the arts.

Hofer & Pintrich (1997) sustain that this model is in line with the literature on conceptual change (Carey, 1985; Vosniadou & Brewer, 1994; Wellman & Gelman, 1992) as well as with research on the theory of the mind (Wellman, 1990; Wellman & Gelman, 1998), which suggests that the knowledge of individuals in a particular domain is structured in a more or less similar way to the structures of scientific theories. This means that it must have three characteristics: consistency, different ontological categories and a causal-explanatory framework.

According to Hofer & Pintrich (1997), their model has both consistency between its ideas and concepts as distinctive ontological categories, two of the three characteristics proposed by Wellman (1990) to consider that a body of knowledge may be regarded as a theory. Wellman's (1990) third criteria, which states that a theory should provide a causal explanatory framework, in order to make a phenomenon understandable and predictable in its domain, requires more research to test the application.

The first characteristic is that coherence refers to the relationships and connections between the different beliefs of an idea or concept (Wellman, 1990). According to Patrick & Pintrich (2001), this is an on-going process, where at one extreme there is a consistency in which conceptions would be discrete ideas, disconnected and made up of little bits of knowledge; and at the other end, ideas would be organized in a more formal way such as scientific theories, principles and theorems providing explicit descriptions of the relationships between ideas. It is not that teachers' beliefs are organized in formal scientific ways, but they show some consistency. For example, the idea that learning is primarily the domain of facts and the memorization of content supports a transmission of an information teaching model, where the teacher tells the students what the facts are and expects the memorization of these for later evaluation in which the students should remember them.

Another example is the belief that teaching is a process of intentional mediation and it is compatible with a model of learner-centred teaching where the teacher is just a counsellor who guides the students by planning work that stimulates the construction of knowledge and abilities that lead them to their personal development.

As indicated by Patrick & Pintrich (2001), the second criterion refers to the idea that a theory has some conceptual categories, or better put, some ontological categories among the various entities and processes in a domain or field of knowledge (Wellman, 1990). In a study by Chi et al., (1994), an important ontological distinction in science was seen between objects and processes. For example, they found that students often have an ontological commitment to their conception of heat and temperature as objects rather than processes. Moreover, this categorization as an object automatically attributed them with certain characteristics that are incompatible with their true nature as processes. A conceptual change of this belief would appear when students stop assigning the category of objects and instead came to see them as processes.

Another example is in the case of the beliefs of teachers, that many teachers assign an object category to the motivation of their students and see students as having and not having motivation. In contrast, most current social cognitive models of motivation try to describe the motivation of students in qualitative and multidimensional terms (Ames, 1992; Pintrich & Schunk, 1996), instead of only seeing it in terms of a simple category that can take on only two possible values. Many current models of motivation would describe motivation as an on-going dynamic process full of interactions between students and the context rather than an object that students should or shouldn't have (Pintrich & Schunk, 1996). However, research suggests that more often teachers see cognition as an object rather than an already-built dynamic process. A change in beliefs would occur when teachers begin to see motivation as a process. This may require a change in their conceptualization of motivation, which is not an easy process, because many ontological distinctions are intuitively appealing and useful in many contexts.

Hofer & Pintrich (1997), emphasize that conceptualizing epistemic beliefs about the nature of knowledge and the process of thinking in terms of personal theories helps clarify and define the theoretical framework on personal beliefs.

2.6.2.2.1 Dimensions of epistemic beliefs

As stated by Hofer & Pintrich (1997), the model of epistemic theories consists of four dimensions: certainty of knowledge, simplicity of knowledge, justification of knowledge, and source of knowledge. These dimensions are grouped into two broad areas:

1. The nature of knowledge, which refers to what one believes that knowledge is. This is seen as an understanding that grows and moves away from an absolutist knowledge point of view to a constructivist and contextual one. This area includes the dimensions of the certainty of knowledge and the simplicity of knowledge.

2. The nature or process of knowing, which refers to how the individual comes to know and understand aspects such as evaluating the evidence, the role of authority and the process of justification. It includes the dimensions involving the source of knowledge and the justification of knowledge.

Here is a description of the main features of these dimensions:

About the Nature of Knowledge:

Certainty of Knowledge: refers to the degree to which the individual sees knowledge as fixed or variable. This belief is seen as a sequence that changes over time. At the lowest levels of this sequence is that absolute truth exists with certainty. At the highest levels of this sequence is conditional knowledge, which evolves when a person is open to new interpretations or when an individual opens up to new possibilities so their personal theories may be modified by an exchange of knowledge.

Simplicity of Knowledge*:* refers to knowledge that is seen as an accumulation of facts or concepts that are closely interconnected. At the lower levels of this model, knowledge is seen as disconnected, isolated, concrete or as facts that may be known; and at higher levels, individuals sees knowledge as relative, subjective, conditional and contextual.

About the Nature of Knowing:

Source of Knowledge: at the lowest levels of the model, knowledge originates outside the ego (self) and resides in an external authority removed from the individual knower. This authority has the power to transmit knowledge. At the highest levels the ego (self) is the knower, with the ability to construct knowledge in interaction with others.

According to Hofer (2001) and Hofer & Pintrich (1997), some other researchers have described this moment as a turning point for the development and change of beliefs. For example, Perry (1970) described this awareness as one of the fundamental changes in his model when he says that the knower must move from being a receiver of knowledge to being a creator of knowledge. King & Kitchener (1994) also mention the need, at this stage, for a change in the act of getting to know. The knower moves from being a passive spectator to being an active constructor of meaning. Baxter Magolda (1992) says that at this stage a change is required in the learner's role, the role of peers and the role of guardians for an evolution in the way to get to know.

Justification for Knowing: This dimension refers to how individuals evaluate the arguments on knowledge, which include the use of evidence, the view individuals have of authority, expertise and the assessment of experts. When knowledge is uncertain, at the lower levels people justify their beliefs through observation or authority, or on the basis of whatever they feel is right. It is only at the higher levels that individuals use guidelines for analysis and questions and evaluate and integrate their personal points of view with those of the experts.

2.7. Teachers' epistemic beliefs and their relationship with the teaching-learning process.

2.7.1. Research on teachers' epistemic beliefs

Maggioni & Parkinson (2008) assert that the study of teachers' individual epistemology is relatively young and the amount of research available for this population is considerably less abundant than the research focused on students. It was in the 90's when researchers began to study teachers' beliefs about their subject matter. The interest on teachers' domain-specific epistemic beliefs and instruction is very recent. These studies focus mainly on teachers' beliefs of the constructed or discovered nature of their specific disciplinary knowledge, teachers' beliefs on the constructed or transmitted nature of learning, and components of epistemic beliefs triggered by contextual factors.

2.7.2. Beliefs about learning and teaching

It is worth saying that epistemic beliefs relate entirely to beliefs about knowledge and its acquisition. However, in this study as in many others (Hofer & Pintrich, 1997; Schraw, 2001) beliefs about learning and teaching are also included. Although there is much controversy surrounding it, the reasons for the inclusion are that it is considered that knowledge about learning and knowledge about teaching are fundamental components of teachers' expert knowledge. Also because beliefs about teaching and beliefs about learning that emerge in this context have an explicit epistemic character, because they regard the nature and justification of learning and teaching. Maggioni & Parkinson (2008), in a comprehensive review of the literature about epistemic beliefs, found some teachers conceptualize learning as the receiving of a body of knowledge developed by experts, and in this case they tended to prefer rigidly structured, teacher-centred practices, dominated class discussions, and overall did not provide opportunities for students to develop their own questions. In addition, these teachers were particularly concerned that students internalized a correct answer. Thus, they tended to emphasize conventions and following directions, viewed themselves as the only authority in the classroom, preferred discussion of non-controversial topics, and often used a pattern of interaction that was characterized by teacher-initiated questions, student responses, and teacher evaluation of completing outcomes. On the other hand, teachers that perceive learning as the actively constructed understanding of the world adopted a constructivist view of learning and tended to share authority with the students, encouraged positive and mutually supportive exchanges among the students, emphasized the formulation of meaningful questions for answers to other people's questions, focused on helping students develop effective ways to generate and validate knowledge, and underscored the personal relevance of the topics investigated. These teachers were also comfortable with leaving the outcome of students' investigation sometimes uncertain, a situation that not only stimulated discussion but also produced frustration in some students.

2.7.3. How teachers' beliefs operate

An appropriate metaphor would be that, in general, beliefs function in a similar way to a magnifying glass. They clarify and guide the interpretation of what may be ambiguous or unfocused. Usually, teachers interpret ambiguous situations in ways that are consistent with their beliefs. Beliefs serve as a basis for establishing goals and principles framing details and focusing the attention and energy of the teacher. In addition, they define what is peripheral, by determining what teachers do not see, emphasize or evaluate. Beliefs give meaning to what the teacher experiences in the classroom. Moreover, as Pajares (1992) affirms, beliefs prepare teachers to experience certain emotions by assigning some pleasant or unpleasant sensations, such as failure or success.

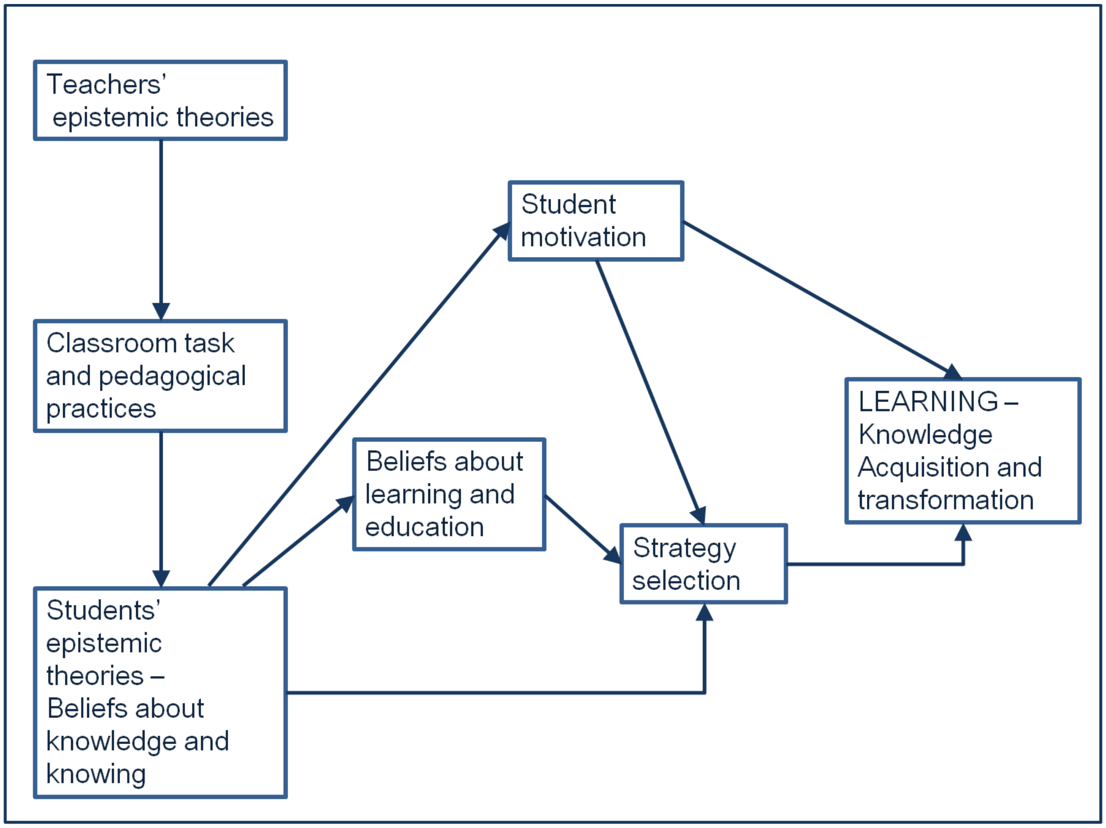
Further, epistemic beliefs act as a 'filter' that determines the experiences of an individual in teaching and learning contexts (Muis, 2004). Several researchers have found that teachers' epistemic beliefs, namely, beliefs about knowledge and knowing, influence their professional practice and have a profound impact on life in the classroom. They can also determine their actions, for instance, their competence, which brings unexpected consequences not only in the classroom but in the various academic environments where the teacher performs. As Maggioni & Parkinson (2008) state, epistemic beliefs characterize the ways in which individuals look at the world (the external, physical reality, themselves, or ideas) in order to gain knowledge, and have been found to influence teachers' choice of pedagogical practices.

On this point, Kagan (1992) conducted a study about professional growth among pre-service teachers and those just beginning their career in which they reviewed 40 learning-to-teach studies. She found that most of the studies reviewed showed a close connection between the teacher's personal beliefs, past experiences and personality, with their classroom practice. Although the context of these 40 studies differed, findings were relatively cohesive. She found that pre-existing beliefs and prior experience played a central role in filtering the content of educational course work. The study also found that the personal beliefs that pre-service candidates bring to teacher education programmes usually remain inflexible. Candidates tend to use the information provided in course work to confirm rather than to confront and correct their pre-existing beliefs. Thus, a candidate's personal beliefs determine how much knowledge the candidate acquires from a pre-service program and how it is interpreted. She also concluded that professional growth consists, among others, of an increase in metacognition, that is, novices become more aware of what they know and believe about pupils and classrooms and how their knowledge and beliefs are changing. Kagan's research confirmed the importance of the epistemic beliefs of teachers in the context of the classroom. At the same time it poses two questions: do pre-service candidates change their personal beliefs during the course of a teacher education program? And, with regards to changing personal beliefs, is cognitive dissonance between a student teacher and their cooperating teacher desirable? She concluded that personal beliefs remained stable during the course of a teacher education program and student teachers were more likely to examine and reconstruct their own beliefs if they were confronted with a cooperating teacher whose beliefs were different from their own. Although experiencing cognitive dissonance and disagreement may ultimately be beneficial for growth, it is often uncomfortable.

Teachers' epistemic beliefs influence life in the classroom. Hofer (2001) proposed a model for Higher Education (Fig. 4 Working model of how epistemic theories influence classroom learning) that starts with the teachers' point of view and ends with student knowledge acquisition and transformation. The process implicates teachers' approach to teaching, students' epistemic beliefs, students’ approach to learning and learning itself. This learning may be knowledge acquisition or construction, depending on the instructional strategy selected.

Following this direction Schraw & Olafson (2002) and Schraw & Sinatra (2004) suggest teachers with more sophisticated epistemic beliefs make more flexible choices and engage with their students more. This indicates the need to give teachers the opportunity to develop their own epistemic beliefs and to understand the role that their beliefs and their students’ beliefs play in the learning environments to promote more sophisticated ways of thinking in students. Similarly, Schwartz (2008) showed that teachers with more sophisticated beliefs (learning is not quick, knowledge is constructed by taking on other perspectives) were more likely to use dialogue to promote thinking in children with disabilities, with the exception of those students deemed to be at risk. Conversely, teachers who held more naïve personal epistemologies (knowledge is absolute and can be passively received) used more teacher-centred, traditional approaches to teaching. In general these studies show that sophisticated personal epistemologies are linked to constructivist teaching practices.

Figure 4 Working model of how epistemic theories influence classroom learning by Hofer, 2001



In summary, teachers' epistemic beliefs can be considered as guiding principles that serve as magnifying glasses through which new experiences can be understood. Teachers' epistemic beliefs can be formed without any evidence and can sometimes be full of contradictory evidence, but are part of the identity of a teacher. Epistemic beliefs and their influence on teaching and learning contexts tend to be little discussed by teachers because most are implicit, disconnected or unconscious. Literature suggests that failure to assess beliefs may have negative consequences because they guide the practice and priorities, determine what should be ignored, influence decision making processes and determine what kind of interactions are important.

2.7.4. How beliefs are changed

In order for beliefs to be changed, it is important to consider several aspects:

Researchers of epistemic development such as Baxter Magolda (2002), King & Kitchener (2002) and Kuhn (1991) have found that there is a trend towards progression in the development of beliefs; this progression would begin at an early stage of human development and lead into adulthood, becoming stronger in those who go through some type of educational experience, for example, school or college. These studies suggest the need to change these beliefs over time from the simplest to the most sophisticated. According to this, knowledge is transformed from a simplistic position to a relativist position. It then moves forward to a stage where people are active constructors of knowledge, are able to make judgments and commitments in a relativistic context. However, it is not clear where the process of epistemic understanding begins. What is clear is that it is not until about the age of 4 that a knower begins to emerge in children's conceptions of knowing. Children become aware that mental representations, as products of the human mind, do not necessarily duplicate external reality. Before this, children achieve a concept of false belief, they are unwilling to attribute a belief that they themselves know to be false to another person. Once they attain this understanding, the knower, and knowledge as mental representations produced by knowers, come to life (Kuhn, 2004 p. 271). More research is needed in this field.

There is little evidence on the specifics of the change in epistemic beliefs and what fosters epistemic development. However, most studies, independent of the underlying model, suggest that this is done through the promotion of the development and challenge of existing ideas to current ideas of a higher order, so as to encourage cognitive conflict and cognitive reorganization. Almost all models of epistemic beliefs have propounded this mechanism, which is a Piagetian concept, as the basis for the change in epistemic beliefs. This requires individuals to feel unsatisfied with their existing beliefs and to question the validity of their actual beliefs, for example, by confronting their ideas with other opposing ideas and finding new clearer, useful and accessible alternatives, or finding a way to connect new beliefs with the existing ones (Hofer and Pintrich, 1997; Kienhues et al., 2004).

There are various ways to promote epistemic development in the classroom. One way is by using a learner-centred teaching approach in which teachers encourage students to question and comment, where teachers recognize the student's reactions and facilitate their participation in classroom activities (Baxter Magolda, 1992). Another way is to provide opportunities for individuals to discuss and analyse ill-structured problems in the classroom, to teach students the skills to gather and evaluate information, to engage students in the discussion of controversial issues and help them to do some research into their personal assumptions about knowledge and how this is obtained. Also, epistemic development is promoted in classrooms when teachers encourage students to show respect for others' theories and provide both cognitive and emotional feedback and support (Kardash and Scholes, 1996; Schommer, 1990).

Another factor to take into account for changing epistemic beliefs is to distinguish between general beliefs, which appear to be relatively more stable, and specific beliefs, which are related to a specific domain of knowledge and are more variable (Gill et al., 2004). They found that the instructional intervention designed to change epistemic beliefs of pre-service teachers' about teaching and learning mathematics had a positive influence in the treatment group. Receiving instructional intervention demonstrated greater change in implicit epistemic beliefs than the control group, which used the traditional learning methods. Finally, a long-term intervention designed to facilitate the reflection on, and development of, more sophisticated epistemic beliefs was implemented as part of a three-year-long teaching program. The results indicated that, over time, participants became more constructivists in their beliefs about knowing. Furthermore, Kienhues et al. (2004) suggests that for better results long-term interventions are required to change general beliefs and short-term interventions to change specific beliefs. In a later study, Kienhues et al. (2008) found the possibility of changing epistemological beliefs of a specific domain through a short-term intervention. The group receiving epistemic confrontative (face-to-face) instruction changed towards a more sophisticated point of view.

Finally, it is useful to note that epistemic beliefs theory is in line with literature about conceptual change. In this sense, Pintrich et al. (1993) and Patrick and Pintrich (2001) suggested the role of motivation, context and affection for teacher conceptual change. They suggested that these three factors play a significant role in facilitating or inhibiting change in the conceptions of teachers. This is what is known as warm conceptual change. They argued that most conceptual change models have focused on cognitive factors involved (called cold or rational factors) and have not examined the role of motivational factors (called warm factors), but conceptual change and cognitive growth need both. They suggested that many of the cognitive factors that are important for conceptual change are related to motivational factors. Cognitive factors are: (a) metacognitive awareness (b) a deeper level of cognitive processing (as opposed to memorization) and use of cognitive strategies and; (c) thinking and processing of general scientific thinking and problem solving. The three adaptive motivational beliefs that facilitate change are: a) mastery or performance goals b) personal interest and utility value and c) the role of self-efficacy. Of course, much of this argument is still awaiting real evidence, but offers suggestions for future research and implications for teaching educational psychology.

In summary, for beliefs to be changed it is important to consider several aspects. First, there is a trend towards progression in the development of beliefs. Studies about beliefs suggest the need to change these beliefs over time, from the simplest to the most sophisticated or from the general to the more specific. To foster epistemic development we should promote cognitive conflict and cognitive reorganization in individuals. Also, to change epistemic beliefs the following should be taken into account: motivation, and context and affection, because they play a significant role in facilitating or inhibiting change in the conceptions of individuals. Finally, it is necessary to distinguish between general beliefs, which appear to be relatively more stable, and specific beliefs, which are related to a specific domain of knowledge and are more variable.

2.7.5. **Change in the epistemic beliefs of teachers.**

According to Patrick & Pintrich (2001) epistemic beliefs constrain or facilitate conceptual change in teachers. They suggested the existence of beliefs that are more favourable for an epistemic change than others, and as such they outlined four dimensions of favourable beliefs for epistemic change based on the dimensions of the epistemic theory model by Hofer and Pintrich (1997). Patrick & Pintrich (2001) stated that depending on the teacher's position, conceptual change may be facilitated or impeded. The four facilitator positions are:

(1) The belief that knowledge is always in development, based on new evidence, research, models and theories;

(2) The belief that knowledge is not simple but is complex, situational, relative and contextual;

(3) The belief that knowledge may be repressed by the individual but in relation to claims about evidence, models and theories developed by others; and

(4) The belief that knowledge should be justified by the use of evidence and reasons full of alternative points of views.

Patrick & Pintrich (2001) suggested that to promote the change or development of these facilitator beliefs in trained teachers, instructors could explain the implicit tensions and the uncertainties about teaching during the training sessions. For example, they may ask teachers to metacognitively reflect on their decisions and their classes while teaching and at the same time to verbalize these thoughts so that the teachers in training could be witnesses to the complexity of making decisions in pedagogy. Epistemic beliefs theory says that is not an easy developmental progression and that learners of all levels need a lot of support as they confront these issues in the classroom.

Also, instructors may help facilitate the change of beliefs in teachers in training, or in teachers in their early years of professional experience by encouraging them to identify and express their beliefs about learning, motivation and teaching, and by emphasizing inconsistencies in their types of thinking and in their language. Instructors may facilitate the teachers' change in beliefs even more when designing courses to motivate learners to engage with the material in a profound and meaningful way. Another way to facilitate change in beliefs is changing implicit theories of teachers' epistemic beliefs into the explicit epistemic belief that supports them.

Without a doubt, in order to change these beliefs we need to encourage teachers in training or professional teachers to be honest with themselves and confront their current belief system, evaluate it and use the ones that really are useful for their students.

In accordance with Bendixen (2002), Pintrich (1993) and Posner et al. (1982), there are some conditions that are required for the appearance of a conceptual change in teachers as well. These conditions come from the literature in the nature of change in scientific paradigms:

1. We need to feel that current beliefs are no longer working in a satisfactory way (dissatisfaction). We need to feel inconsistency or cognitive dissonance, for example, dissatisfaction with current beliefs.

2. We should be able to understand the new beliefs. To fulfil this, the new beliefs must be intelligible (intelligibility) and clear.

3. We should be able to apply the new beliefs in an adequate way. To fulfil this, the new beliefs should be plausible (plausibility) and reasonable.

4. The new beliefs must face any challenges and guide teaching and learning processes. The new concepts must be fruitful (fruitfulness of rival conceptions), must have the potential to be extended to other areas and to open up new possibilities.

Some other required conditions to be taken into account include:

1. It is required to bring pre-existing beliefs into consciousness and create a propitious environment to break them up (Pajares, 1992).

2. We need to help teachers to judge conflict as a challenge rather than a threat (Gregoire, 2003),

3. We must provide teachers with the necessary time to reflect on their beliefs and reconcile these with their field and current teaching context (Davis, 2006).

4. Finally, we must not forget non-cognitive factors such as motivation, educational background as well as the affection needed for change, for example, interest in the subject, intense emotions, anxiety or negative/positive feelings related to new challenges (Pintrich et al., 1993).

A simple awareness of the beliefs is not enough to create change. As stated by Hofer and Pintrich (1997), most theories in the field agree that the teachers require a state of imbalance, conflict or cognitive dissonance which would allow them to see how their beliefs are no longer working to teach their students in a positive way. A conflict or dissonance challenges teachers to face their failures. These failures could be valuable and may transform teaching if they are accepted in a positive way. It is therefore necessary to help teachers to interpret their faults and see changes as a challenge and an opportunity to grow rather than as a threat.

Some researchers propose other mechanisms of change such as epistemic doubt, epistemic volition and resolution strategies that work in an interconnected way (Bendixen, 2002; Boyes & Chandler, 1992). For instance, Boyes & Chandler (1992), include epistemic doubt as part of the relativist thinking where the individual is constantly questioning the existence of absolute knowledge. And Bendixen (2002) expands the perspective of this concept by considering epistemic doubt at any stage of the epistemological development. Epistemic doubt implies questioning the validity of current beliefs. It can be provoked by contextual factors such as being confronted with the opposing opinion of another person. Epistemic doubt in itself does not imply change or progression in epistemic development. It is possible that when facing doubts, the teacher decides to return to their former beliefs or stay true to their current beliefs. This doubt could be only an impetus. To reach change, the teacher will require something else, the teacher will require volition, which means focusing attention and concentrating on solving any dissonance. This means that it is not enough to just have doubts, but that action is required. Finally the third component is focused on resolution strategies that depend on the previous experiences of the first two aspects. Some strategies may include reflection, social interaction and argumentation. The three components (epistemic doubt, epistemic volition, and resolution strategies) interact to bring forth change and progression. This model does not escape the possibility of a reversal of beliefs rather than a development, as it considers epistemic beliefs development as a dynamic process. Although the model has not yet been evaluated in detail a retrospective interview study undertaken by Bendixen (2002) supports the crucial role of epistemic doubt for changes in epistemological beliefs.

Throughout our research I developed a specific strategy to bring about change in beliefs. The methodology takes into account the socio-cognitive conflict. To challenge preconceptions on teaching and learning I used the peer collaboration strategy in which teachers could engage in social interactions that would lead them to a conflict. When this clash of beliefs comes into contact with others' beliefs it may create a state of imbalance between the study participants, which would result in the construction of new conceptual structures and new understandings. The construction of shared knowledge and mutual understanding takes place through the growing individual's ability to consider the perspectives of others. Roschelle and Teasley (1995), for example, emphasize the role of shared understanding and state that collaboration is a "coordinated and synchronized activity, resulting from a sustained attempt to build and maintain a shared conception of a problem" (p.70).

Finally I mean to state that previous research has shown that teachers' beliefs are often difficult to change (Borko & Putnam, 1996; Calderhead, 1996). Professional teacher development programmes have had little or no impact on teachers' beliefs about teaching (Brookhart & Freeman, 1992; Knowles, Cole, & Presswood, 1994; Korthagen & Kessels, 1999). But current research (Olafson & Bendixen, 2002) has found that when designing training and professional teacher development courses, where appropriate conditions are provided -teachers are given the opportunity to articulate and make explicit their beliefs about teaching and learning processes, and the implications of holding such beliefs are discussed-, programmes have shown as having a small but positive impact on changing teachers' beliefs.

Patrick & Pintrich (2001) assert that epistemic beliefs constrain or facilitate conceptual change in teachers. The way teachers organize their teaching is related to their beliefs about learning or to the way they understand learning (Pintor & Vizcarro, 2005). Taking into account the research and studies mentioned above, metacognitive skills are considered an essential and desirable characteristic of teachers' skills. Teachers need to be aware of their epistemic beliefs and to identify and develop their own metacognitive competencies in a proactive way; this means in an enterprising, dynamic, preventive, anticipated way. There are some situations and activities that promote metacognition in teachers. Some of these include teamwork, well prepared planning activities, observation of other teachers' and colleagues' activities, and observation of activities planned by teachers with a different socio-cultural perspective. Other situations include the use of computer and new technologies. All of these help in the promotion of metacognition as well as in transforming naïve or simplistic teaching and learning conceptions into more sophisticated and elaborated ones (Schraw, 1998). Definitely, these metacognitive skills provide them with opportunities to reflect and analyse constantly about their own goals, to take decisions and solve problems, to go beyond individualism, to get to know conceptual differences and to accomplish understanding and to develop abilities to manage everyday situations.

2.8. How epistemic beliefs are measured

To look at the epistemic beliefs of in-service teachers, I used an adapted version of the *Beliefs about Teaching and Learning in your Discipline Questionnaire* (DEBQ), devised by Hofer, (2000).

Epistemic beliefs had been measured through interviews, task resolution, ill-structured problem solving, error-detection studies, self-reporting measures, thinking-aloud methodologies, and a variety of written instruments such as questionnaires and multiple-choice inventories, similar to methods used for assessing metacognition and self-regulation. Among the instruments are: the Measure of Epistemological Reflection by Baxter Magolda (1992); the Measure of Intellectual Development (MID), a production-task instrument with essay stems; and the Learning Environment Preferences (LEP), a recognition-task instrument with forced-choice items (see Moore, 1991, for more information on the MID and LEP). There is also the Assessment of Reflective Judgment by King & Kitchener (1994). A more general assessment of epistemological beliefs is available through Schommer's Epistemological Belief Questionnaire (Schommer, 1990), a self-report questionnaire with items rated on a Likert type scale, it is the most useful paper-and-pencil measure of general epistemological beliefs for a large scale administration.

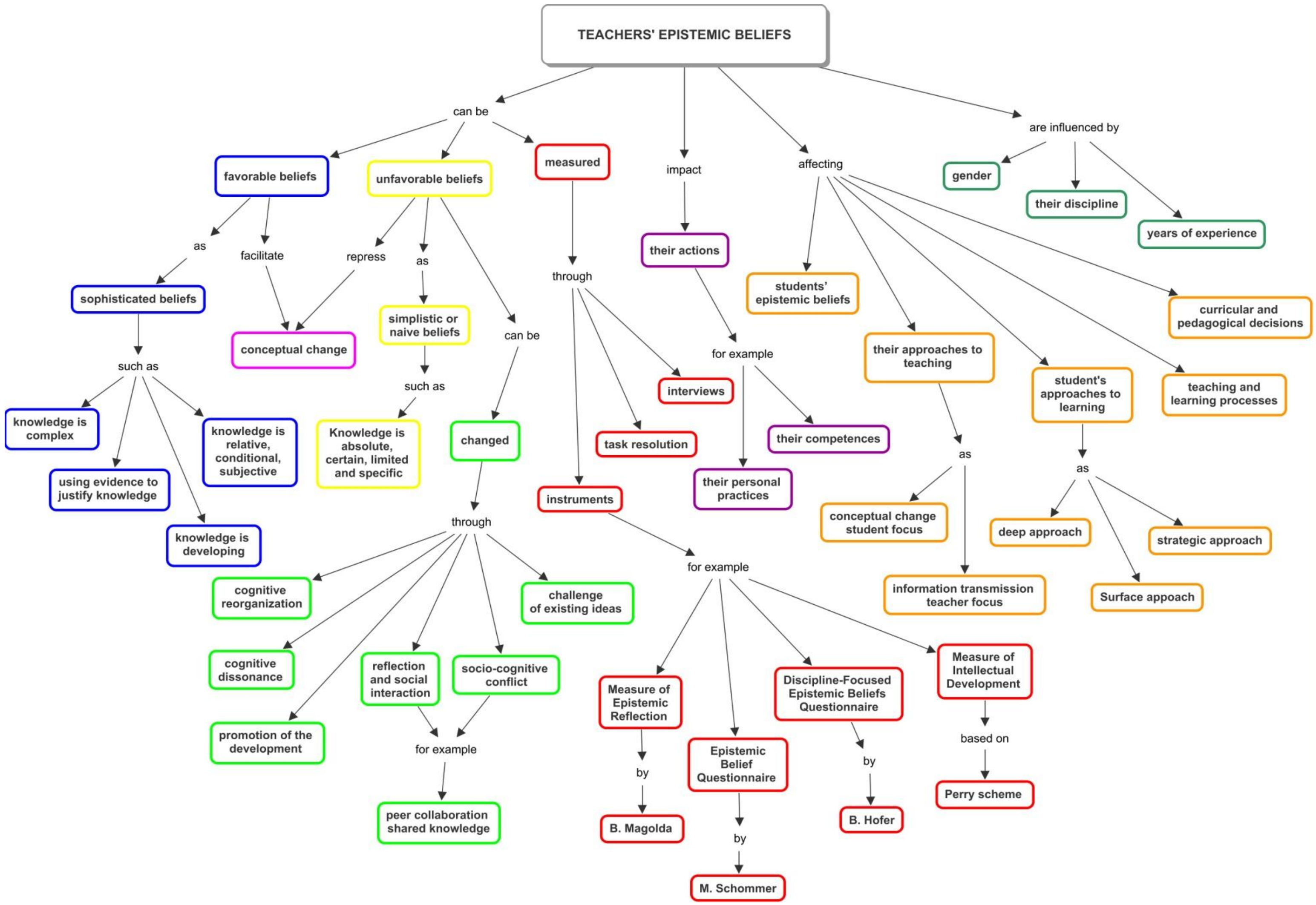
However, none of the mentioned instruments measure all four dimensions proposed by Hofer (1997), so the authors developed a new questionnaire -using the other questionnaires as a foundation- that could measure all four dimensions, as well as the disciplinary differences between them. Hofer et al., (2000) developed the Discipline-Focused Epistemological Beliefs Questionnaire (DEBQ). The instrument consisted of four scales and a total of 27 items on a 5-point Likert scale (1=strongly disagree; 5=strongly agree). These scales are: certainty of knowledge; simplicity of knowledge; justification of knowing: personal and; source of knowledge: authority (Hofer, 2006; Hofer, 2001; Hofer, 2000; Hofer & Pintrich, 1997; Tolhurst, D., 2004).

An adapted version of three factors of this questionnaire was used for this research study (See appendice). This tool has been tested in learning contexts with students in the classroom (Hofer, 2004), as well as on teachers in higher education contexts (Clancy & Fazey, 2008). This thesis is based mainly on the Epistemic Beliefs Theory by Hofer and Pintrich (Hofer, 2006; Hofer, 2001; Hofer, 2000; Hofer, 2004; Hofer & Pintrich, 1997).

2.9. Chapter Summary:

The following concept map 1 was made by the author of this thesis to summarize the characteristics of the epistemic beliefs of teachers and its relationship with teaching and learning processes.

Concept Map 1: Characteristics of epistemic beliefs of teachers and its relationship with teaching and learning processes



SECTION 2

APPROACHES TO TEACHING AND PHENOMENOGRAPHY

2.10.1 Introduction

In this section I am going to talk about Approaches to Teaching and Phenomenography. The approaches to teaching are based on an experimental model that has its origins in an interrogative technique known as phenomenography (Brockbank & McGill, 2002; Prosser & Trigwell, 1999). The application of such methodology to higher education gave rise to a model of the learner as an active, responsible adult who can share their experiences, and a teacher who is conscientious and willing to help their students understand the significance of their learning experiences and as such be able to achieve more (Ramsden, 1988). From these phenomenographic studies emerged conceptions that revealed, among other things, the manner in which students approached their learning and later, as teachers, focused on their teaching. Phenomenography is a relatively new theory, which encourages teachers to adapt their teaching methods to the individual needs of the student.

2.10.2. The origin of the term Phenomenography

Phenomenography was developed in the early seventies by a research group at the University of Gothenburg in Sweden in the Department of Education (Marton, 1999). The word phenomenography was coined in 1979, and first appeared in an article by Ference Marton (1981). Etymologically, it derives from the Greek "phainemenon 'and' graphein" which respectively mean appearance and description. Phenomenography is therefore the description of things as they appear to us. The objective of research is to qualitatively describe different ways of experiencing phenomena.

According to Amedeo Giorgi (1999), although the word phenomenography was not used in classical Greek philosophy, an interest in describing "what appears" can be found in Pyrrhonism. Today, interest in phenomenography has taken a different path. According to Giorgi (1999), the first academic to use the term "phenomenography" was the psychologist Ulrich Sonnemann who, in his book "Existence and Therapy: An Introduction to Phenomenological Psychology and Existential Analysis" (1954) introduced the word in order to distinguish between the two schools of psychopathological research of Jaspers and Heidegger (Hasselgren & Beach, 1997). According to Sonnemann, phenomenology would be better called phenomenography because it is a purely descriptive record of the experiences of immediate subjective experience as told. The direct quotation is, "*Phenomenography is a descriptive record of subjective experience as it is told, for example, by a person in a psychiatric examination without questioning the participation of the ego in such communication*".

Other authors in other contexts have also used the term phenomenography, such as the Mexican author Alfonso Reyes (1997). Reyes spoke of phenomenographical literature. He stated that the study of literary phenomenon is phenomenography because any single representation of the world is unique. In a footnote in his work "The Literary Experience" (1952, pp. 84-85) he explained that, to avoid confusion with the phenomenology of Husserl, he prefers to use the term "phenomenography", the definition of which he took from the book "A New System of Deductive and Inductive Logic" (1903) by the Mexican author Porfirio Parra. However, it was Ference Marton and his colleagues (1981) who first significantly developed it as a tool for educational research (Hasselgren & Beach, 1997).

In the early days the term phenomenography did not have a clear definition. This could have been because Marton was not formally trained in phenomenography, as the theory had not been in existence during his early professional career (Giorgi, 1999). However, in reality, in early research, phenomenography was more empirical than theoretical in nature (Akerlind, 2005). Only later did a theoretical framework begin to emerge.

Early phenomenographic research was focused on study skills, and exactly what and how people learn (Hasselgren & Beach, 1997). The researchers questioned why some people were better than others at learning and whether there are different ways of understanding learning tasks, which in turn led to another question - why do people differ in their approaches to learning tasks (Marton et al., 1984)?

The researchers set out to take as little for granted as possible. The process of learning was studied in comparatively natural conditions, and the objective of the study was to examine the learning process from the point of view of the student. The researchers' discovery was that the understanding of any examined phenomenon, both on a large population or a small sample, is limited and qualitatively varies, and this directly affects the quality of later learning. These studies were the basis for further development of a study interested in describing phenomena as seen by other people, which Marton later called phenomenography (Marton, 1981, Marton & Booth, 1995).

Phenomenography, despite its short existence compared with other approaches to qualitative research, has produced more than 150 doctoral theses to-date, more than 1500 scientific publications and various scientific research projects around the world (Marton et al., 1997).

2.10.3. Phenomenography is not phenomenology

As phenomenography is little known in popular culture compared with phenomenology, a fair question to ask is what exactly is the relationship between phenomenography and phenomenology? Firstly, phenomenography is not phenomenology. Both phenomenography and phenomenology share the term "phenomenon" which means "to make manifest" or "to bring to light". However, the suffix "graph" in phenomenography means "show" or "describe" what is manifest, whereas the suffix "logos" in phenomenology means “to bring together what appears to clarify the logic or structure”. Thus, phenomenography "would be the act of representing an object of study as a qualitatively different phenomenon" (Marton & Booth, 1997, p. 110), while phenomenology is the process by which what appears is investigated, in order to reveal its structure or organizing principle. The fundamental difference between the two is that phenomenography is empirical research, while phenomenology is a philosophical research method.

In stating this, I can say that both phenomenology and phenomenography can share the same object of research, but differ in the ways that they treat this object (Marton and Booth, 1997). Both research methodologies value a strictly qualitative approach to learning, and both regard the perspective of the student as essential. Both claim to be descriptive, and both recognize the different ways in which people can perceive or understand a situation.

Despite shared values, there are major differences between the two approaches, not least in the way they understand phenomenon in action. Consequently, different results are produced when the two methodologies are used in research studies (Marton & Booth, 1997).

While the goal of phenomenology is to describe the essence of the ways in which a phenomenon can be seen, the objective of phenomenography is to identify the variation in the forms in which it is seen. In addition, the different approaches are applied to different disciplines. As I previously stated, phenomenography was born in an educational context while phenomenology is a philosophical method (Giorgi, 1999). It can also be said that phenomenography can claim a distant influence from phenomenological philosophy. Finally, although it is true that both approaches share some concepts and definitions, the ways in which these concepts are applied are very different (Marton & Booth, 1979, p.110).

It is worth noting that the phenomenographic approach used by Marton and his colleagues in order to contrast phenomelegy with phenomenography is based primarily on Husserl's philosophical phenomenology (Marton & Booth, 1997). However, there are other approaches that derive from this philosophical approach. There is, for example, the scientific approach to psychological phenomenology developed by Amedeo Giorgi (1970, 1986, 1999, 2009), which is not mentioned by Marton and colleagues, which perhaps would have allowed a more accurate and complete contrast. Phenomenography is an approach that is still being developed. It is still in a state of flux (Pang, 2003). Using a concept by T. S. Kuhn (1970, p. 35), many years of "normal science" still remain for researchers to consolidate their approach to new developments, verify their assumptions and evolve a new paradigm of reference.

2.10.4. The early development of phenomenography and its fundamental concepts

The history of phenomenography *grosso modo* can be seen as having two broad periods. There is an initial, experimental period, in which basic principles were developed, and a current period in which the theory is being further consolidated, its principles proved, and new concepts developed (Bowden & Marton, 1998, Marton and Booth, 1997.)

The roots of phenomenography can be found in some empirical studies into the ways in which Swedish college students learn whilst reading academic texts (Marton, 1974, Dahlgren, 1975; Säljö, 1975, and Svensson, 1976). Researchers sought to understand the differences in the manner in which various students read a text and related this to the learning outcomes obtained, which is to say their final marks. They found that those who focused on memorizing sections of the text had worse results than those who focused on what the author wanted to express. The researchers also wondered what the different forms of experiencing a phenomenon (in this case learning) were, and how these forms were related to each other. The students gave descriptions of their experiences. These were studies of individual subjects, but were analysed at a group level (Marton, 1981; Akerlind, 2005).

The researchers conducted a qualitative analysis of the results, which they organized into different categories. They then gave these results an order based on logical relationships, which produced an outcome (Pang, 2003). Studies derived from this initial research helped phenomenography to evolve as a research specialization (Marton, 1986; Pang, 2003). A large number of subsequent studies were conducted. Some of these dealt with learning content and studied the ideas of people in different disciplines. Some of these studies include, Dahlgren's studies on the concepts of economics (1980), Lybeck's studies of the conceptions of the proportionality of students (1981), the studies of Johansson, Marton & Svensson (1985) on students' understanding of mechanics, Neuman's research into how young children handle problems in arithmetic (1987), Lybeck, Marton, Strömdahl, & Tullberg's studies on the students' design of the mole concept in chemistry (1988) and Renström's research (1988) into students' understanding of the nature of matter. A parallel series of phenomenographical studies examined the act of learning and focused on the study of student conceptions of what learning really is (Säljö, 1982; Pramling, 1983, Marton et al. 1993).

As a research method, phenomenography has also been applied outside the context of education, in studies such as Theman's research into the concepts of political power (1983), Wenestas' studies on the concept of death (1984), and the research of Marton et al. on views of scientific intuitions about the Nobel prize (1992). These developments allowed phenomenography to emerge as a valid approach to research (Marton, 1981, 1994) and to create an educational model that Marton and colleagues later called The Study of Learning.

A description of the key principles that emerged out of these initial developments follows:

2.10.4.1. Definition of the concept and interpretative perspective

Phenomenography can be defined as a qualitative research method, with an interpretative aspect (Svensson, 1997) that aims to determine the qualitatively different ways in which people experience and understand the world around them (Marton, 1981). This interpretive aspect regards social reality as a human construction and is built through an individual's perception of their own environment. It is a result of personal perspectives of significant interactions (Imel et al., 2002), which are realized through inter-subjectivity (Wellington, 2000), and socialization (Silverman, 2000).

The interpretive aspect of Phenomenography means that the nature of reality (or ontology) can be defined as non-dualistic (Bryne, 1988). This means that there are no two worlds, no two separate objective and subjective realities. The world of mental representation does not claim dominance over an objective reality. There is only one world, which is simultaneously objective and subjective, a world that human beings express and understand in different ways and which has meaning in the relationship between the two realities (Marton, 2000; Trigwell, 2006).

How do we come to know about this world or this reality? Phenomenography says through the ideas or through the experiences and conceptions that people have about the world, with the assumption that the same phenomenon can be interpreted in different ways and therefore lend itself to different interpretations. This way of coming to know (epistemology) is called second-order perspective. Detail is not in the way things are, but how they appear. This is a more interpretative approach that anticipates more descriptive and differentiated answers to questions. It is this second-order perspective which appeals to phenomenography (Marton, 1981, 1986).

Phenomenography aims to investigate a *relational* human experience. This means that phenomenography does not focus on the phenomenon itself, or on the individuals who are experiencing the phenomenon. It does not attempt to experience these individuals' reality or the process of creating perceptions of that reality. Rather, the focus is on the relationship between the totality of these aspects, in the way in which people experience and understand the phenomenon (Booth, 1992, Marton, 1988).

The objective of research on phenomenography is the **variation** of the ways of understanding that people have of the different phenomena to place it into different conceptual categories. The goal is not to find any one single definition, but to look for variations in different aspects of what is being studied (Marton & Booth, 1997). To achieve this, it is assumed that people understand situations differently.

We understand **phenomenon** as something of the world, concrete or abstract, which can be defined by the researcher and by others. Examples of phenomena may be learning, teaching, technology, communication and education. Phenomenography studies the way in which people understand phenomenon, how they learn about it, or experience it.

The cognitive relationship between the individual and the phenomenon is called **conception** (Booth, 1992, Marton & Booth, 1997). In other words, a concept is an internal relationship between “experience" and what is "experienced" (Marton, 1995; Marton & Booth, 1997). It is a set of ideas that address how the person has experienced a phenomenon. These are not psychological entities residing in the minds of people (Marton, 1995).

Conceptions are basic forms of knowledge (Svensson, 1997), ways of experiencing and describing things, and as such are fundamental to phenomenographical research (Bruce, 2002, Marton & Pong, 2005). There are two interlinked aspects: the referential aspect, which refers to the overall meaning of the object conceptualized, and the structural aspect, which refers to a specific combination of features of the object of study (Marton & Pong, 2005). The referential aspect is the particular meaning of an individual object (anything delimited and focused on by the subject), and a structural aspect is the combination of features discerned by and focused on the subject.

Conceptions can take on various names: "how to conceptualize," "ways of experiencing", "ways of seeing", "forms of grasping," "ways of understanding" or "structures of consciousness" (Marton & Booth, 1997, Marton & Pong, 2005). Conceptions are not visible and explicit, but are implicit and are revealed only in the form of the categories of description (Saljo, 1996).

2.10.4.2. Categories of description.

The main result of phenomenographical research is the categorizing description of conceptions (Marton, 1981, 1986). These descriptive categories reveal the ways in which the phenomenon under investigation is experienced (Marton & Booth, 1997) and describe key aspects of this phenomenon (Richardson, 1999).

These descriptive categories are primarily obtained through data collection methods such as questionnaires (Trigwell, 2006), interventions (Wahlstrom, 1997) and interviews.

This categorization represents only the experience of a group of people, and because of this, it can be said that the number of qualitatively different ways of experiencing a phenomenon is relatively limited.

There are no predefined categories outlined before the analysis or any intention of fitting the data into predetermined categories. The categories emerge after the data is analysed. They are based on distinctive, fundamental differentiations. They are presented hierarchically, reflecting an increase in the levels of understanding and showing the relationship between the concepts that form part of every category.

The creation of categories entails a long and repetitive immersion in the data in order to understand its meaning. Similarities and differences are sought, the data is grouped and classified, and then provisional group categories are developed and repeatedly compared against all the data (Akerlind, 2005). Each descriptive category is labelled as a description of the conceptions of people, that is to say their ways of experiencing phenomenon (Marton, Hounsell, Entwistle, 1984). Finally, since the categories represent different ways of thinking about the same subject, they can be used in different ways, and can be extrapolated to other contexts.

Phenomenographists emphasize that it is important to understand that the categories do not represent a developmental sequence. The way in which conceptual development occurs is an empirical development (Akerlind, 2005; Marton, 1981, 1986, Uljens, 1996).

These descriptive categories are the backbone of phenomenographic analysis. The researcher obtains information from them that allows to differentiate between variations in conceptions, variations that are based on the differences between categories of description.

Four key qualities underpin the categories of description. Marton (1988) describes these qualities as relational (the subject-object relationship comprising the conception); experiential (based on the experience of participants in the study); content oriented (focused on the meaning of the phenomenon under investigation); and finally, qualitative (descriptive in nature).

2.10.4.3. Outcome space

The outcome space is a set of hierarchically organized categories of description (Marton, 1988), structured by the researcher in order to represent different ways of experiencing a particular phenomenon (Akerlind, 2005; Marton & Booth, 1997).

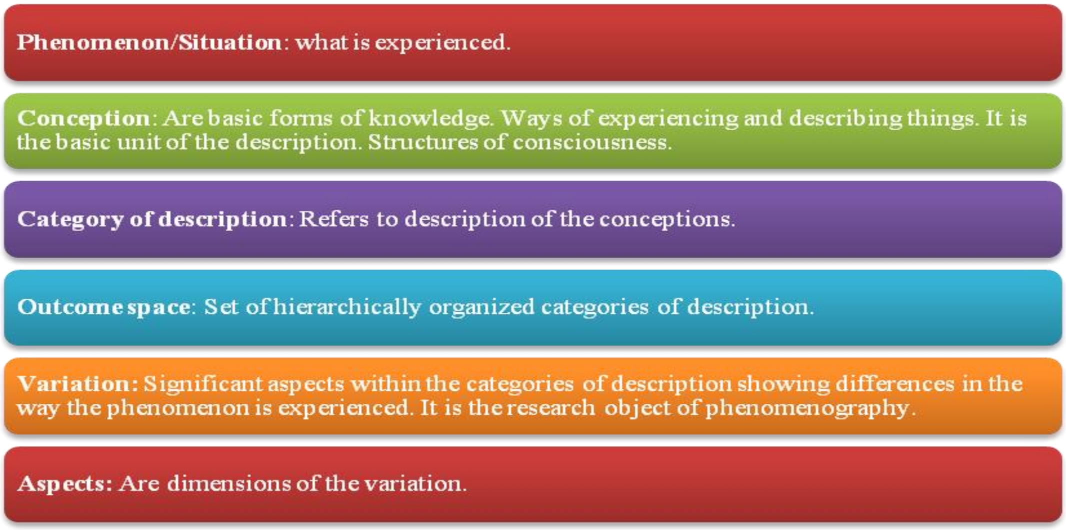
Marton & Booth (1997, p. 125) described three criteria for assessing the quality of an area of results:

1. Each category needs to reflect something other than the phenomenon. The individual categories should each be clearly related to the phenomenon, so that each category tells us something different about a particular way of experiencing the phenomenon.

2. The categories must have a logical relationship to each other. This relationship is in most cases, hierarchical. This is an important feature of the outcome space. This hierarchical relationship assumes that different forms of experiences are organized into a set of increasingly complex categories, which in turn represent all the possible experiences of a particular phenomenon. The categories of lower-level description represent ways of experiencing something that is less complex, while higher-level categories represent more complex or more complete forms of experience.

3. The outcome space is parsimonious. This means that the variation in the experience is represented by as few categories as possible in order to capture critical variations in the data. The number of categories in a set is determined by the extent of variation. In any event it is limited in number.

Chart 1 Summary of the basic concepts of phenomenography



2.10.5 New developments

2.10.5.1 The theory of variation and the anatomy of the awareness.

"The world is not constructed by the learner, nor is it imposed upon him/her; it is constituted as an internal relation between them (Marton & Both, 1997, p. 13)".

Phenomenography is the study of aspects of learning and teaching that promote effective learning and generate a more productive teaching environment. Phenomenographers initially focused on the description of conceptions and the outcome space. Nowadays, the new, more theoretical and less experimental, phenomenography centres more on variation and its architecture, i.e., the structure of the conscience (Marton & Booth, 1997).

Variation is a structure "within", not "between" conceptions, as is the case of the outcome space (Marton & Pong, 2005); in general it refers to the significant aspects within the categories of description that show differences in the way the phenomenon is experienced (Marton et al., 2010). Common aspects between conceptions are not included since they are not part of the variation. As Trigwell (2006) states "centring only on differences leads to an outcome space whose description of the phenomenon is partial, not total, as might be expected from other types of analyses such as a phenomenological one or an analysis of content".

The key idea in the theory of variation is that in order to learn one must discern, and in order to discern, variation must be experienced. Put another way, discernment depends on variation and variation is important for effective learning. Why is this so? The answer can be found in an experimental study from some time back on motor learning (Moxley, 1979). This, very simply consisted of children practicing hitting an object with a ball. The children in the control group always hit the ball in the same direction while those in the experimental group hit the ball in different directions. Both groups were then asked to hit the target from what was a new direction for both. The result was that the experimental group performed far better than the original control group. The variation in directions had been fundamental to their practicing and, therefore, for learning (Marton, 2000).

Taking this idea further, I can say that, on the one hand, learning is associated with a change in discernment of a phenomenon's characteristics, which in turn implies a change in the learner's focal consciousness (Marton & Booth, 1997). A further point is that not everybody discerns the same things; in the same situation some will discern some aspects and others will discern others because they see, or understand, the situation or phenomenon differently. The variation experienced (by one group of people) means that we can see how the same aspect or phenomenon is understood differently, from different perspectives. The conceptions we form come from the aspects we are able to discern in a phenomenon or situation, and in what we focus on. And what we discern is what varies - the differences.

On the other hand, the most efficient way of seeing something is when a person is able to discern more fundamental or characteristic features of a certain phenomenon and is able to keep these in their focal consciousness simultaneously. Again, it is variation (or rather experiencing variation) that allows us to distinguish more critical features of the phenomenon, granting us a clearer understanding of it (Fazey & Marton, 2002).

When I speak of critical features of a phenomenon, I am referring to the dimensions of the variation, to those characteristics that are discerned and that remain in a person's focus of consciousness. They are necessary attributes of the phenomenon if a particular meaning is to appear in the learner's conscience and they are specific to each phenomenon as well as being essential for the development of the learner's understanding and of the associated skills. The presence of critical features in the consciousness often distinguishes between a person who understands a phenomenon and one who does not. Critical features can be identified empirically through interviews, tests and discourse analysis in the classroom. Teachers' experiences with the phenomenon can also be used to identify critical features.

It should be noted that there are many phenomena or situations that, depending on the context, can at any time be focused on or retained at a lower level. Being aware of these aspects does not mean that we are aware of other aspects of the phenomenon, merely that they have not been focused on and, therefore, have not been discerned (Wing Yan, 1999). The features we focus on appear in our focal consciousness (which is that which enables us to separate and consider aspects or elements from within the wider field in which they appear).

To continue with this basic idea, being good at something is having the ability to experience or understand something in a certain way. Learning can be seen as the ability to discern features or aspects of what is being learnt. It depends on students being able to discern the critical features of a concept or topic, and the relationships between those features, simultaneously (Marton & Tsui, 2004). It is also seen as a change in the way a phenomenon is experienced, and so what is needed for this to happen? Something has to vary for a change to be experienced. When certain aspects of a phenomenon vary while others do not, it is the former that is discerned (Marton and Booth, 1997).

However, for a phenomenon to be experienced in a particular way some of its characteristics must be discerned simultaneously. The more aspects, characteristics and attributes of a situation simultaneously considered, the better the results and the greater the likelihood of success.

Thus, a particular way of experiencing something has to do with a series of aspects or related dimensions of variation that are discerned and focused on simultaneously (Marton, 1999).

In short, the quantitatively different ways of experiencing something can be understood in terms of discerning critical features, of discerning them simultaneously and of the potential variation of the aspects discerned of a given phenomenon.

How can we design learning environments for effective student learning? One way is for the teacher to be aware of the learning object when preparing the classes, as well as during and after the classes.

According to the theory of variation, the learning object is a specific capacity that the students are expected to develop (Marton & Pang, 2007). There are two parts involved: a direct object – the content to be learned (the "what") – and an indirect object – what the students should be able to do with that content.

The learning object is evaluated from three perspectives: the intended (planned) object of learning, the enacted (offered) object of learning, and the lived (variation) object of learning.

The first addresses what the teachers want the students to learn and what they are able to do with the content taught in the classroom. It is the answer to the question: what is intended to be learnt? And it is described from the teacher's perspective.

The second, the enacted object of learning, is a description of how the teacher structures the class in order to achieve the learning objects and for the critical features to come to light. It is a description of what does and does not vary in the classroom. It is the answer to the questions: what are the students offered in terms of learning possibilities? And, what was one able to learn in this class? It is also known as the "variation space" or "learning space". The enacted object of learning is described from the researcher's perspective. The researcher uses recordings and classroom discourse analysis to determine what aspects of variation are present in the classroom. This object does not guarantee that learning will occur: it is merely a description of what it is that is possible to learn from the variation experienced. What is actually learned is called the lived object of learning, and is described from the perspective of the learner.

Another way of designing learning environments that favours effective student learning is for the teacher to design learning experiences based on the architecture of variation. The teacher should design experiences that help students to simultaneously discern and focus on the crucial aspects of an object of learning using variation. Marton & Booth (1997) hold that in relation to each learning object certain patterns of variation and non-variation are involved in the learning environment. By consciously varying certain critical features of the phenomenon under study while keeping others unchanged a variation space can be established which may persuade the students' focal consciousness and have an effect on the critical features, thus enabling them to experience an object of learning.

Marton & Booth (1997) also suggested paying attention to the relevant structures of learning situations. Any learning situation, or any situation in general, has a structure that is important to those experiencing it. It has critical features that indicate its aims, what is demanded and that point to where it is taking us. These are natural frameworks for learning to occur in. They are patterns the variation's dimension. Teachers need to organise learning situations in which the students can learn about new abstractions, principles, theories and explanations through events that produce a state of uncertainty. Any event should serve to present an obscure whole, a partial understanding that requires completion and challenges the student to do this.

Lastly, according to Marton & Tsui (2004, pp. 16 - 17), if we want our students to acquire these capacities, we must heed the following variation patterns:

Contrast: To experience something in itself, a further, comparative, experience is required.

Generalisation: To completely understand something people need to experience several "appearances" of it.

Separation: To experience a feature of something one needs to separate that feature from the rest and to do so while the other features remain unchanged. Of importance here is to pay attention to the critical features that comprise the object of learning.

Fusion: Situations in daily life that have only one critical feature that varies are rare. Hence, critical features are experienced simultaneously, rather than separately. In other words, it is necessary to develop the capacity to perceive different situations holistically. The conjecture is that having the capacity to see a phenomenon as a set of analytically separated elements that are simultaneously experienced would provide a more effective base for "powerful" action in any given situation.

For examples of variation patterns like separation and fusion see Åkerlind, G.S. (2008), A phenomenographical approach to developing academics' understanding of the nature of teaching and learning, *Teaching in Higher Education, Vol 13*, pp 633-644.

2.10.6. The phenomenographic research.

2.10.6.1 Data collection methods

Although various types of data can be used, the dominating method for collecting data is through an individual interview, which is carried out in a relaxed conversational manner that encourages participants to reflect on their experiences more deeply (Entwistle, 1997).

A guide is used to ensure that certain topics are covered, but there are no limitations with this method.

The personal interview is generally used on small samples (Marton & Booth, 1997). It is semi-structured and the interviewee is invited to reflect on a particular phenomenon introduced through general questions. The emphasis is on understanding the perspective of the interviewee and the interviewer's questions should be focused on achieving this. One needs to strike a delicate balance between respect for the interviewee's discourse and the right interventions on the part of the interviewer.

As Marton (1984) indicates, the personal interview seeks to capture the various ways in which the participants experience something. It is not only the words, but also the actions that are important. Since phenomenography is empirical, the researcher (interviewer) is not studying their own consciousness or reflection, but that of the subjects. The phenomenographic interview should be performed as a dialogue that favours a critical and systematic elaboration of the subject's hitherto unelaborated aspects of the experience. Both the researcher and the interviewee construct the experiences and comprehension thereof together. These experiences and comprehensions do not exist prior to the interview; they are social constructions of the moment. Yet it runs deeper in that they are an aspect of the consciousness of the interviewee that has undergone change during the course of the interview. They have gone from being irreflexive to reflexive. Hence the semi-structured nature of the interview, as this gives the interviewer leeway to deal with certain issues as they arise in greater depth, while the interviewee has more freedom to reflect on these.

The starting point may be the phenomenon itself that is in question. For example, "What do you understand by learning"? Very often more specific approaches are adopted to get the interview going, e.g. reading a text, talking about a familiar situation, or solving a problem. In studies dealing with teaching, teachers are asked about a class they are giving, the focus they are employing or perhaps why they are using certain methods. The interviewer needs to encourage the interviewee to reflect on the text, the situation or the problem and often how the latter comes to grips with it (Marton, 1981).

The interviews are recorded, transcribed and analysed to uncover the variation in the experience (Trigwell et al., 1999). First, the phenomenographers try to identify the greatest number of subjects and then they build up description categories that reflect the variation in which the teachers approach their teaching (Ramsden, 2003). The idea is to find one or more dimensions of variation. When a group of categories are related it is known as an outcome space. The relationships between categories are hierarchical and reflect the different ways in which certain phenomena are experienced (Marton & Booth, 1997).

Other methods used for collecting data include face-to-face and online educational interventions and questionnaires (Fazey, 2005; Trigwell et al., 2004; Entwistle, 2004).

2.10.6.2. A criticism of the phenomenographic interview and the analysis

According to Richardson (1999), in Marton & Booth (1997) the need to "guide the interview towards a state of meta-consciousness in order to allow the participants to express their conceptions" is emphasized. These authors claim that the interview can become quasi-therapeutic and the researcher will have to employ specific strategies to break down or get round the interviewee's defence mechanisms of negation and resistance. The interview could become a powerful psychodynamic meeting for both parties since it shares many of the features of a psychotherapy session (King, 1996)". However, according to Richarson (1999), the authors seemed to have ignored the ethical problems that arise when the interview is treated as a psychotherapeutic experience and warns that interviewees could be led towards a metaconscious state similar to that of the false memory syndrome.

A further criticism of the phenomenographic interview is made by Pozo et al. (2006), who claim that the answers given by the subjects can be interpreted as constructions that are conditioned by the demands of the situation.

Richardson (1999) also criticizes the analysis of data collected through interviews, affirming that Marton & Saljo (1984) emphasize that the description categories should be made from the comparison of the data, while in a traditional analysis of content these are defined beforehand and imposed upon the data. Marton had been inspired by the phenomenological concept of "bracketing" or of controlling any preconceived notion that might contaminate the immediate experience itself (Marton, 1986; 1988). Yet this way of analysing qualitative data from phenomenographic interviews is also found in "grounded theory". This methodology, developed by Glaser & Strauss (1967), states that theoretical understanding arises from a reiterated process based on constant sampling, comparison and an analysis of transcribed interviews or other discursive materials (Strauss & Corbin, 1990, 1994). In grounded theory researchers are encouraged to forego any preconceptions. The similarity between Marton's approach and grounded theory is alluded to in Entwistle & Ramsden (1983, p. 14) and Francis (1993). In this vein, many have criticized that in the absence of any procedural manual on phenomenographical analysis, grounded theory techniques need to be employed to analyse the transcript interviews, e.g. Laurillard (1978, pp. 65-67).

2.10.6.3. Phenomenographical analysis

Phenomenographical analysis is principally based on transcriptions of interviews in which subjects describe the phenomenon under study. The transcriptions provide the raw material to make inductive comparisons of the descriptions, which is expected to allow the description categories to be provided. If this is achieved, an independent examiner will cross-reference check them. These analyses can be very laborious, and this means that the phenomena or situations studied are frequently reduced to a minimum if one wishes to ensure they are able to obtain a set of possible descriptions (Lindblad, 1988).

A phenomenographical analysis seeks a description and an understanding of experiences (Marton, 1981). The keys lay in the variations of the perceptions of the phenomenon as experienced by the perceiver, and also in the variations in the ways the researcher experiences and describes something (Pang, 1999). Phenomenography enables the researcher to use their own experiences as information in the phenomenographical analysis (Roger Säljö, 1996; Uljens, 1996), which is a recent development of phenomenography.

Unlike other approaches, phenomenography does not seek to describe people's representations of nature and the acquisition of knowledge, but to go into how learning is experienced and interpreted. The analysis is directed towards the aspects experienced that are defined from our internal relation with the situations in the world in which we are learning. The approach centres on description and categorization (Marton & Booth, 1997).

During the interview the participants are invited to reflect on their experiences of the phenomenon from their own perspective. The interviews are then transcribed and the analysis stage begins. Here it is important that the researcher discards any preconceived ideas. Instead of judging the extent to which the responses reflect an understanding of the phenomenon or how similar the expressed views are to those of the researcher, what they must do is focus on the similarities and differences between the ways in which the phenomenon appears to the participants (Marton, 1981).

The analysis will reveal that there is more than one way of understanding the phenomenon. It is important to be aware that one is not analysing the person. The data gleaned from the transcriptions of the various interviews for analysis constitute an inseparable and extensive whole.

In accordance with Marton & Booth (1997), in order to refine the information it is necessary to discern what is relevant and what is not, i.e., to discern those points of view that really describe how the phenomenon in question is experienced. Phenomenographers insist that data extracted at this time are susceptible to later reconsideration. Phenomenographers have learned that it is usual to find more than one subject or phenomenon during the interview, so it is important that before beginning the analysis all the data are organized by phenomenon and that the analysis is then undertaken subject-by-subject or phenomenon-by-phenomenon.

The next step is to identify the various forms of understanding or experiencing the phenomenon. Two mechanisms reveal certain understanding. The first, as already mentioned, is based on similarities, i.e., when two different expressions that have the same meaning are found, thus reflecting a certain way of understanding phenomenon. And secondly, when two expressions reflect two different meanings, the two forms of understanding the phenomenon can be thematized using what is known as the contrast effect. This enables us to begin to identify and group the various ways in which the phenomenon is experienced. At this point, phrases or words used by the participants can be quoted, and so the analysis starts to be refined by extracting and accumulating data (Marton, 1981).

There are two contexts to be considered here. One is known as the "pool of meanings", which covers everything that the participants have said about a particular thing. The other is what one person says about other things. Therefore, we need to make sense of the expressions on both a collective and individual level, and this is the hermeneutic element of the phenomenographical analysis (Marton & Booth, 1997).

After grouping the relevant expressions, the focus shifts to the relationships between the groups. The aim is to establish the fundamental characteristics of each group as well as their distinguishing features. A set of categories of descriptions are created using terms that represent the variation in how a certain phenomenon is experienced, conceptualized and understood. There are logical relationships between the categories of description and, as they represent different capacities of seeing the phenomenon in question in relation to a certain criterion, a hierarchy can be established. This complicated ordering of the categories of description is known as the outcome space (Marton, 1981).

Phenomenographers say that the analysis should be interactive, i.e., every step or moment must be connectable with others (Marton & Booth, 1997). The categories of description and the outcome space are the main findings of any phenomenographical study. Once created, they can be reapplied to the data from which they originate. Thus, a judgment would be made in reach case with regards to which description category or categories may be applicable. Then, one should be able to obtain the frequency distribution of the description categories.

2.10.6.4. Reliability of the results of phenomenographical research.

According to Marton (1994), the question many researchers face is about whether another researcher can reach the same findings with the same data. The answer that phenomenographers often give is that phenomenographical analysis should be seen as a procedure of discovery rather than one of measurement. In other words, the result does not have to be repeated, but once the outcome space of a phenomenon has been revealed, it should be disseminated in such a way that other researchers can recognize cases of different forms of experiencing the phenomenon in question. Once an outcome space has been developed, another researcher should be able to judge what description categories to apply to each individual case in the material analysed. It is suggested that two independent, competent researchers should reach a "reasonable degree of agreement", i.e., they should agree on at least two thirds of the cases.

In accordance with Marton (1994), various criteria have been suggested for obtaining reliable data:

The first criterion is that the researcher must be continuously oriented towards the phenomenon being studied throughout the research process. To be oriented towards the phenomenon also means to be oriented towards the formulation of the research question. A weakness in many qualitative studies is the lack of a clear definition of the research question (Kvale, 1994). This, rather than the variation in possible interpretations of the data, often makes the presented results difficult to understand.

Secondly, the analysis and presentation of the outcomes should consist of a description of the ways of experiencing the phenomenon, not of explanations about why these experiences appear the way they do. Researchers are often tempted to use their arsenal of theories and models to explain things outside the experiences reported by the interviewees.

Thirdly, all aspects of the experiences that are observed should, at the beginning of the analysis, be seen as equally important in order to faithfully interpret the essential aspects of the interviewees' ways of experiencing the phenomenon.

Fourthly, the researcher must continually adapt different possible interpretations that appear when they read through the data until the basic structural meaning has been established.

Finally, the researcher should not only identify what the interviewees experience but also how they experience this "what". The concluding model of the descriptions should relate the interviewees' expressions of what they seem to experience to the how they seem to experience it (Neuman, 1997).

2.10.7. Phenomenography and its relationship with learning and teaching

2.10.7.1. Students' experiences of learning: Students' conceptions and approaches to learning

2.10.7.1.1. Conceptions of learning

According to phenomenography, conceptions are the set of ideas held regarding a phenomenon or situation that students or teachers use when learning or teaching. We form conceptions of all the aspects in our perceived world, and when we do so we use these abstract representations to delimit aspects of it (Pratt, 1992). We see the world through the eyes of our conceptions and these seem to determine the actions a subject takes to succeed in achieving the proposed learning goals (Säljö, 1979).

Säljö (1975) conducted a study in which students showed differences in their perceptions, and these differences (variations) came from pre-conceived ideas formed by experiences of similar situations that the students incorporated into the experiments. The study clearly revealed that behind every strategy or act there were assumptions or conceptions that determine students’ responses in similar learning situations.

Later, Säljö (1979) conducted another study based on interviews in which he asked a group of adults to say what learning meant to them. The analysis threw up five qualitatively different conceptions, to which a sixth was added later (Marton et al., 1993).

Learning was seen as:

1. An increase of knowledge. Learning is acquiring information or "knowing a lot".
2. Memorization. Learning is storing information that can be reproduced.
3. Putting data and procedures into practice. Learning is acquiring facts, skills and methods that can be retained and used as necessary.
4. Understanding meaning. Learning involves relating parts of the subject matter to each other and to the real world.
5. Interpreting and understanding reality in a different way. Learning involves comprehending the world by re-interpreting knowledge.
6. A personal change or development applied to adult students in particular (later inclusion by Marton et al., 1993)

The study showed two types of conceptions, some reproductive ones, centred on memorization (the first three points), and the other transforming ones, centred on understanding and adaptation to the context (the last three points).

2.10.7.1.2. Approaches to Learning

The learning approaches were developed by Marton & Saljo (1976, 1984, and 1997). They entail strategies adopted by students as they learn. They were analysed from a strategic angle of addressing studies and from the intention or reasons for adopting that strategy (Prosser & Millar, 1989). From the transcriptions of interviews of students performing a task the authors identified two qualitatively different approaches to learning: a surface approach and a deep approach.

Subsequent studies found a third approach, called a strategic (Ramsden 1981) or achieving approach (Biggs 1987), which has to do with motivation for competition and success oriented strategies. The achieving or strategic approach can be summarized as a very well-organized form of surface approach, in which the motivation is to achieve good marks. The exercise of learning is construed as a game, so that acquisition of technique improves performance. It works in the same way as the game of analogy: insofar as learning is not a game, it breaks down (Atherton, 2011).

These types of learning were also identified by Biggs (1987), Entwistle (1990, 1998) and Ramsden (1992) in other research studies into the approaches of studying specific tasks.

Subsequent studies such as van Rossum & Schenk (1984) and Saljö (1987) associate learning conceptions with deep and surface approaches to learning, and find that the three last, more advanced, conceptions were related to deep learning, while the less advanced approaches, the first three, were associated to surface learning. A plethora of further studies have duplicated and confirmed these findings in almost all areas of teaching and also for the case of specific learning objects such as Biggs et al. (2007), Ramsden (1992) and Trigwell & Prosser (1991).

a. Deep approach

In the deep or transformation approach the intention is to understand ideas in themselves, to find meanings and relate ideas to knowledge and previous experience. A deep approach to learning means students have an intrinsic interest in the task and an expectation to enjoy and complete them. It also implies that students are focused on the meaning of what is intended to be taught, that they relate to what they are learning using their previous knowledge and that they tend to integrate theory with practice. The strategies they adopt are to perform the task in a way that is consistent with their own experience by organizing the content into a coherent whole and by considering the task to be performed as an individual activity to improve their knowledge. They also relate and differentiate the evidence and the arguments by seeking underlying patterns and principles and relating them to the conclusions. They evaluate logic and the arguments carefully and critically, with an active interest in the course content. Students who approach learning in deep way tend to present sophisticated conceptions and positive perceptions of the context. Moreover, they are also more likely to obtain better academic results (Entwistle et al., 2002; Entwistle, 2005)

b. Surface approach

The surface or reproduction approach students see the task as an external imposition that they have to tackle. Their intention is to satisfy course requirements, study without reflecting on any strategies of purpose, see the course as unrelated piecemeal knowledge, memorize facts and procedures routinely, find difficulties in making sense of any new ideas presented to them, feel under excessive pressure and are over worried by study (Entwistle, 2005). Their motivation is pragmatic and extrinsic and their aim is to use minimum effort to satisfy demands. They adopt strategies that include focusing on the separate parts of the whole, on reproducing the essential parts as faithfully as possible, on memorizing rather than understanding, on studying without reflecting on the purpose or the strategy. A surface approach to learning means that students focus on elements outside the contents, e.g. a mathematical formula or a definition that has to be memorized for formal assessments. Hence, students associate concepts and facts routinely, without reflection, without integrating or understanding them, and perceiving the task to be an external imposition (Marton & Saljo, 2005). Students who use a surface approach to learning tend to present fragmented conceptions and negative perceptions about the learning contest. They also tend to get lower academic grades (Kreber, 2003; Lingard et al., 2009; Trigwell & Ashwin, 2006).

c. Strategic approach

In the strategic or organizational approach the aim is to achieve the highest possible grades by making a huge effort to study, finding the right conditions and materials to study, managing time and effort effectively, paying a lot of attention to requisites and criteria, and adjusting one’s study to the perceived preferences of the teachers (Entwistle, 2005).

It should be clarified that while learners can be classified as “deep”, “surface” or “strategic”, these are not personality traits. A student may use different approaches at different times, even while having a preference for one approach in particular. Furthermore the approaches correlate quite well with motivation, i.e., a deep approach correlates with intrinsic motivation and a surface approach with extrinsic motivation, although this is not something fixed. Any of these approaches can be adopted by a student for whatever motivation (Marton, 2005).

Learning is not determined by students' characteristics, but how they tackle academic activities responds to the way in which they perceive the key elements of the learning situation they find themselves in (Ramsden, 2003; Webster et al., 2009). For example, a student who perceives that the evaluation of a certain course is based on memorizing may feel the need to employ surface learning to pass the examinations set. Yet the same student could go about their learning taking a deep approach, when he perceives that the course's teaching and assessment require so. The differences between deep and surface approaches lie in the student's intentions when addressing the task (Entwistle, 2008).

Although students' learning has been studied from other perspectives, e.g., an epistemic beliefs approach (Hofer & Pintrich, 1997), learning orientations (Beaty et al., 1997) or implicit theories (Pozo et al., 2006), the phenomenographic perspective has the advantage of resulting directly from students' descriptions of their own learning, after reading an academic text on which they were expected to answer questions (Hernandez Pina et al., 2012).

Pozo et al., (2006) claim that the difference between this phenomenographic perspective and other learning conceptions is that it does not seek to describe an individual's representations of nature and the acquisition of knowledge, but to examine how a phenomenon or situation is experienced and interpreted. The analysis is directed towards the aspects experienced, which are defined from our internal relationship with the world in which we learn. It starts from the assumption that people experience phenomena in qualitatively different ways, which is why the approach is based on the description and categorization of the variations and not of the individual conceptions (Marton & Booth, 1997).

To end, the value of these findings is that they enable us to show students how to learn, how to study and to recognize themselves as learners (Rhem, 1995).

2.10.7.2 Teachers' experiences of learning and teaching: conceptions and approaches to teaching and learning

2.10.7.2.1 Conceptions of learning and teaching

Another important finding of phenomenographical research looks at the conceptions and approaches to teaching. Prosser & Trigwell, in a series of important phenomenographic research works in the 1990 such as Prosser et al. (1994), Trigwell et al., (1994), Prosser & Trigwell (1999), reported that university lecturers used a variety of conceptions of teaching and learning in their educational work. The authors identified six teaching and five learning conceptions that were qualitatively different, and each was centred on the strategies that the teachers adopted in their teachings and the intentions related to them.

The conceptions were simultaneously studied from a phenomenographic perspective by other researchers with similar, related or complementary findings, for instance, Kember (1997) found that teaching conceptions basically fall into two large groups, one centred on the teacher or the content and the other on the student or the learning. Each orientation had two associated conceptions. He also found a transitory, teacher-student interaction category, which served as a bridge between the two approaches. Two of the five categories proposed – imparting information and knowledge transmission - centre on the teacher; a third, intermediate category is the predominance of teacher-student interaction (apprenticeship); and finally there are two categories that centre on the student where the most important feature is facilitating understanding, conceptual change and intellectual development. Kember (1997) concludes, among other things, that conceptions influence teachers' approaches to teaching and in turn these influence the approaches and learning results of the students.

The teaching conceptions detected by Prosser and Trigwell in their joint research (Prosser et al., 1994; Trigwell et al., 1994 and Prosser & Trigwell, 1999) were:

- Teaching as transmitting concepts of the syllabus
- Teaching as transmitting the teacher’s knowledge
- Teaching as helping students acquire concepts of the syllabus
- Teaching as helping students acquire teacher's knowledge
- Teaching as helping students develop conceptions
- Teaching as helping students change conceptions

While the learning conceptions were:

- Learning as accumulating more information to satisfy external demands
- Learning as acquiring concepts to satisfy external demands
- Learning as acquiring concepts to satisfy internal demands
- Learning as conceptual development to satisfy internal demands
- Learning as conceptual change to satisfy internal demands

Prosser & Trigwell (1999) identified two large groups of conceptions, those that perceive teaching and learning as the transmission of information, and those that see them as a conceptual change.

The studies revealed that university lecturers who held conceptions of information transmission, with little or no attention given to the students or their understanding, also held student learning conceptions that emphasized an accumulation of information rather than developing and changing conceptions and understanding. Likewise, teachers holding more complete teaching conceptions – centred on students, teachers and context – also had a more complete understanding of learning.

2.10.7.2.2 Approaches to teaching

Teaching approaches are strategies adopted by the teacher when leading a class. They have been treated from a phenomenographical angle by various authors who find a variation in the way teachers approach their teaching and evidence that these teaching approaches are connected to their teaching conceptions. Yet it was Prosser & Trigwell (1999) who began to research teaching approaches in relation to their students' learning (Kember, 1997), employing individual interviews and follow-up questionnaires given to university lecturers in the sciences, in order to ascertain their teaching approaches and its relationship with their students' learning.

The approaches were analysed from a relational perspective, which refers to the existence of an internal relationship between the individual and the world, where the two are not independent of each other but are connected through the individual's consciousness of the world. In the case of teaching approaches, this means that there is a relationship between teachers, their students and the teaching-learning context as seen through their experiences of these situations, which in turn builds a unique situation for each one.

The researchers identified five teaching approaches each described in terms of an intention and a strategy (Trigwell et al. 1994) in which four types of intentions were combined: Transmission of information, acquisition of concepts, conceptual development and conceptual change; and three types of strategies: teacher-based, teacher-student interaction and student-based.

The approaches found were:

- A teacher-focused strategy with the intention of transmitting information to students
- A teacher-focused strategy with the intention that students acquire the concepts of the discipline
- A teacher/student interaction strategy with the intention that students acquire the concepts of the discipline
- A student-focused strategy aimed at students developing their conceptions
- A student-focused strategy aimed at students changing their conceptions

The approaches were categorized into two qualitatively different groups: Information Transmission/Teacher-Focused Approach and Conceptual Change/Student-Focused Approach.

a. Information Transmission/Teacher-Focused Approach

The Information Transmission/Teacher-Focused Approach is centred on the teacher or on the content with the intention of transmitting information or content to the students. The key issue here is the strategies and the content transmitted by the teacher. The class and the text are the main teaching means. Any prior knowledge of the student is not considered important and it is assumed that students do not need to activate this during the learning teaching process (Trigwell & Prosser, 1996). The student is more passive and the teacher more active as it is the teacher who organizes the content and transmits these to the students through more directive strategies (Biggs, 2003).

b. Conceptual Change/Student-Focused Approach

The Conceptual Change/Student-Focused Approach focuses on the students and the intention is to develop or change their learning conceptions. The approach sees teaching as a facilitator of learning (Prosser et al. 1999). The students are seen as builders of their own knowledge. Teachers cannot transmit a new vision of the world; students have to create it on their own (Trigwell et al. 1999). The emphasis lies on the learner, their learning processes and the understanding that is generated regarding course content. Besides classes and texts, activities that generate active learning actions by the students are used, such as discussions, peer reviews, fieldwork, and others (Prosser & Trigwell, 2006). When teachers focus their teaching on learning, the students tend to approach it in depth and achieve better academic results. The student becomes more aware of more aspects that make up a concept and can relate that concept to other previously learnt ideas and so achieve better results. The teacher ceases to be the centre of the teaching; the student is more active, more involved in the learning and a builder of their own knowledge (Prosser et al., 2003).

2.10.7.2.2.1 Dynamic or stable nature of teaching approaches

Researchers have offered different points of views as to whether teaching approaches are of a dynamic or stable nature. Kember and Kwan (2002) see the approaches as being relatively stable, stating that an enormous effort is required to change underlying beliefs, that the teacher is either focused on the content or on the student and that approaches are resistant to change. In contrast, Trigwell & Prosser (1996) emphasize the contextual and dynamic nature of approaches to teaching, which means that the same teacher can, depending on the context, employ features typical of student-oriented teaching and, at other times resort to teacher-centred approaches. Likewise, Samuelowicz & Bain (1992, 2001) assert that teachers change their approaches to teaching according to their perceptions of the situation.

2.10.7.2.2.2 Teaching approaches and disciplines

As to whether scientific disciplines have any effect on teaching approaches, it has been reported that teachers who taught hard disciplines, such as the physical sciences, engineering and medicine, were more likely to apply an Information Transfer/Teacher-Focused Approach (ITTF) a to teaching, whereas teachers from soft disciplines, such as social sciences and the humanities, took a more Conceptual Change/Student-Focused Approach (CCSF) to teaching (Trigwell, 2004; Lueddeke, 2003). In another study on approaches to teaching with teachers of design and physics, Trigwell (2002) found that the former were more oriented toward student-centred teaching than the latter.

2.10.7.2.2.3 Relationships between approaches to teaching and approaches to learning

Trigwell et al. (1999) and Trigwell (2004) found an association between teachers' approaches to teaching, students' learning approaches and the quality of learning outcomes. A teacher-focused approach share common features with the students' surface learning approach. Teachers using this approach conceived teaching and their students' learning in a less complete manner. A student-oriented strategy share common features with a deep learning approach. Teachers using this approach conceived teaching and learning in a more complete manner.

2.10.7.2.2.4 Relationship between approaches and conceptions in teaching

It is clear that how teaching is understood has a great effect on the teacher's activity (Fenstermacher & Soltis, 1998).

Research shows that teaching approaches are related to teachers' conceptions of teaching (Prosser & Trigwell, 1999; Vermunt & Verloop 1999). Teachers whose teaching is student-oriented also see teaching as a facilitator of students' learning, as a process of building students' knowledge and as supporting students' conceptual changes, while teachers whose teaching is teacher-oriented see teaching as information transmission.

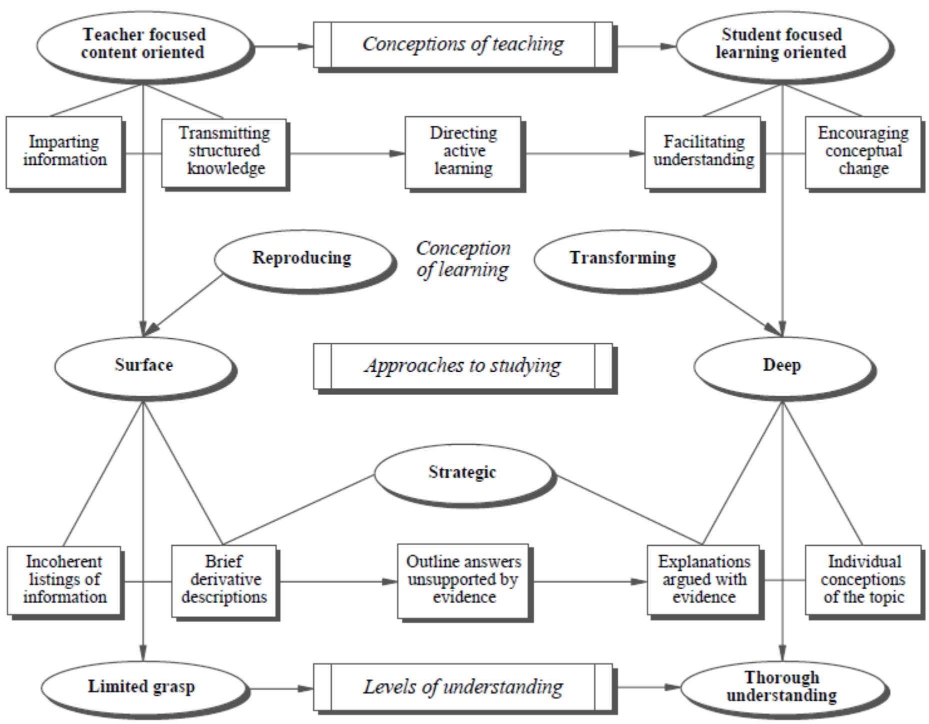
Trigwell et al. (1994) found a logical relationship between teachers' intentions and the strategies they used in the classroom. Those whose intention was to transmit information used a teacher-centred approach while those who sought development or conceptual change opted for student-centred strategies.

Elsewhere, Trigwell et al. (1999) reported that teachers with more complexes teaching conceptions adopted student-oriented teaching approaches and those with more limited teaching conceptions went for teacher–oriented approaches and information transmission.

The findings highlight that if the aim is to enhance teaching and learning qualities through academic courses for teachers the intentions associated with the teaching strategies need to be taken into consideration (Trigwell & Prosser, 1996a). Similarly, if our aim is for teachers to improve or change their teaching focus from one centred on knowledge transmission and the teacher, to one that focuses on conceptual change and learning, then solely training or gaining experience over time is not enough. Teachers need to change the way in which they conceive learning and teaching, i.e., they must change their conceptions and beliefs for more sophisticated ones that are student-oriented (Trigwell & Prosser, 1996; González, 2011).

The following Figure 5 by N. Entwistle (2000) sums up the relationship between approaches to teaching and the conceptions of learning and teaching held by teachers (Trigwell & Prosser, 1999). The figure also presents the ways in which the approaches to teaching adopted by teachers influence their student's approaches to studying and their learning outcomes.

Figure 5 Relationship between approaches to teaching and approaches to learning by Entwistle (2000)



2.10.7.2.3 Relationship between teaching approaches, conceptions and epistemic beliefs

A growing number of research papers support the connection between teaching practices, conceptions and teachers' epistemic beliefs. Pajares (1992) claimed beliefs act as a filter and play a key role in the decisions that teachers make regarding the importance they assign to knowledge. He found a relationship between teachers' beliefs and their teaching conceptions. For example, a teacher with a simplistic epistemology holds the belief that knowledge is simple, clear and specific and the ability to learn is innate and pre-established. In contrast, a teacher who advocates that knowledge is sophisticated will believe that learning is complex, uncertain and tentative and can only be achieved gradually and progressively. In the same train of thought other authors have found similar results, such as Wong (2009), who found that teachers who believe that they possess knowledge and that this does not change spend more time trying to transmit factual knowledge to their students rather than designing their teaching to kindle the desire in their students to explore the subject and to learn independently and critically. Teachers holding the belief that innate intelligence determines how much and how quickly something can be learnt will not see the necessity of helping students to develop learning and meta-cognitive skills. Also, Lawson et al. (2007), when researching into the belief systems and teaching approaches of university lecturers, found that teachers who focus their teaching on conceptual change have more sophisticated beliefs about the justification of knowledge. They also found that teachers who saw teaching as the transmission of knowledge held simpler epistemological beliefs about the certainty of knowledge, attainment of knowledge and source of knowledge. Moreover, Schraw & Olafson (2002) found that teachers with more sophisticated epistemic beliefs are more involved with their students and make more flexible decisions, while Aypay (2010) studied teachers' epistemic beliefs and their teaching and learning conceptions, and found that future teachers who hold sophisticated epistemic beliefs use objects of teaching that are congruent with those beliefs. Specifically, teachers who saw science as a developing knowledge and the learner as a seeker of answers to their own questions focused their teaching aims on helping students to learn scientific knowledge and to develop the necessary thinking skills for scientific research. Those who consider science as facts, i.e., they hold simple epistemic beliefs, put more weight on thinking skills related to science.

To summarise, research has shown that teachers hold a variety of epistemic beliefs (Hofer, 2001) and these epistemic beliefs influence their conceptions about teaching and learning (Trigwell & Prosser, 1999). In turn, these conceptions of teaching and learning have an impact on the adopted approach to teaching (Trigwell & Prosser, 1996). Therefore in order to change how teachers teach we have to change the way they conceive teaching and learning (Trigwell & Prosser, 1996).

2.10.7.3 The approaches to teaching inventory (ATI)

In an effort to monitor teachers' approach to teaching, Trigwell & Prosser (1996a, 2004) developed the Approaches to Teaching Inventory (ATI), which is employed in this thesis. The Approaches to Teaching Inventory (ATI) is one of several that has arisen from a phenomenographical perspective. Although initially it was developed to explore the relationship between students' and teachers' approaches to learning, nowadays it is being used across various teaching and learning environments. Principally, it has been used as a way of gathering information to analyse the relationships between the approaches to teaching and other elements in the context of teaching and learning. It also allows monitoring the changes of the teacher's approaches to teaching in one specific subject (Prosser & Trigwell, 2006; Gibbs & Coffey, 2004).

The ATI is designed to capture the qualitative differences of teaching approaches reported by the teacher in a specific context. There are two scales that were identified in a phenomenographical study using science teachers (Trigwell, Prosser & Taylor, 1994): the Conceptual Change/Student-Focused Approach (CCSF) and the Information Transmission/Teacher-Focused Approach (ITTF).

The CCSF scale measures the degree to which teachers adopt a student-focused strategy to help their students change their views or conceptions of the phenomenon under study. The students are seen as builders of their own knowledge and the teachers focus on what the students do in different learning situations. A student-oriented strategy is important as it is the student who assumes the responsibility for their own learning in order to build a new point of view of conception. The teacher is aware that he cannot transmit a new viewpoint or conception.

The ITTF scale measures the degree to which the teacher adopts a teacher-based strategy with the intention of transmitting information about a subject to the students. It is the teacher and the teacher's activity that is most important in this approach.

In the original questionnaire each scale contains 8 items. Answers are given on a 5-point Likert scale ranging from "rarely, if ever" to "almost always". There have been several versions of the questionnaire with a varying numbers of items, although analyses and tests reveal no statistically significant differences among them.

The questionnaire was converted into an online format using a web-server and put on a website in order to automatically gather, store and recover the information. The questionnaires were conducted in various stages. During the first stage, the 111 participants answered the two questionnaires only once. During the second stage, the stratified samples answered the two questionnaires twice, at the beginning and end of each intervention.

2.11 Information and Communication Technologies (ICTs) for facilitating learning and teaching

The idea to include ICT in this research comes from the fact that I have more than 15 years of experience working with them for educational purposes. I thought it would be interesting to explore the possibility of a change of epistemic beliefs through a short instructional online intervention. Also, I thought it would be also interesting compare two groups, one without technology and other mediated by them and see the result. This was unexpected and positive result. Initially, I designed a face-to-face intervention but I immediately came to mind to design a second one, an online intervention and see if there were changes in the outcomes. All methodological aspects of the online intervention and analysis of the results are in the Chapter of the Methodology and the Chapter of the Discussion of the Results respectively. Also, a justification for a face-to-face and online intervention is given in the Introduction Chapter. I want to say that a big number of authors support the belief about the role and effectiveness of virtual environments in the teacher formation process and in the encouragement of fostering new teaching and learning models and approaches. Virtual environments when used adequately result in helpful and positive strategies for the development of learning environments. Laurillard (2013) asserts that digital environments can help and the environments allow teachers to share their ideas within a professional community. Salinas (2004) has reported the benefits of technology information and communication in teachers' training and in fostering new learning and teaching methods and approaches. Moreover, Castañeda & Adell (2011) declare that professional teacher development processes have benefit through the use of information technology and communication. These authors believe that the creation and administration of virtual learning environments have expanded the process of professional development as well as the interaction and communication between colleagues.

On the other hand, the change in the epistemic beliefs and the approaches to teaching as a result of an intervention facilitated by online learning environments is supported by the work a several researchers. For instance, Smith (2010), in a phenomenographic investigation, found out that collaborative learning environments online presented epistemic challenges for the adult graduate participants (doctoral and masters students) and promoted the use of new strategies, such as the trust in themselves, in their peers and in their teachers that is needed to reach a deeper learning and adopt a student-centred teaching method in the student. Marra (2002) suggested that effective online learning environments can encourage epistemic development and Kienhues et al., 2008 found the possibility of changing domain-specific epistemic beliefs through a short-term online intervention. For these reasons I included the Information and Communication Technologies in this study.

CHAPTER THREE

RESEARCH METHODOLOGY

Introduction

Hitherto, Chapter One set the scene of this research. Chapter Two established the conceptual underpinnings and identified several research questions. The literature review examined the constructs of epistemic beliefs and approaches to teaching and the relationship with teaching and learning processes in a higher education context. Epistemic beliefs and approaches to teaching have been studied mainly from the perspective of the student. There has been limited research into in-service university teachers and even more limited are those that use the epistemic beliefs model (Hofer, 2004) and approaches to teaching model (Trigwell & Prosser, 1996a, 2004). There are still many unanswered questions. I do not know exactly how beliefs work in those teachers or in what way gender, the number of years of experience or social context influence this group of people. It is still unclear whether short-term changes after an intervention will be maintained over time. I used a mixed methods research design in line with the aims of research. Qualitative and quantitative methods were used to gain an insight into the epistemic beliefs and approaches to teaching of in-service university teachers. Teachers enrolled in this thesis belong to distinct academic programmes at Universidad del Norte, Colombia, South America. Only part-time, full time and associate in-service teachers were included. Pre-service teachers were not included in the sample. This chapter provides a detailed description and analysis of how this study was carried out, the methods used to achieve the objectives and the data collection. The full description of research objectives, research approach, style of research, participants, ethical issues, instruments, design and procedure are also provided.

3. Hypothesis of the research

My hypothesis is that teachers hold a variety of epistemic beliefs (Hofer, 2001). At the same time, they experience the various teaching and learning situations in a certain way (Marthon & Booth, 1997). These beliefs and these experiences influence their conceptions about teaching and learning (Trigwell & Prosser, 1999). These conceptions of teaching and learning, in turn, have an impact on the approach the adopt to teaching (Trigwell & Prosser, 1996). Therefore, in order to change the way they conceive teaching and learning (Trigwell, 1995; Trigwell & Prosser, 1996), and to consequently change how teachers teach, we have to first understand how they conceive teaching and learning and then we have to understand the way in which they experience those things.

3.1. Research objectives

The general objective is to establish whether a relationship exists between epistemic beliefs about teaching and learning, and approaches to teaching, in lectures at the Universidad del Norte in Colombia in order to support changes in teaching that encourage students to adopt a deeper approach to understanding their subjects. By the end of the research I expect to:

1. Establish a relationship between the lecturers' epistemic beliefs and their approaches to teaching.
2. Develop, through peer-collaboration methodology, a shared understanding of learning, teaching and information and communication technology that will lead to changes in epistemic beliefs, and;
3. Confirm whether changes in epistemic beliefs lead to changes in approaches to teaching.

3.2. Research approach

Studying social science is complex. This complexity is because of its subject, namely the behaviour of individuals and social groups within educational settings. Given the wide range of possible behaviours it is impossible to pretend that there is one single theory or approach that addresses all the issues and problems facing education.

Therefore researchers make use of different approaches and methodologies to study various topics such as learning, teaching, motivation, development or beliefs. As Beltran (1995) stated "there is no single paradigm in the social sciences. But this is not a developmental disability or a preparadigmatic state, as Kuhn thought. The presence, in the social sciences, of competitive schools of thought is a natural and quite mature state."

In this context, in the scientific community there is an epistemological debate about which approach is most used and which offers better and more reliable results for educational research. Some researchers claim that quantitative methodology is the most widely used, while others deem that it is qualitative research.

Those who use the quantitative approach for research in education say that in the use of more objective techniques more reliable and durable data are offered, which is the only way to develop useful theories (Gardner & Galanouli, 2004).

Moreover, proponents of qualitative methodology argue that there are several ways to study a phenomenon and that most of these are too complex to be reproduced in a laboratory, so it is necessary to study them in a natural context. As an example I mention the complex process of teaching and learning, seen as a psychosocial phenomenon. Here, the student's behaviour occurs within a particular educational context, one that is more complex due to the influence of individual differences. The result of this complexity is that each student has their own decision-making processes and different interpretations of each situation that may occur.

It is an interesting debate. Personally I share Gardner & Galanouli's view (2004, Pg 155) that "methods must be chosen that are 'fit for the purpose', that is, methods that are judged 'fit' by the process of careful analysis of the research objectives. Therefore, the final research design may be quantitative or qualitative or, perhaps more common today, a judicious combination of both".

Therefore, the approach I use for this research will be primarily qualitative but carefully combined with quantitative techniques. This research will include the following data collection techniques: questionnaires, interviews, informal discussions, keeping records, online and face-to-face focus groups and graphical representation. In this way I hope to take advantage of the best features of both methodologies.

3.3. Style of research

The style of this research is correlational. I am interested in exploring the relationship between epistemic beliefs about teaching and learning and their teaching approaches of a group of lecturers in Barranquilla, Colombia. As I explain in the sections on instruments, I aim to explore and understand the experience of teaching and learning in a group of academics through the relationship between epistemic beliefs and teaching approaches. The purpose of this study is not to find cause-effect relationships; this study is correlational. As Hammond (2011) asserts, beliefs are not predictive of behaviour but they do help explain the framework in which judgments about teaching and learning are made.

The five variables that we are going to measure and correlate are:

- Epistemic beliefs about certainty of knowledge
- Epistemic beliefs about justification for knowing: Personal
- Epistemic beliefs about source of knowledge: Authority
- Approach to teaching: Information Transfer/Teacher-Focused Approach (ITTF)
- Approach to teaching: Conceptual Change/Student-Focused Approach (CCSF)

I will make two types of measurements, one previous to and one following a face-to-face intervention and one previous to and one following an online intervention.

3.4. Participants

111 lecturers across different academic programmes including Engineering, Psychology, Education, Business Administration, Economy, Medicine, Nurse, Law, Languages, Social Communication and Journalism at the Universidad del Norte in Barranquilla, Colombia participated in the study. A random selection was carried out from the total population of full-time, part-time and visiting lecturers at the Universidad del Norte. Only lecturers with administrative duties, such as Deans, Heads of the Departments and Program Coordinators were excluded.

The gender breakdown of participants in the sample is 68 men (61%) and 43 women (39%). The age group ranged from 25 to 60 years old, and the number of years of experience ranged from 1 to 40, with a mean of ($M = 13.88$; $SD = 9.291$).

Academic programmes were grouped into 5 main areas:

1. Humanities: History, Art, Literature, Philosophy, and Languages.
2. Social Sciences: Education, Psychology, Journalism, Economy, Law, Business Administration, Accounting, Finance, and Marketing.
3. Health Sciences: Medicine, Nursing.
4. Basic Sciences: Physics, Maths, Chemistry, Biology, and Statistics.
5. Engineering.

The number and percentage of lecturers by discipline is:

Humanities	19 lecturers	17%
Social Sciences	43 lecturers	39%
Health Sciences	11 lecturers	10%
Basic Sciences	12 lecturers	11%
Engineering	26 lecturers	23%

From the 111 participants I selected a sample where half of them held more naive beliefs and the other half held more sophisticated beliefs. I divided them into two stratified samples. Participants were randomly assigned to one of the two groups. One sample was invited to take part in a face-to-face educational intervention and the other in an educational intervention using the Internet. Eight lecturers completed the face-to-face interventions and 11 lecturers participated in the online intervention, both using a modified 'marshes' methodology.

The characteristics of the group that completed the face-to-face intervention were: 10 to 35 years of experience teaching at a university level. They were aged between 30 and 50 years old. Four were women and four were men. Three lecturers belonged to the School of Humanities, one to the School of Health Sciences, three to the School of Social Sciences and one to the School of Basic Sciences. Three lecturers work full-time (FT), three part time (PT) and two were visiting lecturers at the University.

The characteristics of the group that completed the online intervention were: 5 to 32 years of university teaching experience. Their ages ranged between 25 and 60 years old, four were women and seven were men. Five lecturers belong to the School of Engineering, one to the School of Health Sciences and five to the School of Social Sciences. Eight lecturers work full time (FT) and three as visiting lecturers at the University.

3.5. Ethical issues

The awareness of ethical concerns in this research is reflected not only in procedural ethics: research participants, methods of data collection, type of data collected or what is to be done with the data, but also across each stage of this study. To be aware of the impact that the study can have on the participants, and behave in a manner so that their rights and their dignity are preserved, is what Cohen et al, (2007) calls "ethical behaviour". It is worth mentioning that although this study was undertaken outside the UK and the participants are from a Latin-American country, it is a doctoral degree in the UK. So, I followed the ethical guidelines for educational research in the United Kingdom and the research ethics guidelines of Bangor University. The Colombian legislative requirements for educational research were also taken into account.

3.5.1. Ethical Procedures and Informed Consent

In order to ensure the epistemological and methodological rigor of a research study, it is necessary to make clear from the beginning what is the position, the motivation and the interest of the researcher in relation to the study (Burgess, 1989). To be protected against the ethical issues that may occur during this study, it was important to be transparent, and not hide the purpose of the study at any time (Reynolds, 1979). During the planning stage of the project, I wrote a letter (Appendix one) addressed to the Heads of the university clearly explaining the study's intention and asking for permission and their necessary collaboration to carry the study out.

I gave all participants informed consent (Appendix two) before data collection. According to Diener and Crandall (1978) the informed consent is *"the procedures in which individuals choose whether to participate in an investigation after being informed of facts that would be likely to influence their decisions".* In this document, participants were fully informed of the purpose of the research, the field of study and the objectives to be achieved. They were also informed, in both the Informed Consent and verbally at the beginning of the interventions, of the cost/benefits (Frankfort-Nachmias and Nachmias, 1992) that participation in the study could give them. The costs involved included the feeling of losing time, feeling judged by their beliefs, that their beliefs may be subject to public scrutiny and of perhaps a little embarrassment when faced with unfamiliar situations. Moreover, I explained to them the social benefits resulting from the findings and the feelings of satisfaction at having contributed to education and science. Special considerations (Burgess, 1989) were not needed as all participants were of age, with adequate powers of reasoning and without any intellectual disability. They were informed that participation in the research was voluntary. I guaranteed the anonymity and confidentiality of data collected. I followed the recommendation made by Frankfort-Nachmias & Nachmias (1992) that to ensure anonymity and confidentiality it is better to codify and number the name of the participants. As Raffe et al., (1989) also suggest, the entire participant's information is saved on a spreadsheet and there are only two copies stored on two computers, both protected by password. After this study has been finalised this information will be deleted. Finally, as Simons and Usher (2000) suggest, the intervention participants were asked for additional authorization (Appendix three) for permission to take photos and for recordings to be made of the meetings for educational purpose.

3.5.2. Problems and dilemmas confronting the researcher: Researcher Bias

As Cohen et al., (2007) assert, the ethical aspects not only deal with procedural ethics but must also be considered as a principle. Cavan (1977, p.810) also defines ethics as "a *matter of principled sensitivity to the rights of others, and that 'while truth is good, respect for human dignity is better".* Therefore it is important to reflect on the figure of the researcher and how their background or emotions may influence or bias a research study. That the subjects of this study were also colleagues addresses questions related to researcher bias that requires reflection.

In all research, the validity and accuracy of the results may be influenced by error, which can result from random variation (random) or a systematic deviation of the results (bias) (Burgess, 1989). Lansing et al. (1961) define bias as "a systematic or persistent tendency to make errors in the same direction, that is, to overstate or understate the ‘‘true value’’ of an attribute”. Hammersley and Gomm (1997) define it as a “systematic error”. It can be said that the research bias is an error that occurs when the researcher influences the results in order to validate it. When a study is conducted, especially if it is qualitative, biases naturally occur in the research design, they are inevitable, but its impact can be minimized to recognize and deal with them. The aim is for an impartial study that respects the dignity of the participants, to observe the fundamental principles of ethics and take all variables into consideration (Cohen et al., 2007).

The researcher can be biased throughout the research process. Some errors arise in the design, others because researchers select populations that have more probabilities of producing positive results. Bias makes qualitative research depend much more on the experience and personal opinion than quantitative research, as it requires sticking to a certain point of view or jeopardizing the impartiality of the research. Positivist researchers suggest that their quantitative research studies are more reliable than qualitative studies, as they always seek to eradicate any bias in their research designs. What it should always keep in mind about bias is that it is inevitable in many disciplines. As this study is a combination of qualitative and quantitative research techniques, what I did was to trying to minimize the bias as much as possible. To conduct research with transparency and honesty (Cohen et al. 2007) means accepting the existence of bias, recognizing biases to remove them from the design phase and control it during the analysis, be clear what will happen during each stage, seek to understand the inherent biases, and aim for its effects to be reduced as much as possible.

3.5.2.1 Minimizing researcher bias

The issue of bias is a complex problem. To minimize researcher bias, multiple evidence must be collected with different procedures. During the data collection and analysis of quantitative data of this study, research bias was minimized by using statistical methods of data reduction with objective techniques to add rigor to the process of making decisions that had to be made, as the data was driven and evidence-based. I used factor analysis that is a very effective method for the detection of bias (Oort, 1992). To extract the number of factors I used the confirmatory factor analysis (CFA), which is much more procedurally rigid.

Moreover, to minimize researcher bias as the result of being a colleague of the participants I used informed consent (Reynolds, 1979). This document sets out the foundations of an “implicit contractual relationship between the researcher and the researched” (Cohen et al., 2007), and establishes the foundations on which subsequent ethical considerations can be structured. Moreover, the fact that the researcher and the subjects maintain a relation of equals allowed a more in-depth acknowledgment and understanding of the topics as well as greatly reducing the perception of superiority or power that can mistakenly create an idea of being in a position of researcher vs. participants. This peer relationship also allows a positive approach to being close partners, and not a distant subject, which should be avoided. In this type of research this aspect can be seen as more of a value, than as a bias to be eliminated. What I mean is that it is vitally important that subjects are willing participants in the study and do not feel compelled or induced to participate through false relations. Moreover, the knowledge and experience of the researcher on the field of study can be seen as an asset, although the impact and analysis of data should be carefully considered and reflected upon as it is, of course, open to bias (Cohen et al., 2007).

To minimize researcher bias during interviews I made sure to ask the right questions in both interviews and on questionnaires. The questionnaires were translated into Spanish by professional translators and then piloted. A team of fellow researchers verified its reliability. For the interviews I used open-ended questions on the subjects in order to gain a better perspective of the research topic and be less prone to ignore the choices that can be important for the participants. Also, helping to minimize errors in the interview meant being clear about the variables from the beginning, and defining them operationally. The ethical aspects of the interviews are described widely the section on phenomenography.

To control selection bias I used randomization. The random assignment of participants allows them to remain balanced by randomness. To avoid choosing unsuitable subject is important to define the requirements of the participants in the planning stage.

In summary, ethical concerns in this research study is reflected not only in procedural ethics but also across each stage of this study. In the informed consent all research participants were guaranteed confidentiality and anonymity. I tried to minimize the maximum bias. Statistical methods of data reduction with objective techniques provided rigor and validity to the decision making process. Ethical behaviour is guaranteed throughout research.

3.6. Instruments

In this study I have used several instruments to collect data: two validated questionnaires, digitally-recorded interviews, online and face-to-face focus groups, graphical representations and record keeping.

I was aware of the limitations when questionnaires or other multiple-choice-type inventories are used as methods to gather data about teacher conceptions and beliefs. They are constraining methods. Also, some researchers consider that these do not validly represent teachers' beliefs (Richardson, 1996, p. 107) and that they may also fall prey to self-fulfilling prophecies (Kane, Sandretto & Heath, 2002). Often no category exactly defines what people have in mind, it does not always capture what is going on in the subject's mind, we can not be certain whether the participants are telling the truth, whether they deliberately falsify their answers (Cohen et al., 2000) or whether their responses are espoused theories of action or theories in use (Argyris et al., 1985; Argyris, 1993).

For this reason, I have used multiple instruments because this leads to a better understanding of the issue under investigation and helps to obtain more reliable results (Cohen et al., 2000). Besides, the use of multiple data sources and research methods, allows the researcher to view the focus of inquiry from several vantage points, which has been called "the heart of qualitative research's validity" (Davidson & Tolich, 1999, p. 34). In addition, my thesis is designed to encourage new studies that may include, for example, this type of relationship. My goal is to study the teaching and learning experience of the teacher and not their observed behaviour.

3.6.1 Two Questionnaires

As a way of measuring two types of views on teaching (Trigwell et al., 1994) and the lecturer's personal beliefs (Hofer, 2000), and because it is a very useful tool for gathering information (Wilson & McLean, 1994), I used the Approaches to Teaching Inventory 22 (ATI 22) (Appendix four) developed by Prosser and Trigwell (1999b) and the Beliefs about Teaching and Learning in your Discipline Questionnaire (DEBQ) (Appendix five) developed by Hofer (2000).

The two questionnaires were translated into Spanish by expert translators and converted into an online format. Then, using the Universidad del Norte web-server, it was uploaded to a webpage in order to automatically gather, store and recover the information. The questionnaires were used during several stages. During the first stage, the 111 participants answered the two questionnaires, just once. During the second stage, the stratified samples selected answered the two questionnaires twice, at the beginning and end of each intervention.

3.6.1.1 Approaches to Teaching Inventory (ATI)

The Approaches to Teaching Inventory (ATI) is one of several that are derived from the phenomenographic perspective. Although initially developed to explore the relationship between the students' approaches to learning, and the teachers' approaches to teaching, nowadays it is being used across different teaching and learning environments. Principally, it has been used as a way of gathering information to analyse the relationships between the approaches to teaching and other elements of the teaching and learning contexts. It also allows monitoring of the changes of the teacher's approaches to teaching in one specific subject (Trigwell, Prosser & Taylor 1994; Trigwell & Prosser, 1996b; Prosser & Trigwell, 1999; Trigwell et al., 2004; Prosser & Trigwell, 2006; Gibbs & Coffey, 2004).

The ATI is an instrument designed to capture the qualitative differences in approaches to teaching reported by the teacher in a particular context. It has two scales that were identified in a phenomenographic study with science teachers (Trigwell, Prosser & Taylor, 1994): Conceptual Change/Student-Focused Approach (CCSF) and Information Transmission/Teacher-Focused Approach (ITTF).

The CCSF scale measures the degree to which teachers adopt a student-centred strategy to help students change their views or conceptions of the phenomenon they are studying. Students are seen as constructors of their own knowledge, and teachers focus on what students do in different learning situations. A student-centred strategy is important because it is the students who take responsibility for their own learning in constructing a new point of view or conception. The teacher understands that they cannot transmit a new perspective or conception.

The ITTF scale measures the degree to which the teacher adopts a teacher-focused strategy with the intention of transmitting information to students' about a discipline. It is the teacher themselves, and their tasks that are the most important thing in this approach.

In the original questionnaire, each scale contains 8 items. Responses range on a 5-point Likert scale (1 = rarely, if ever, 5 = almost always). There have been several versions of this questionnaire in which the number of items have changed; however, the tests do not show statistically significant differences between the various questionnaires.

Although the Approaches to Teaching Inventory (ATI) is widely recognized as a research tool (Gibbs & Coffey 2004), it has been criticized by Meyer & Eley (2006) not only with respect to the way in which the questionnaire was developed, but also with regards to the dimensionality posited. According to them, the ATI is considered conceptually limited in providing a comprehensive picture of the variation in approach to teaching on the part of teachers. The ATI has been criticized first in terms of its empirical dimensionality, and then for the procedures employed during its development. The first 'conceptual change' factor is considered unambiguous in terms of the associated intention and strategy items. Three of the items in the second 'information transmission' factor also exhibit weak loadings.

In response to the above, Trigwell & Prosser (2004) analysed the validity of the ATI (the original 16-item version) based on data from 650 respondents spread over 10 studies. The results of other studies (Gibbs and Coffey 2004; Trigwell et al. 1998, 1999) also confirm that the ATI can be used to examine the relationship between the approach to teaching and students' learning. The nature of the relationship is similar in all four studies: a student-oriented approach on the part of the teacher aimed at conceptual change shows a positive correlation with an in-depth approach to studying on the part of the students. A teacher-oriented approach, aimed at information transmission, however, exhibits a positive correlation with a surface approach to studying on the part of students. They conclude that these results provide further support for the validity of the ATI.

As part of a research study into the relationship between the approach to teaching, context and teacher characteristics, Stes et al. (2008) also developed a Dutch version of the ATI. The authors conclude that their research supports the reliability and validity of the current Dutch version of the ATI. Consequently, the instrument can be used in educational research or practice to obtain insights into the teaching approach of teachers. Further research into the differences in the structure of the ATI when used in different cultures would be valuable.

Trigwell (2002) reports the results of a pilot study on the variation in approaches to teaching of teachers of design. It contains a comparison between the literature reports of qualitative descriptions of teaching design and the variation obtained using a quantitative method (the Approaches to Teaching Inventory). The quantitative approach revealed that, as in other teaching contexts, there is significant variation in descriptions of how teaching the subject of design is approached, but that, overall, the approaches adopted by teachers of design are described as being more student-focused than in most other areas of higher-education teaching. The results also suggest that when design teachers describe their approaches as more student-focused they are more likely to say that they learn more during the teaching of their subjects and are more likely to give students the opportunity to explore their own creative ideas. The Approaches to Teaching Inventory was found to be a useful indicator of qualitative variation in teaching approaches in creative fields such as design.

I have used a version of the questionnaire adapted by Clancy & Fazey (2006). It was translated from English and was then piloted with teachers at an important university in Barranquilla, Colombia, before being used with the sample population. The version of the ATI used in this project has 2 scales: Information Transmission/Teacher-Focused Approach and Conceptual Change/Student-Focused Approach and it has 11 items on each scale. The two scales contain two sub-scales - intention and strategy – with one intention and strategy item from each scale.

3.6.1.2 Discipline-Focused Epistemic Beliefs Questionnaire (DEBQ)

The second questionnaire was the Discipline-Focused Epistemic Beliefs Questionnaire (DEBQ) by Hofer (2000) which was made up of questions adapted from questionnaires like the Checklist of Educational Values by William Perry and the Epistemological Beliefs Questionnaire by Marlene Schommer. The reason for this was that none of the instruments mentioned measured all four of the dimensions proposed by Hofer & Pintrich (1997). Thus, the authors developed a new questionnaire based on the previous one that could measure these, as well as the disciplinary differences between them.

According to a review by Hofer & Pintrich (1997) some new items from the four dimensions were added to the questionnaire. The original questionnaire was conducted by a group of expert researchers on this issue. Subsequently, three psychologists reviewed the content validity, the relevance of the items and the wording of the questions. The respondent chooses a subject area as a reference in order to be able to answer (Hofer, 2006a; Tolhurst, 2004; Hofer, 2001; Hofer, 2000; Hofer & Pintrich, 1997). The original instrument consists of four scales and a total of 27 items on a 5-point Likert scale (1=strongly disagree; 5=strongly agree). Individual items were rated on a 1–5 Likert-type scale; high scores indicate agreement with less sophisticated beliefs.

The scales or dimensions proposed by Hofer (2000) are:

1. Certainty/ Simplicity of knowledge
2. Justification of knowing: Personal
3. Source of knowledge: Authority.
4. Perceived attainability of truth

According to Hofer (2000) the certainty of knowledge and simplicity of knowledge did not emerge as separate factors in the factoring of the DEBQ, as suggested by the literature. Items that had been hypothesized for both dimensions were loaded on one factor, labelled certain/simple knowledge. This finding is similar to the results reported by Qian & Alvermann (1995) in their use of the domain-general epistemological beliefs questionnaire.

Hofer (2000) also reports that for the justification for the knowing: personal dimension emerged as a combination of distinct aspects from the original justification for knowing and source of knowledge dimension. However, it does not represent the breadth of the dimensions as hypothesized; thus, they have been named accordingly. ‘‘Justification for knowing: personal’’ represents the view that knowing is justified by individual opinion or firsthand experience. Hofer (2000) asserts that this factor does not contain items related to the evaluation of evidence, reason, or assessment of expert opinion, which would also be considered aspects of justification for knowing among existing models; these items did not factor in any meaningful way. The dimension ‘‘source of knowledge: authority’’ relates specifically to expert knowledge, texts, and other external authorities as the source of knowledge. However, this factor did not contain those items related to individual construction of meaning, identified by most theorists as an aspect of the source of knowledge, but which did not factor in a meaningful way in this study.

These scales or dimensions are grouped into two broad areas (Hofer, 2001):

1. The nature of knowledge, which refers to what one believes that knowledge is. This is seen as an understanding that increases and moves from an absolutist knowledge point of view to a constructivist and contextual one. This includes the dimensions Certainty of Knowledge and Simplicity of Knowledge.

2. The nature or process of knowing, which refers to how the individual comes to know and understand aspects such as the evaluation of evidence, the role of authority and the process of justification. This includes the dimensions: Source of Knowledge and Justification for Knowing. A complete description of the main features of these dimensions is found in the literature review. An adapted version of three factors from the DEBQ was used in this research with the online sample.

Three factors remained after my factor analysis:

Factor 1: Certainty/Simplicity of Knowledge (seven items: 2, 4,5,7,9, 18, 24)
Factor 2: Justification for Knowing: Personal (five items: 12, 15, 21, 22, 23)
Factor 3: Source of Knowledge: Authority (two items: 25, 26)

This tool also has been tested in learning contexts with students in the classroom (Hofer, 2004), as well as teachers in higher educational contexts (Clancy, Fazey & Lawson, 2007; Clancy & Fazey, 2008). This thesis is based mainly on the model of epistemic beliefs according to B. Hofer (2006, 2004, 2001, 2000) and Hofer & Pintrich (1997).

3.6.2 Digital-Recording Interviews.

The interviews were semi-structured. The intention was to deepen aspects extracted from the responses given by the lecturers in their questionnaires.

The interviews were recorded, transcribed and analysed to reveal the variation in experience (Trigwell et al., 1999). To accomplish this, I first identified as many issues as possible, and then developed categories of description to reflect the variation in which teachers approach their teaching (Ramsden, 2003). I tried to find one or more dimensions of variation. A group of interrelated categories are called the outcome space. The relationship between the categories is hierarchical and reflects the different ways in which certain phenomena are experienced (Marton & Booth, 1997). During the interview, the research participants were invited to reflect on their experiences of the phenomena in question. I focused on the similarities and differences in the ways in which the phenomenon appeared to the participants.

The questions for the interview were divided in three main subjects. The first was on beliefs about knowledge and knowing. An example of the type of question addressed in this subject was: sometimes people talk about 'searching for truth' in a discipline. What is your view? Another example of the questions included was: how do you know when you know something? How do you confirm your knowing? The second set of questions was on beliefs about learning and teaching in their discipline. Example of the types of questions in this subject was: what is learning? What is understanding? How do you prefer to go about learning new material? How do you know when you have learnt something? The final set of questions addressed information and communication technology in education. Participants were asked: how can they help in the learning of students?

3.6.3 Face-to-Face and online focus groups

The main idea was to focus discussions on a particular issue. The format was semi-structured. The lecturers were asked about their attitude toward different aspects of teaching and learning and how knowledge is constructed. Questions were asked in an interactive group where participants were free to talk with other lecturers. Two groups were chosen from the population. One group participated in a face-to-face focus group and the other in an online focus group. In the corresponding Design and Procedure section we explain this instrument.

3.7. Design and procedure

To access the knowledge and experience of the lectures about teaching and learning I considered it appropriate, besides administering the questionnaires, to design an intervention, which was divided into four phases (see Diagram 1). This intervention was inspired by an experimental methodology called the Marshes Approach which was intended to be used as a way of exploring the understanding of experience in a complex issue such as those expressed by individuals and groups (Fazey et al., 2005).

3.7.1 The original methodology "The Marshes Approach"

"The Marshes Approach" was originally applied to develop an understanding of environmental issues, and first used on a dynamically complex wetland system to attempt to generate ecologically valid insights into serious and immediate environmental and social problems, as well as to provide a means for gathering perspectives on an issue as it is understood by a particular group. From an environmental point of view, the informants were not necessarily educated academic individuals, but people who due to their long-term experience or variety of experience could be labelled to be experts. Similar to a Delphi study, it comprises multiple investigative techniques that are employed in a progressive phase over a given period of time. By using multiple techniques participant learning is enhanced within the study group by exposing them to the understanding of others and by seeing issues from different perspectives. As with a Delphi study a process of verification involving the informants is employed at each level to ensure that the investigators' interpretation of the informant's understanding is correct. The approach involves, in the first phase, a series of interviews with the informants and in the later phases the informants are brought together in a workshop setting, which leads to two phases of interpretation overall. A final workshop is arranged to present the informant's overall understanding and interpretations in a causal loop diagram. In summary, the methodology involves research carried out in a series of structured phases using techniques with the, intention to elicit a whole group understanding which will effectively be greater than the sum of the parts of the individuals' understanding of an issue.

3.7.2 The modified methodology

In this research I used a modified version of the Marshes Approach. My scheme comprised several research techniques based on a phenomenographic approach to identify an understanding of teaching and learning. My methodology also involved the completion of a series of stages by participants in order to develop a shared group understanding of a complex issue. Below, I will explain the steps followed.

3.7.2.1 Pilot test

First, I carried out a pilot test to try out the functionality of the actual questionnaires, the items, the instructions and the analysis of the data, and to test the viability of the methodology. The test was carried out with 12 volunteer lecturers at the Universidad del Norte in Colombia. The age range was between 30 and 50 years. The number of years of university teaching experience ranged from 5 to 25 years. They would not form part of the real sample of the study. I identified some problems related to the web-based questionnaire's appearance, formatting, and also some technical problems. Besides this, I received feedback from the volunteers about the questionnaire's wording. Changes were made to increase the reliability, validity and practicability of the questionnaire (Oppenheim, 1992; Morrison, 1993; Wilson & McLean, 1994:47) to eliminate ambiguities and difficulties in wording (Cohen et al., 2000).

3.7.2.2 First phase

As seen in Diagram 1, the first phase was to select the population of lecturers that would participate in the study. Lecturers at Universidad del Norte in Colombia were selected at random and received a formal letter sent by email requesting their participation in the study. They were informed that participation was purely voluntary and given information about the confidentiality of their responses. The lecturers who were interested gave their consent by email. A second email enclosing the technical instructions to access the test online was then sent. The lecturers had to complete two questionnaires: The Approaches to

Teaching Inventory (ATI), and the Discipline-Focused Epistemic Beliefs Questionnaire (DEBQ). 111 lecturers completed and returned both questionnaires.

3.7.2.3 Second stage

During the second stage I selected a stratified sample from the total number of lecturers who completed the two tests. I carried out two interventions on this stratified sample. The sample was divided into two groups, with whom I performed a face-to-face and an online intervention.

a. Face-to-face intervention

I designed a face-to-face intervention to explore the understanding of complex subjects like learning, teaching and the use of information technology in the teaching and learning of a group of lecturers at the Universidad del Norte, and to also develop a shared understanding of knowledge in teaching and learning and to provoke a change of attitude in approaches to the teaching and epistemic beliefs of a group of teachers at the Universidad del Norte in Barranquilla, Colombia. It consisted of an individual semi-structured interview to obtain more information prior to a focus group discussion. Each participant was interviewed about their personal epistemology, and the common success factors that contribute towards individual interpretation and understanding of learning situations were identified. They also completed the same two tests, the ATI and the DEBQ, at the beginning and at the end of the face-to-face intervention.

After the interview and completion of the questionnaires, lecturers participated in a focus group discussion in which they had the opportunity to give their opinions and also listen to the opinions of other lecturers, which allowed an understanding or “appreciation” of the topics from different perspectives. Participants entered into discussions that were aimed at eliciting their implicit knowledge, the knowledge that represents their conceptual understanding of certain issues or objects of learning. By actively participating in discussions, participants are exposed to others' understandings, which represent variations in ways of understanding particular issues. Participants take on other perspectives and are able to discern further aspects of the object of learning or issue which were previously unknown to them.

Within the focus group discussion, participants were divided into smaller groups and asked to prepare schemes to represent their opinions. A moderator facilitated the work and group discussions, retaining a neutral position at all times. The focus group was developed in a real space without the help of technology.

b. Online intervention

An online intervention was designed to test the efficacy of a virtual collaboration model between peers to develop a shared understanding of knowledge in teaching and learning and to provoke a change of attitude in the approaches to teaching and epistemic beliefs of a group of teachers in the University in Barranquilla, Colombia. The purpose of creating a virtual learning community was to elicit implicit knowledge to illustrate the representation of the lecturers' conceptual understanding of complex issues, which can be integrated with knowledge from other lecturers to produce a collective group understanding, which is greater than the sum of the parts of individual understandings.

The results were compared with the results of the face-to-face intervention. This collaborative model was developed in a virtual environment with synchronic and asynchronic interactions. In comparison, the face-to-face collaborative model was developed in a real room without use of electronic technological resources. The digital resources that I used for the online intervention were: Electronic mails, chats, forums and videoconferences to asynchronous or synchronous discussions and concept map tools. The reason for the selection of these resources were that they allow greater interaction with academics, they are widely used across the academic world and almost all the lecturers at the target institution are highly familiar with their use.

3.7.2.4 Third stage

During the third stage I produced a graphical representation. Feedback from interviews and focus group discussions were presented in a graphical format representing the key elements and concepts identified by all participants and their critical relationships. The sum of the knowledge presented will represent a greater understanding than any provided by an individual original understanding. The development of understandings represents an overall change in participant's conceptual understanding of the issue and increases the development of their learning flexibility. I am going to use Phenomenography to analyse the data from the individual interviews to explore each phenomenon, collectively, as a whole, finding similarities and differences between the experiences. My interest was to create a new knowledge and a new understanding of the phenomena to promote effective, more accurate and more specific methods for training teachers. There were categories of description and an outcome space from the data.

3.7.2.5 Fourth stage

During the fourth stage I applied the ATI and DEBQ to the samples. Next I compared the scores before and after the intervention and checked whether a change was produced afterwards.

There was a verification process at every stage of the methodology to assure the reliability and validity of the results.

Chapter summary

My following Diagram 1 summarizes the steps I followed in the methodology.

This chapter has established the methods used in this research to achieve research objectives. I also offer a rationale for the methods chosen. A combined methodological approach justified the exploration of the variables from two different but interrelated paradigmatic points of view. The purpose to use mixed methods was complementarity. A consent form was completed from each enrolled participant. Confidentiality and anonymity was guaranteed to all research participants. The style of this research is correlational. It is not a purpose of this study to find cause-effect relationships. Qualitative and quantitative methods allow exploring and understanding the experience of teaching and learning in a group of in-service teachers through the relationship between epistemic beliefs and teaching approaches. A pilot study enabled the DEBQ and ATI to be tested for suitability for use with university lecturers. Semi-structured interviews were used as a vehicle to explore the issues of epistemic beliefs and approaches to teaching. Diagram 1 offers a summary of the steps followed in the methodology.

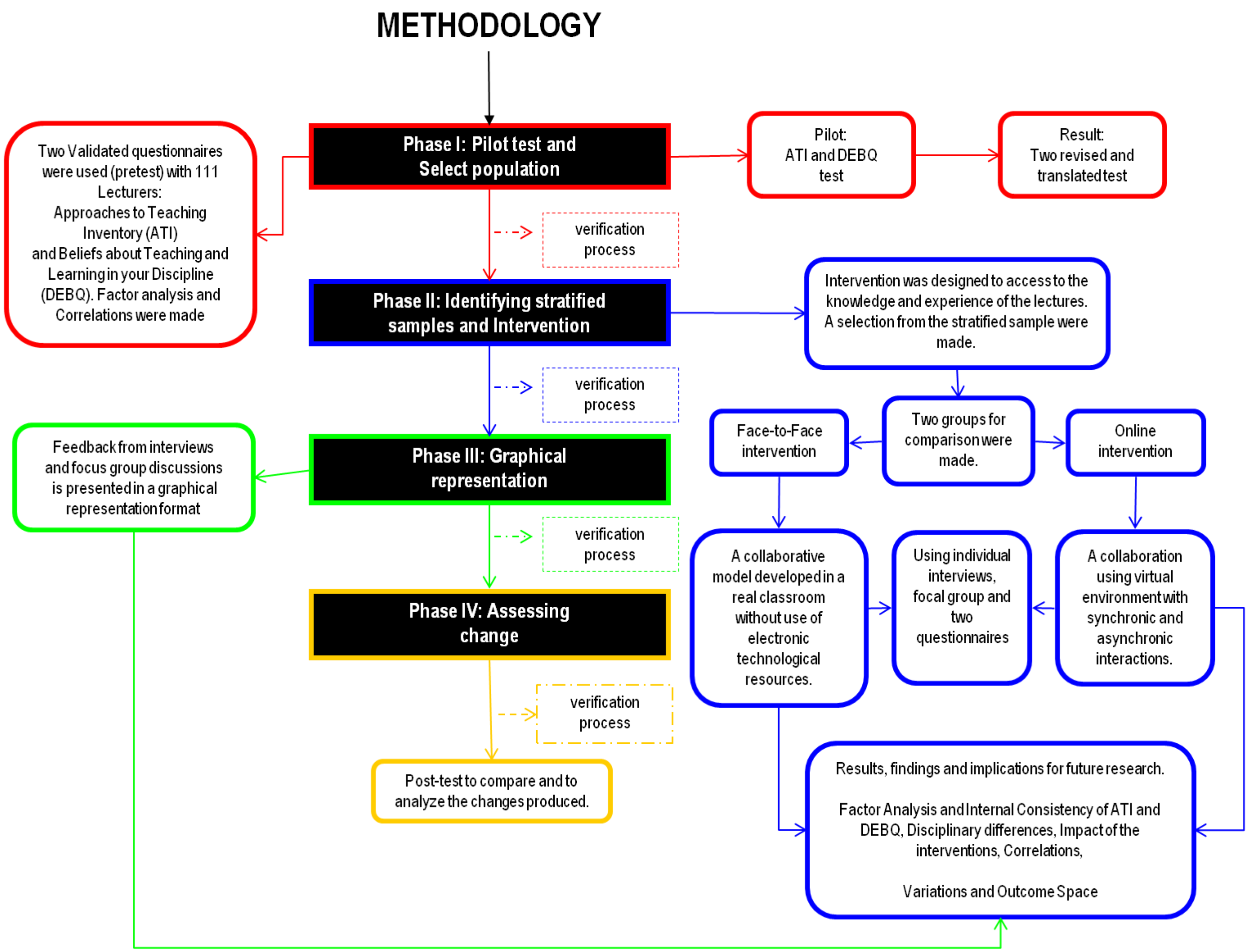


Diagram 1: Summary of the methodology

CHAPTER FOUR

RESULTS

Previous chapter five I made a presentation of the methodology, methods, instruments and also ethical issues involved the research. This chapter is devoted to make a presentation of the results.

4.1. Factor Analysis and Internal Consistency: Approaches to Teaching Inventory (ATI) (Trigwell and Prosser, 2004)

In order to examine what the underlying structure is of the items of Approaches to Teaching Inventory (ATI 22) (Trigwell & Prosser, 2004), and how many factors are involved in the inventory, the 22 items of the ATI were subjected to a factor analysis (FA) using SPSS Version 19. Prior to performing the FA the suitability of data for factor analysis was assessed. Inspection of the correlation matrix revealed the presence of many coefficients of .3 and above. The Kaiser-Meyer-Oklin value was .742 exceeding the recommended value of .6 (Kaiser, 1970, 1974) and Barlett's Test of Sphericity (less than .05) p= 0.000 (Bartlett, 1954) reached statistical significance, supporting the factorability of the correlation matrix (see table 3).

Table 2 - KMO and Bartlett's Test of ATI

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		,742
Barlett's Test of Sphericity	Approx. Chi-Square	580,503
	df	136
	Sig.	,000

Initial analysis using Principal Axis Factoring statistical method analysis revealed the presence of six factors with eigenvalues exceeding 1; explaining 10.771 percent, 9.675 percent, 7.507 percent, 7.216 percent, 5.692 percent and 5.337 percent of the variance respectively. The six factors explained a total of 46.198 percent of the variance. An inspection of the scree plot revealed a clear break after the second factor. Using Catell's Scree Test (1996), it was decided that the two first factors would be retained for this research (See Figure 6).

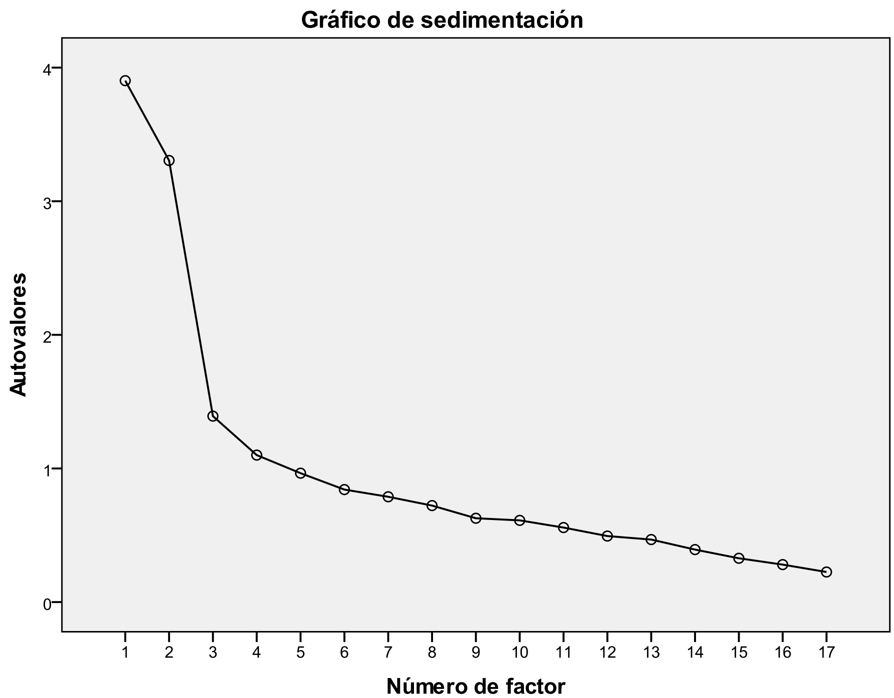


Figure 6 Scree plot of eigenvalues following Principal Axis Factoring of the ATI

To aid in the interpretation of these two factors, a Varimax rotation was performed. The rotated solution revealed the presence of simple structure (Thurstone, 1947), with both factors showing a number of high loadings (all above .40) and all variables loading substantially on only one factor. The items with low loading were eliminated. The two factor solution explained a total of 35.112 percent of the variance, with Factor 1 contributing 18.661 percent and Factor 2 contributing 16.450 percent (see table 4 and 5). The interpretation of the two factors was consistent with literature on the ATI. The results of this analysis support the use of the two factors as separate scales, as suggested by the authors (Trigwell & Prosser, 1996; Prosser & Trigwell, 1999; Trigwell & Prosser, 2004).

Table 3 - Eigenvalues - % variance explained (ATI)		
Factors	Eigenvalues	% variance explained
1. ITTF	3,902	18,661
2. CCSF	3,305	16,450

Table 4 - Rotated Factor Matrix(a)		
	Factor loading	
	Factor 1 ITTF	**Factor 2 CCSF**
ati11	,659	,102
ati10	,628	,134
ati1	,604	-,225
ati4	,583	,153
ati9	,566	,002
ati19	,518	,019
ati16	,512	-,012
ati2	,489	-,083
ati12	,478	,095
ati6	,474	,061
ati20	-,116	,737
ati17	-,016	,694
ati21	-,154	,688
ati18	,093	,635
ati13	,046	,532
ati7	,131	,501
ati22	,171	,489
% of variance explained	18.661%	16.45%
Extraction Method: Principal Axis Factoring. Rotation Method: Varimax with Kaiser Normalization. a Rotation converged in 3 iterations.		

The two factors represent the following dimensions: (1) Information Transmission/Teacher-Focused Approach (ITTF) and (2) Conceptual Change/Student-Focused Approach (CCSF). The loading of each of the items of the two factors are presented in the Table 6 Rotated Factor Matrix and Table 7 that also describe the items. The main loadings on Factor 1 are items 1, 2, 4, 6, 9, 10, 11, 12, 16, 19 and the main items on Factor 2 are 7, 13, 17, 18, 20, 21, 22.

Table 5 - Rotated Factor Matrix(a)

ATI 22	Factor	
	1 (ITTF)	2 (CCSF)
ati11	.659	
ati10	.628	
ati1	.604	
ati4	.583	
ati9	.566	
ati19	.518	
ati16	.512	
ati2	.489	
ati12	.478	
ati6	.474	
ati20		.737
ati17		.694
ati21		.688
ati18		.635
ati13		.532
ati7		.501
ati22		.489

Extraction Method: Principal Axis Factoring. Rotation Method: Varimax with Kaiser Normalization. a Rotation converged in 3 iterations.

Table 6 Factor Analysis of Approaches to Teaching Inventory (ATI)			
		Factor loadings	
Question number	**Variables**	**Information Transmition-Teacher Focus**	**Conceptual Change-Student Focus**
11	In this subject, I provide the students with the information they will need to pass the formal assessments.	.659	
10	I think an important reason for running teaching sessions in this subject is to give students a good set of notes	.628	
1	In this subject students should focus their study on what I provide them	.604	
4	It is important to present a lot of facts to students so that they know what they have to learn for this subject.	.583	
9	I structure my teaching in this subject to help students to pass the formal assessment items.	.566	
19	My teaching in this subject focuses on delivering what I know to the students.	.518	
16	In this subject my teaching focuses on the good presentation of information to students.	.512	
2	It is important that this subject should be completely described in terms of specific objectives that relate to formal assessment ítems	.489	
12	I should know the answers to any questions that students may put to	.478	

	me during this subject		
6	In this subject I concentrate on covering the information that might be available from key texts and readings.	.474	
20	Teaching in this subject should help students question their own understanding of the subject matter.		.737
17	I see teaching as helping students develop new ways of thinking in this subject.		.694
21	Teaching in this subject should include helping students find their own learning resources.		.688
18	In teaching this subject it is important for me to monitor students' changed understanding of the subject matter.		.635
13	I make available opportunities for students in this subject to discuss their changing understanding of the subject.		.532
7	I encourage students to restructure their existing knowledge in terms of the new way of thinking about the subject that they will develop.		.501
22	I present material to enable students to build up an information base in this subject.		.489

According to Pavot, Diener, Colvin and Sándwich (1991), Factor 1 Information Transmition/Teacher-Focused Approach (10 items) has a good internal consistency, with a Cronbach alpha coefficient reported of .813; Factor 2 Conceptual Change/Student-Focused Approach (seven items) has a good internal consistency, with a Cronbach alpha coefficient reported of .798 In general, the scales have a good internal consistency and can be considered reliable with the sample (n=111) (See Table 8 and 9).

Reliability Statistics

Cronbach's Alpha	N of Items
,813	10

	Corrected Item-Total Correlation
ati1	,522
ati2	,439
ati4	,529
ati6	,420
ati9	,507
ati10	,564
ati11	,590
ati12	,431
ati16	,458
ati19	,458

Table 7 Reliability Test of Factor 1 ITTF

Reliability Statistics

Cronbach's Alpha	N of Items
,798	7

	Corrected Item-Total Correlation
ati7	,451
ati13	,476
ati17	,584
ati18	,566
ati20	,639
ati21	,595
ati22	,442

Table 8 Reliability Test of Factor 2 - CCS

According to Tabachnick and Fidell (1989), it is unnecessary to proceed with a statistical comparison of a pair of factors if similarities between them are sufficiently clear. Because the two-factor structure showed that individual variables loaded highly on different factors for the sample and it was reasonable to use the same labels to name the factors, the criteria outlined by Tabachnick and Fidell (1989) were met and the need for further statistical analyses was obviated.

4.2 Factor Analysis and Internal Consistency: Domain-specific aspects of Epistemic Beliefs Questionnaire (DEBQ) (Hofer, 2000)

In order to examine what the underlying structure of the items of DEBQ (Hofer, 2000) is, and how many factors are involved in the questionnaire, the 27 items of the DEBQ were subjected to a factor analysis (FA) using SPSS Version 19. Prior to performing the FA the suitability of data for the factor analysis was assessed. Inspection of the correlation matrix revealed the presence of many coefficients of .3 and above. The Kaiser-Meyer-Oklin value was .805, exceeding the recommended value of .6 (Kaiser, 1970, 1974) and Barlett's Test of Sphericity (less than .05) p=0.000 (Bartlett, 1954) reached statistical significance, supporting the factorability of the correlation matrix (See Table 10).

Table 9 - KMO and Bartlett test DEBQ 27		
Kaiser-Meyer-Olkin measure of sampling adequacy		,805
Bartlett's test of sphericity	Chi-square approximate	603,871
	gl	120
	Sig.	,000

Initial analysis using a Principal Axis Factoring statistical method revealed the presence of eight factors with eigenvalues exceeding 1; explaining 21.961 percent, 6.235 percent, 4.909 percent, 4.354 percent, 4.220 percent 3.895 percent, 3.774 percent and 2.913 percent of the variance. The eight factors explained a total of 52.260 percent of the variance respectively (See Table 11).

Table 10 - Rotated Factor Matrix[a]			
	Factor loading		
	1	2	3
debq2	,720		
debq4	,646		
debq5	,848		
debq7	,673		
debq8	(,308)		
debq9	,707		(,330)
debq12		,503	
debq15		,464	
debq16		(,353)	
debq18	,704		
debq21	(-,446)	,505	
debq22		,460	
debq23		,405	
debq24	,712		
debq25			,668
debq26			,614
Extraction Method: Principal Axis Factoring Rotation Method: Varimax with Kaiser Normalization.			
a. Rotation converged in 5 iterations			

However, examination of the screeplots suggested a solution of three factors. A clear break after the third factor and eigenvalues supported this as the point where values descended, clustering near 1.00, with little variation among them. Items that loaded onto these factors were retained and, based on both these initial analyses and the literature of the instrument, a three-factor solution was assumed, with a Principal Axis Factoring Procedure, Varimax Rotation and Catell's Scree Test (1996) (See Figure 7).

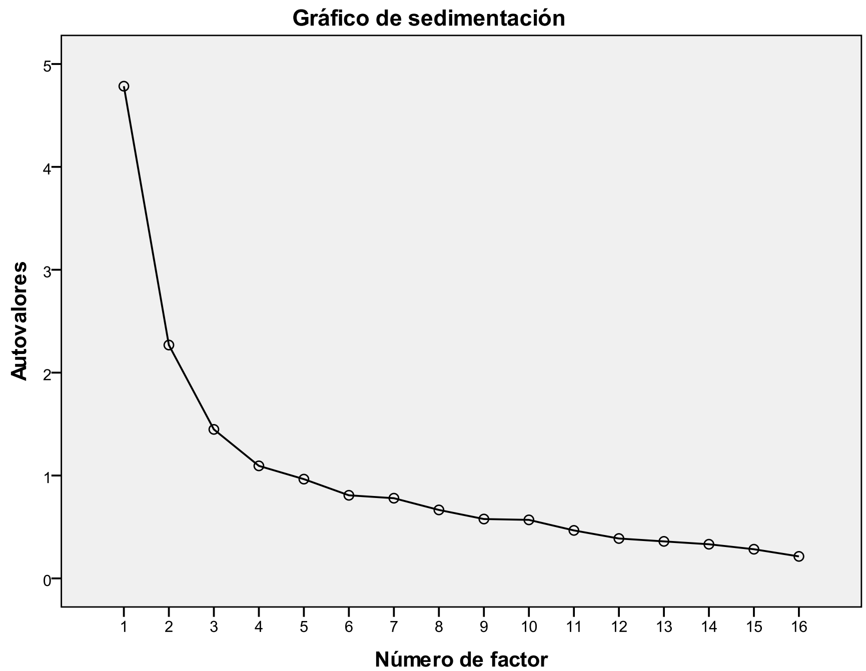


Figure 7 - Scree plot of eigenvalues following Principal Axis Factoring of the revised DEBQ

To aid in the interpretation of these three factors, a Varimax rotation was performed. The rotated solution revealed the presence of a simple structure (Thurstone, 1947), with all three factors showing a number of high loadings (all above .40) and almost all variables loading substantially on only one factor except item 9 "MOST OF WHAT IS TRUE IN THIS SUBJECT IS ALREADY KNOWN" with a loading of 0.707 in Factor 1 and 0.330 in Factor 3 (it was decided to keep it in Factor 1); and item 21 "THERE IS REALLY NO WAY TO DETERMINE WHETHER SOMEONE HAS THE RIGHT ANSWER IN THIS FIELD" with a loading of -0.446 in Factor 1 and 0.505 in Factor 2 (it was decided to keep it in Factor 2). Also, not all original factors remained (Factor 4 "Perceived Attainability of Truth" as conceptualized by Hofer (2000) emerged with a low eigenvalue and it was released). To a limited degree, the results of this factoring fit in with literature on the DEBQ and supported the use of three factors as separate scales as suggested by the author (Hofer, 2000). The three factors solution explained a total of 42.361 percent of the variance, with Factor 1 contributing 26.163 percent, Factor 2 contributing 8.548 percent and Factor 3 contributing 7.650 percent of the variance respectively. (See Table Pattern/Structure for coefficients) (See Table 12 and 13).

Table 11 – Eigenvalues - % variance explained Discipline-Focused Epistemic Beliefs Questionnaire (DEBQ)		
Factors	Eigenvalues	% variance explained
1. Certainty	4,784	26,163
2.Justification: personal	2,268	8,548
3. Source: authority	1,448	7,650

Table 12 - Rotated factor matrix [a]			
	Factor		
	1 Certainty of Knowledge	2 Justification for Knowing: Personal	3 Source of knowledge: Authority
debq5	,848	-,058	-,007
debq2	,720	,038	-,092
debq24	,712	-,058	,028
debq9	,707	,104	,330
debq18	,704	-,015	,093
debq7	,673	,047	,106
debq4	,646	-,296	,241
debq8	,308	,152	,258
debq21	-,446	,505	,104
debq12	-,280	,503	,284
debq15	,010	,464	-,112
debq22	,226	,460	,040
debq23	-,281	,405	,106
debq16	,226	,353	,146
debq25	-,004	,113	,668
debq26	,145	-,013	,614
% of variance explained	26,163%	8,548%	7,650%
Extraction method: principal axis factoring. Rotation Method: Varimax with Kaiser Normalization.			
a. Rotation converged in 5 iterations.			

These factors represent the following dimensions: (1) Certainty of Knowledge; (2) Justification for knowing: personal and (3) Source of knowledge: Authority. The loading of each of the items of the three factors are presented in the Rotated Factor Matrix Table. The main loadings on Factor 1 are items 2, 4,5,7,9, 18, 24. The main loadings on Factor 2 are items 12, 15, 21, 22, 23 and the main items on Factor 3 are items 25, 26 (Table 14).

Table 13 - Factor Analysis of Discipline-Focused Epistemic Beliefs Questionnaire (DEBQ)

		Factor loadings		
Question number	**Variables**	**Certainty of Knowledge**	**Justification for knowing**	**Source of knowledge: Authority**
5	All experts in this field would probably come up with the same answers to questions in this field.	.848		
2	In this subject, most work has only one right answer.	.720		
24	All experts in this field understand the field in the same way	.712		
9	Most of what is true in this subject is already known	.707		(.330)
18	Principles in this field are unchanging.	.704		
7	If you read something in a textbook for this subject, you can be sure it it is true.	.673		
4	What is accepted as knowledge in this field is based on objective reality.	.646		
21	There is really no way to determine whether someone has the right answer in this in this field.	(-0.446)	.505	
12	Correct answers in this field are more a matter of opinion than fact.		.503	
15	Students know the answers to questions in this field because they have figured them out for themselvess.		.464	

22	Expertise in this field consists of seeing the interrelationships among ideas.		.460	
23	Answers to questions in this field change as experts gather more information.		.405	
25	Students are more likely to accept the ideas of someone with first-hand experience than the ideas of researchers in this field.			.668
26	Students are most confident knowing something when they know what the experts think.			.614

According to Pavot, Diener, Colvin and Sandvik (1991), Factor 1, Certainty of Knowledge (seven items) has a good internal consistency, with a Cronbach alpha coefficient reported of .883; Factor 2, Justification for Knowing (five items) has an adequate internal consistency, with a Cronbach alpha coefficient reported of .603 and Factor 3, Source of Knowledge: Authority (two items) has an adequate internal consistency, with a Cronbach alpha coefficient reported of .613. In general, the scales have a good internal consistency and can be considered reliable with the sample (n=111) (Table 15, 16 and 17).

Table 14, 15 and 16 - Reliability Test of Factor 1, Factor 2 and Factor 3 of DEBQ

Reliability Statistics

Cronbach's Alpha	N of Items
,883	7

	Corrected Item-Total Correlation
debq2	,648
debq4	,619
debq5	,778
debq7	,658
debq9	,659
debq18	,686
debq24	,652

Table 14 - Factor 1: Certainty of Knowledge

Reliability Statistics

Cronbach's Alpha	N of Items
,603	5

	Corrected Item-Total Correlation
debq12	,418
debq15	,299
debq21	,480
debq22	,235
debq23	,368

Table 15 - Factor 2: Justification for knowing

Reliability Statistics

Cronbach's Alpha	N of Items
,613	2

	Corrected Item-Total Correlation
debq25	,444
debq26	,444

Table 16 - Factor 3: Source of knowledge: Authority

According to Tabachnick and Fidell (1989), it is unnecessary to proceed with a statistical comparison of a pair of factors if similarities between them are sufficiently clear. Because the three-factor structure showed that individual variables loaded highly on the different factors for the sample and it was reasonable to use the same labels to name the factors, the criteria outlined by Tabachnick and Fidell (1989) were met and the need for further statistical analyses was obviated.

4.3 Descriptive statistics

A total of 111 lecturers responded to both questionnaires. The percentage of gender was 68 men (61%) and 43 women (39%) across the sample. The age ranged between 25 to 60 years old.

The percentage of participants by discipline is:

(1) Humanities: (History, Art, Literature, Philosophy, Languages)	19 lecturers	17%
(2) Social Science: (Education, Psychology, Journalism, Economy, Law, BA, Accounting, Finance, Marketing)	43 lecturers	39%
(3) Health Science: (Medicine, Nursing)	11 lecturers	10%
(4) Basic Science: (Physics, Maths, Chemistry, Biology, Statistics)	12 lecturers	11%
(5) Engineering	26 lecturers	23%

The range of the number of years of experience is from 1 to 40 years, with a mean of (M = 13.88; SD = 9.291). The percentage of participants by number of years of experience is:

1 to 10 years experience	49 lecturers	13.0%
11 to 20 years experience	39 lecturers	10.3%
21 to 30 years experience	18 lecturers	4.8%
31 to 40 years experience	5 lecturers	1.3%

Descriptive statistics are presented for the 2 scales of the Approaches to Teaching inventory (ATI) and the 3 scales of the Beliefs about Teaching and Learning in your Discipline (DEBQ) scores in Table 18. Mean values indicate most of the lecturers present a tendency to scale CCFS of Approaches to Teaching inventory (M= 4.378; *SD* = .5164). The ITTF scale was (M=3.205; *SD* = .7453). On the Epistemic Beliefs questionnaire the highest score was Source of Knowledge: Authority (*M* = 3.284; *SD* = .9111), and the averages for the other two scales were Certainty of Knowledge (*M* = 2.728; SD = .9877) and Justification for Knowing (*M* = 2.753; SD = .7170).

Table 17 - Descriptives Statistics

Variable	N	Minimum	Maximum	Mean	Std. D	Skewness		Kurtosis	
	Statistics	Statistics	Statistics	Statistics	Statistics	Statistics	Std. Error	Statistics	Std. Error
Years of experience	111	1	40	13,88	9,291	,868	,229	,118	,455
ITTF	111	1,2	4,7	3,205	,7453	-,084	,229	-,429	,455
CCSF	111	2,1	5,0	4,378	,5164	-1,380	,229	2,907	,455
Certain	111	1,0	4,9	2,728	,9877	,172	,229	-,738	,455
Justification	111	1,0	5,0	2,753	,7170	,086	,229	,625	,455
Source Authority	111	1,0	5,0	3,284	,9111	-,657	,229	,426	,455
N válido (according list)	111								

The Skewness and Kurtosis of all the variables was checked. All the data showed acceptable normal distribution (Vincent, 1995) of Skewness (range = -1.380 to 0.172) and Kurtosis (range = -.738 to 2.907) (See Figure 8 to 12 Histograms and Graphs of ATI and DEBQ scales).

Figure 8: Histograms and Graphs of Information Transmission Teacher Focus (ITTF) Scale of ATI

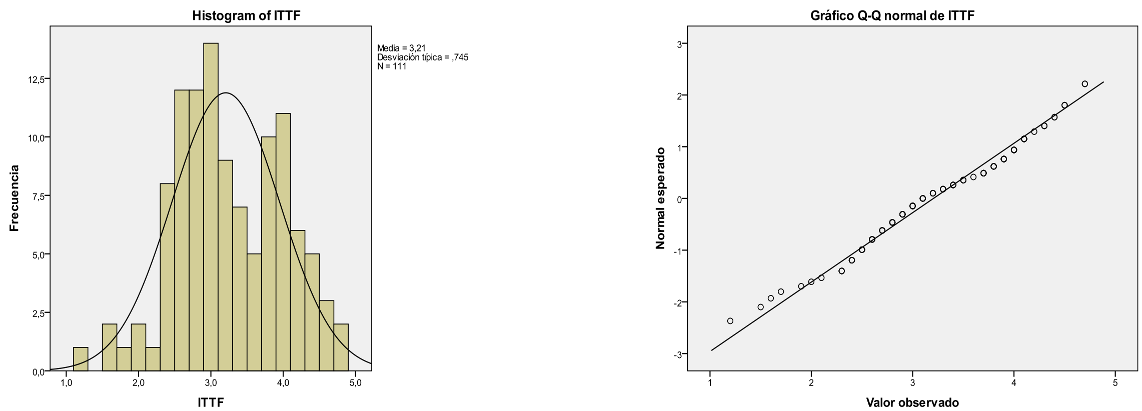


Figure 9: Histograms and Graphs of Conceptual Change Student Focus (CCSF) Scale of ATI

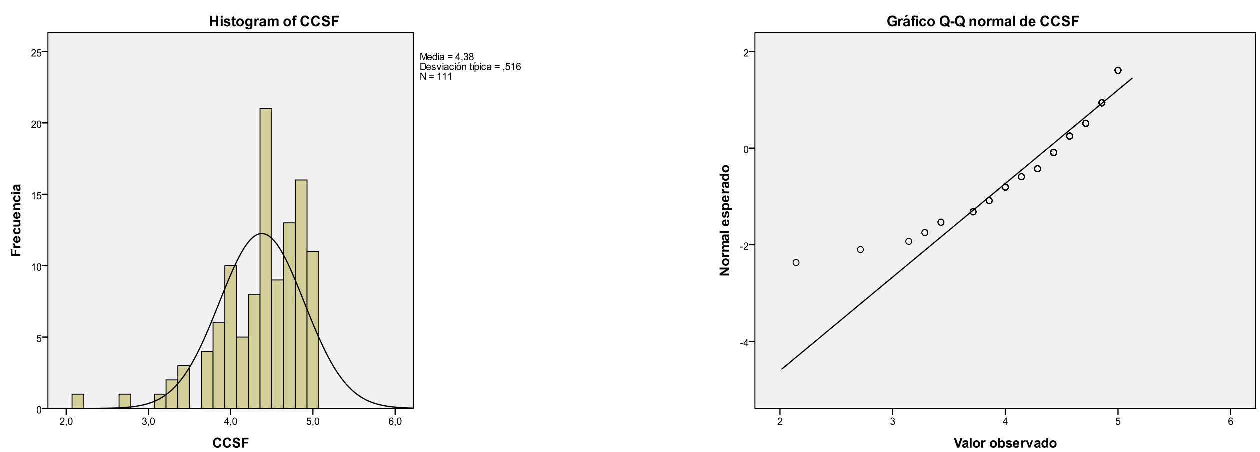


Figure 10: Histograms and Graphs of Certainty of Knowledge scale of DEBQ

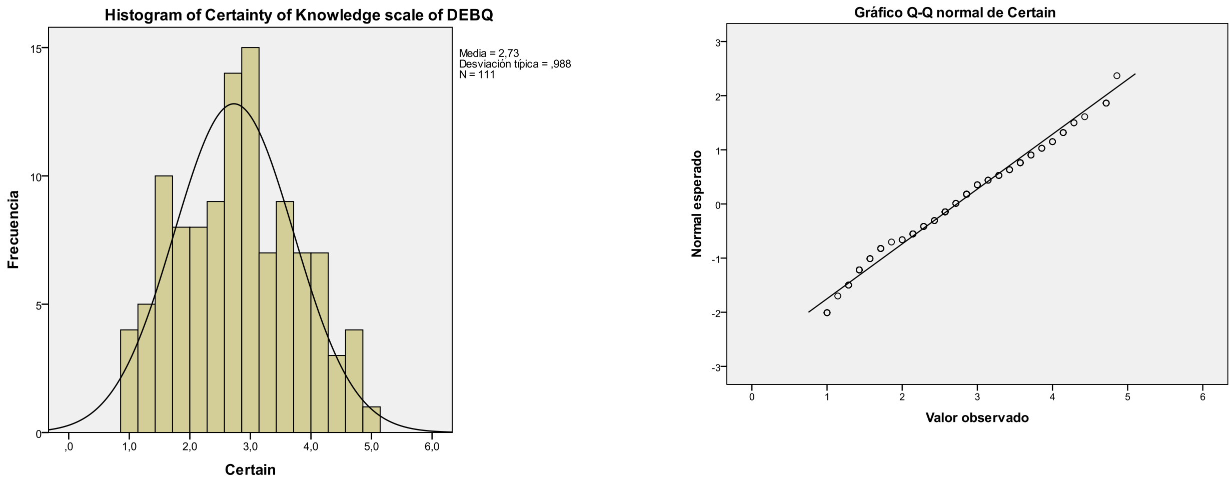


Figure 11: Histograms and Graphs of - Justification for Knowing scale of DEBQ

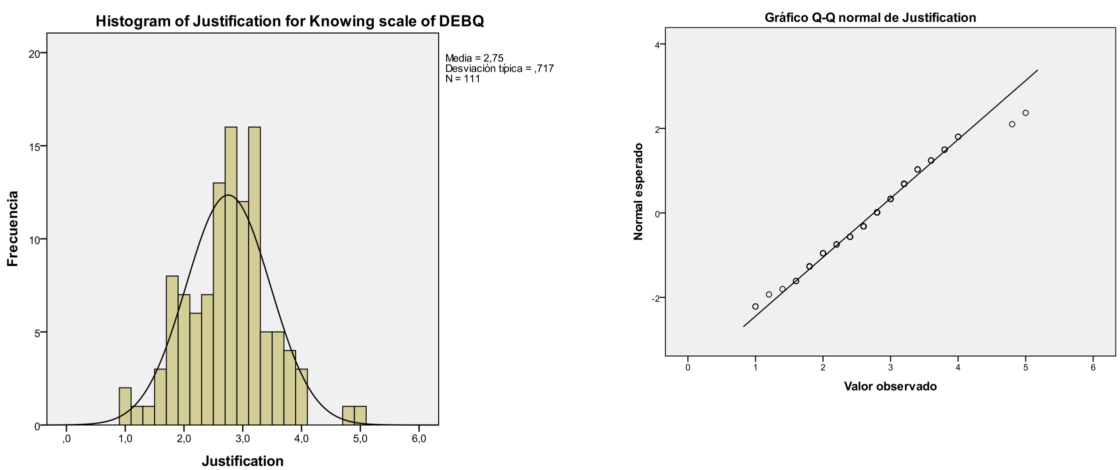
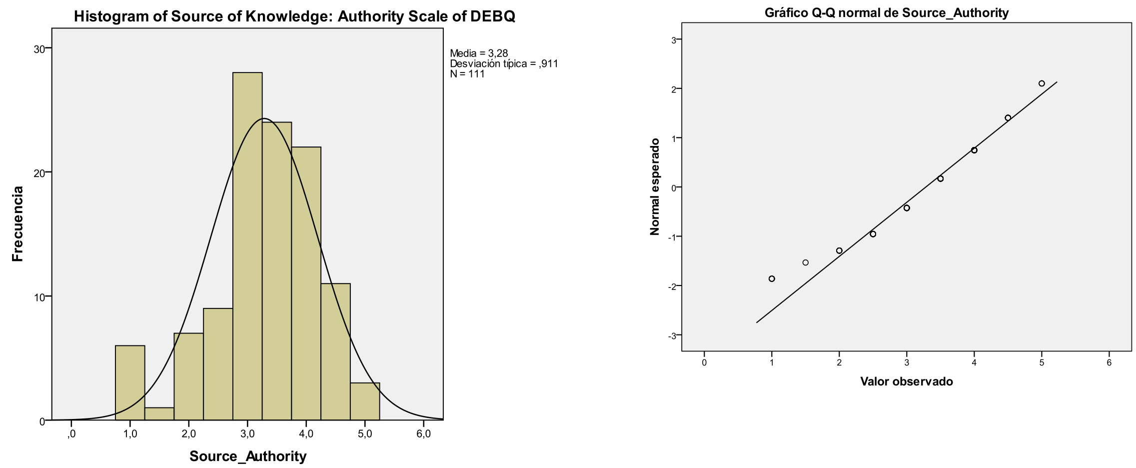


Figure 12: Histograms and Graphs of - Source of Knowledge: Authority Scale of DEBQ



Details of the five variables used are provided in Table 19.

Table 18 - Description of Variables

VARIABLE NAME	VARIABLE LABEL	CODING INSTRUCTIONS
ITTF	Information Transmition-Teacher Focus	This approaches to teaching scale professors transmit to the students' information about their subject. It is centred in the facts and the construct but not in the relations among them. The prior knowledge of the students is not considered important and is assumed that students do not need to activate them during the learning teaching process
CCSF	Conceptual Change-Student Focus	This approaches to teaching scale professors aim to help the learners to change their conceptions of the world or of the phenomenon that they are studying. The students are seen as builders of their own knowledge. Teacher cannot transmit a new vision of the world, student have to create it on their own.
Certain	Certainty/Simplicty of Knowledge	*Certainty of Knowledge:* The degree to which one sees knowledge as fixed or more fluid appears throughout the research, with developmentalists likely to see this as a continuum that changes over time, moving from a fixed to a more fluid

		view. At lower levels, absolute truth exists with certainty. At higher levels, knowledge is tentative and evolving. Openness to new interpretation is a key element of King and Kitchener's (1994) highest stage of reflective judgment, and Kuhn (1991) speaks of evaluative epistemologists (the highest level) as open to the possibility that their theories may be modified by genuine interchange. *Simplicity of Knowledge*: As conceptualized by Schommer (1990, 1994), knowledge is viewed on a continuum as an accumulation of facts or as highly interrelated concepts. Similarly, within other schemes, the lower level view of knowledge is seen as discrete, concrete, knowable facts; at higher levels individuals see knowledge as relative, contingent, and contextual.
Justification	Justification for knowing: personal	Represents the view that knowing is justified by individual opinion or firsthand experience. An individual at lower levels justify beliefs through observation, individual opinion, firsthand experience, or on the basis of what feels right, when knowledge is uncertain. Only at higher stages do individuals use rules of inquiry and begin to personally evaluate and integrate the views of experts.
Source	Source of knowledge: Authority	This relates specifically to expert knowledge, texts, and other external authority as the source of knowledge. At lower levels of most of the models, knowledge originates outside the self and resides in external authority, from whom it may be transmitted. The evolving conception of self as knower, with the ability to construct knowledge in interaction with others, is a developmental turning point of most models reviewed.

4.4 Correlations

111 lecturers from the University completed the two questionnaires: The Approaches to Teaching Inventory (ATI 22) by Prosser & Trigwell (2006) and the Discipline Focus Epistemic Beliefs Questionnaire (DEBQ) by B. Hofer (2000). To explore whether a relationship exists between epistemic beliefs (three scales) and approaches to teaching (two scales), we calculated a Pearson product-moment correlation coefficient.

Preliminary analyses were performed to ensure there was no violation of the assumptions of normality, linearity and homoscedasticity. There was a medium, positive correlation between ITTF and Certain variables ($r=.309$, $n=111$, $p\langle.0005$. There was a small, negative correlation between CCSF and Certain variables ($r=-.251$, $n=111$, $p\langle.0005$. There was a small, negative correlation between Justification and Certain variables ($r=-.254$, $n=111$, $p\langle.0005$ Figures 13, 14 and 15 are the scatterplots that shows the degree of correlation between the variables correlated. Table 20 shows correlations value.

Figure 13 Scatterplot display values for Certain scale of DEBQ and ITTF factor of ATI. The scatterplot shows the degree of correlation between the two variables.

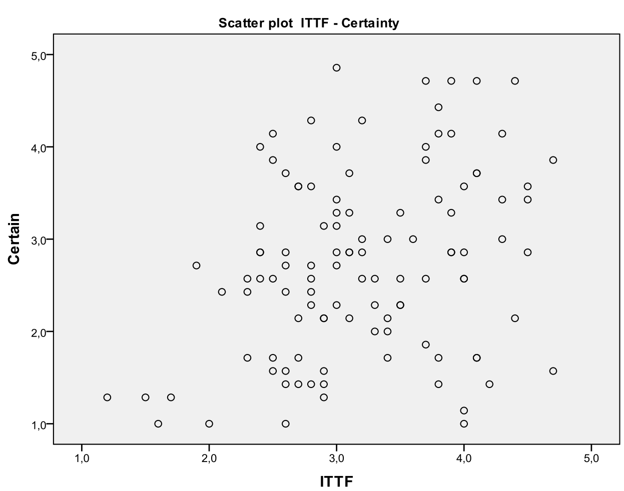


Figure 14 Scatterplot display values for Certain scale of DEBQ and CCSF factor of ATI. The scatterplot shows the degree of correlation between the two variables.

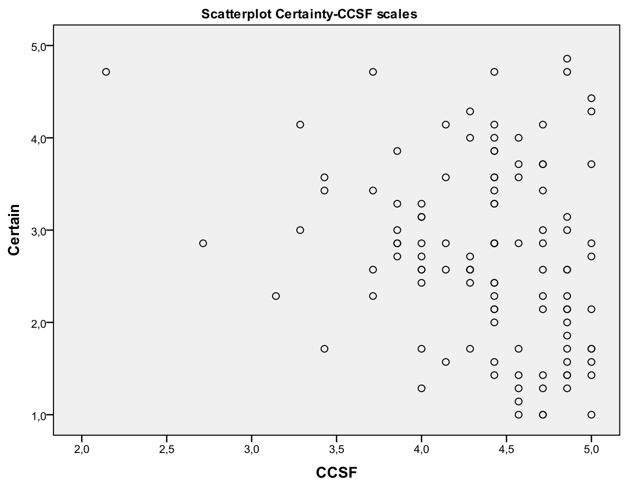


Figure 15 Scatterplot display values for Certain and Justification scales of DEBQ. The scatterplot shows the degree of correlation between the two variables.

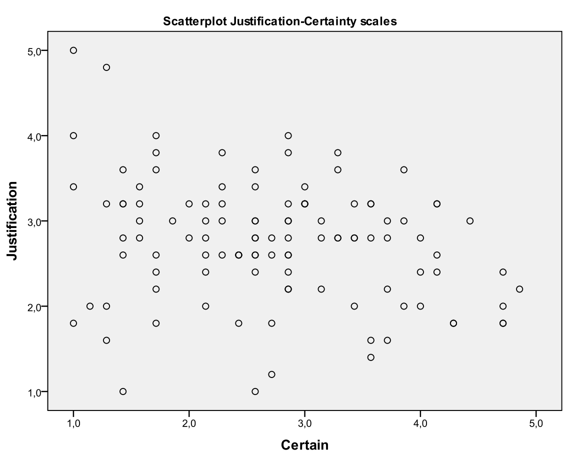


TABLE 19 - CORRELATIONS ATI - DEBQ						
		ITTF	**CCSF**	**Certain**	**Justification: Personal**	**Source: Authority**
ITTF	Pearson correlation	1	,067	**,309****	,028	,022
	Sig. (bilateral)		,484	,001	,767	,815
	N	111	111	111	111	111
CCSF	Pearson correlation	,067	1	**-,251****	,137	,071
	Sig. (bilateral)	,484		,008	,150	,462
	N	111	111	111	111	111
Certain	Pearson correlation	,309**	-,251**	1	-,254**	,170
	Sig. (bilateral)	,001	,008		,007	,074
	N	111	111	111	111	111
Justification	Pearson correlation	,028	,137	**-,254****	1	,151
	Sig. (bilateral)	,767	,150	,007		,113
	N	111	111	111	111	111
Source Authority	Pearson correlation	,022	,071	,170	,151	1
	Sig. (bilateral)	,815	,462	,074	,113	
	N	111	111	111	111	111
**. The correlation is significant at 0,01 (bilateral).						

The positive correlation between Information Transmition/Teacher Focus and Certainty/Simplicity of Knowledge variables indicate that those lecturers that considered teaching as a means to transmit to the students' information about their subject, which is centred in the facts and the construct but not in the relationships among them, and where the prior knowledge of the students is not considered important and it is assumed that students do not need to activate these during the learning teaching process, see knowledge as fixed and have the belief that absolute truth exists with certainty. Also knowledge is viewed on a continuum as an accumulation of facts and is seen as discrete, concrete, knowable facts.

The negative correlation between Conceptual Change/Student-Focused Approach and Certainty/Simplicity of Knowledge variables indicate that those teachers that see teaching as a Conceptual Change/Student-Focused Approach see knowledge as tentative and evolving. They are open to new interpretations and to the possibility that their theories may be modified by a genuine interchange. They also see knowledge as highly interrelated, relative, contingent, and contextual concepts.

And negative correlation between justification for knowing: personal and certainty/simplicity of knowledge variables indicate that the lectures who believe that to achieve a proper learning, rules of inquiry, evaluation of evidence, expertise and authority are necessary, and also the assessment and integration of the views of experts, see knowledge as tentative and evolving. They are open to new interpretations and to the possibility that their theories may be modified by a genuine interchange. They also see knowledge as highly interrelated, relative, contingent, and contextual concepts. It is also worth noting that those lecturers who held naive beliefs, such as to achieve learning individual opinion or the firsthand experience is enough, or they believe that knowledge is simple, absolute or fixed.

4.5 Differences by discipline in Approaches to Teaching and Epistemic Beliefs

Regarding disciplinary differences, the analysis indicated that lecturers did have different perceptions. To conduct these analyses I used a one-way between-groups multivariate analysis of variance (MANOVA) by subject group/discipline (See Table 21).

Table 20 - MANOVA BY DISCIPLINE						
Scales	**Discipline**					**Total**
	Humanities *M* (*SD*)	Social Science *M* (*SD*)	Health Science *M* (*SD*)	Basic Science *M* (*SD*)	Engineering *M* (*SD*)	
Approaches to Teaching						
Information Transmition-Teacher Focus	**3,421** ,8250 (*SD*) N=19	3,151 ,7414 (*SD*) N=43	3,045 ,6105 (*SD*) N=11	**3,042** ,8262 (*SD*) N=12	3,281 ,7144 (*SD*) N=26	3,205 ,7453 (*SD*) N=111
Conceptual Change-Student Focus	**4,609** ,4174 (*SD*) N=19	4,402 ,3884 (*SD*) N=43	4,571 ,3670 (*SD*) N=11	4,274 ,5221 (*SD*) N=12	**4,137** ,7051 (*SD*) N=26	**4,378** ,5164 (SD) N=111
Discipline-Focused Epistemic Beliefs						
Certainty/Simplicity of Knowledge	**2,188** 1,0723 (*SD*) N=19	2,468 ,8945 (*SD*) N=43	2,792 ,9591 (*SD*) N=11	**3,405** ,9113 (*SD*) N=12	3,214 ,7626 (*SD*) N=26	2,728 ,9877 (SD) N=111
Justification for Knowing: Personal	2,632 ,7311 (*SD*) N=19	**2,963** ,6680 (*SD*) N=43	2,836 ,4365 (*SD*) N=11	**2,417** ,4933 (*SD*) N=12	2,615 ,8835 (*SD*) N=26	2,753 ,7170 (SD) N=111
Source of Knowledge: Authority	**3,053** 1,0394 (*SD*) N=19	3,360 ,7506 (*SD*) N=43	3,091 ,8893 (*SD*) N=11	3,292 ,8107 (*SD*) N=12	**3,404** 1,1137 (*SD*) N=26	**3,284** ,9111 (SD) N=111

Note. Individual items were rated on a 1–5 Likert-type scale; high scores on DEBQ indicate agreement with less sophisticated beliefs (*N=111*).

A one-way between-groups multivariate analysis of variance was performed to investigate disciplinary differences in approaches to teaching and epistemic beliefs. Five dependent variables were used: Information Transmission/Teacher-Focused Approach; Conceptual Change/Student-Focused Approach; Certainty/Simplicity of Knowledge; and Justification for knowing: Personal, and; Source of knowledge: Authority. The independent variable was the subject group. Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrixes, and multicollinearity, with no serious violations noted. There was a statistically significant difference between subject groups on the combined dependent variables: F (20, 339.246)=2.388, p=.001; Wilks' Lambda=.646; partial eta squared=.103. When the results for the dependent variables were considered separately, the only difference to reach statistical significance, using a Bonferroni adjusted alpha level of .01, was Certainty/Simplicity of Knowledge: F (4, 106)=6.118, p=.000, partial eta squared=.188. An inspection of the mean scores indicated that the Basic Sciences subject group reported slightly higher levels of Certainty/Simplicity of Knowledge (M=3.405, SD=0.9113) than the other disciplines. This indicated that lecturers of Basic Sciences saw knowledge in their discipline as more certain and unchanging than lecturers of others disciplines. They saw knowledge as fixed and their beliefs were that absolute truth exists with certainty. Also they saw knowledge as an accumulation of facts, and knowledge is seen as discrete, concrete, knowable facts. Lectures in the Humanities have the lowest mean in Certainty/Simplicity of Knowledge (M=2.188, SD=1.0723), this indicated that lecturers of Humanities saw knowledge as tentative and evolving and open to new interpretations. Knowledge was viewed as highly interrelated, relative, contingent, and contextual concepts.

On the approach to teaching, although there are differences, the means are very similar. I found that lectures from the Humanities Faculty have the highest mean in the Conceptual Change/Student-Focused approach to teaching M=4.609 and Engineering lecturers have the lowest mean in CCSF M=4.137 On the other hand the Humanities lecturers have the highest mean in ITTF M=3.421 and Basic Science lecturers have the lowest mean in ITTF M=3.042. With regards to discipline differences on epistemic beliefs, lecturers of Basic

Sciences held less sophisticated beliefs on Certainty (M=3.405, SD=0.9113) while Humanities lecturers held more sophisticated beliefs M=2.188. Lecturers of Social Sciences hold less sophisticated beliefs on Justification: Personal M=2.963 and Basic Sciences lecturers more sophisticated beliefs M=2.417. Engineering lecturers held less sophisticated beliefs in Source of Knowledge: Authority M=3.404 while lecturers of the Humanities held more sophisticated beliefs M=3.053 (See Table 22)

Table 21 - Descriptives Statistics

	Subject group	Mean	Standard deviation	N
Certain factor	1 Humanities	2,188	1,0723	19
	2 Social Science	2,468	,8945	43
	3 Health Science	2,792	,9591	11
	4 Basic Science	**3,405**	**,9113**	12
	5 Engineering	3,214	,7626	26
	Total	2,728	,9877	111

One-way between-groups multivariate analysis of variance (MANOVA) was performed to check for gender and the number of years of experience differences in approaches to teaching and personal epistemology. There was no statistically significant difference between genders and between years of experience.

4.6 Paired Sample T-Test: Face-to-face intervention.

I conducted a Paired Sample T-Test to evaluate the impact of the face-to-face intervention on teachers' scores on the Discipline Focus Epistemic Beliefs Questionnaire (DEBQ) and the Approaches to Teaching Inventory (ATI). There was no significant difference.

I carried out a second Paired Sample T-Test this time comparing the mean of each item. There was a difference in question 6 of the ATI22 but this itself cannot be considered statistically significant. Future measurements should be carried out to delve into this result further. Pre ATI22 (M=3,38, SD=1,598) to post ATI22 [M=2.75, SD=1.035 , t(2.376)=7, p⟨.0005] . The eta squared statistic (.45) indicated a large effect size (See Table 23 and 24).

Table 22 Paired Samples Statistics by item Face-to-face intervention

		Mean	N	Std. Deviation	Std. Error Mean
Pair 6	ati6-pre	3,38	8	1,598	,565
	ati6-post	2,75	8	1,035	,366

Table 23 Paired Samples Correlations by item Face-to-face intervention

		Paired Differences					t	df	Sig. (bilateral)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 6	ati6-pre - ati6-post	,625	,744	,263	,003	1,247	2,376	7	,049

There was a difference in question 14 of the DEBQ but this itself cannot be considered statistically significant. Future measurements should be carried out to delve into this result further. Pre DEBQ (M=2.50, SD=1.512) to post DEBQ [M=3.00, SD=1.604, t(-2.646)=7, p⟨.0005]. The eta squared statistic (.50) indicated a large effect size (See Table 25 and 26).

Table 24 Paired Samples Statistics by item Face-to-face intervention

		Mean	N	Std. Deviation	Std. Error Mean
Pair 14	debq14-pre	2,50	8	1,512	,535
	debq14-post	3,00	8	1,604	,567

Table 25 Paired Samples Correlations by item Face-to-face intervention

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 14	debq14-pre - debq14-post	-,500	,535	,189	-,947	-,053	-2,646	7	,033

4.7 Paired-Samples T-Test: online intervention

I conducted a Paired-Samples T-Test to evaluate the impact of the online intervention on teachers' scores on the Discipline Focus Epistemic Beliefs Questionnaire, DEBQ and the Approaches to Teaching Inventory, ATI.

There was a statistically significance decrease in the Information Transmission/Teacher-Focused Approach, ITTF scale from pre-test ATI (M= 3,28 , SD= ,83) to post-test ATI [M= 2,76 , SD= 1,03 , t (10)= 2,53, p 〈.0005] . The eta squared statistic (0,39) indicated a large effect size in the ITTF scores. There were no statistically significant differences in the others ATI and DEBQ scales. Details of the results are provided in the Tables 27 and 28.

Table 26 Paired Samples Correlations online intervention		**N**	**Correlation**	**Sig.**
Pair 1	ITTF-Pre & ITTF-Post	11	,755	,007
Pair 2	CCSF-Pre & CCSF-Post	11	,779	,005

Table 27 Paired Samples Statistics online intervention		**Mean**	**N**	**Std. Deviation**	**Std. Error Mean**
Pair 1	ITTF_Pre	3,2818	11	,83405	,25147
	ITTF_Post	2,7636	11	1,03274	,31138
Pair 2	CCSF_Pre	4,5318	11	,47728	,14391
	CCSF_Post	4,4727	11	,49617	,14960

4.8 Paired Sample T-Test by item: online intervention

I carried out a Paired Sample T-Test by item on both tests. I found a difference only in question 1, question 2, question 9, and question 13 of the ATI:

There was a statistically significance decrease in question 1 of the Information Transmission/Teacher-Focused Approach, ITTF factor of the ATI from pre-test ATI (M= 3,09 , SD= 1,446) to post-test ATI [M= 2,55 , SD= 1,368 , t(10)= 3,464, p〈.0005]. The eta squared statistic (0.54) indicated a large effect size in question 1's score.

There was a statistically significance decrease in question 2 of the Information Transmission/ Teacher-Focused Approach, ITTF factor of the ATI from pre-test ATI (M= 4,00 , SD= 1,342) to post-test ATI [M= 3,36 , SD= 1,286 , t(10)= 3,130, p〈.0005]. The eta squared statistic (0.49) indicated a large effect size in question 2's score.

There was a statistically significance decrease in question 9 of the Information Transmission/ Teacher-Focused Approach, ITTF factor of the ATI from pre-test ATI (M= 3,64 , SD= 1,12) to post-test ATI [M= 2,91 , SD= 1,375 , t(10)= 3,068, p〈.0005]. The eta squared statistic (0.48) indicated a large effect size in question 9's score.

There was a statistically significance decrease in question 13 of the Conceptual Change/Student-Focused Approach, CCSF factor of the ATI from pre-test ATI (M= 4,91 , SD= ,302) to post-test ATI [M= 4,45 , SD= ,688 , t(10)= 2,887, p〈.0005]. The eta squared statistic (0.45) indicated a large effect size in question 13's score.

Details of the results are provided in the Tables 29 and 30.

Table 28		**Paired Samples Test** **Paired Differences by item: online intervention**					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	ati1-pre - ati1-post	,545	,522	,157	,195	,896	3,464	10	,006
Pair 2	ati2-pre - ati2-post	,636	,674	,203	,183	1,089	3,130	10	,011
Pair 9	ati9-pre - ati9-post	,727	,786	,237	,199	1,255	3,068	10	,012
Pair 13	ati13-pre - ati13-post	,455	,522	,157	,104	,805	2,887	10	,016

Table 29 **Paired Samples Statistics online intervention**		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	ati1-pre	3,09	11	1,446	,436
	ati1-post	2,55	11	1,368	,413
Pair 2	ati2-pre	4,00	11	1,342	,405
	ati2-post	3,36	11	1,286	,388
Pair 9	ati9-pre	3,64	11	1,120	,338
	ati9-post	2,91	11	1,375	,415
Pair 13	ati13-pre	4,91	11	,302	,091
	ati13-post	4,45	11	,688	,207

4.9 Analysis of Variance ANOVA

To control the Type 1 error across multiple tests I used a Bonferroni adjustment. The new alpha value is 0.01. There was no significant difference on any scale.

4.10. Phenomenographic analysis of the interviews and focus groups.

"People do not act in relation to a situation as such but in relation to the situation as they perceive it." Ference Marton, 2006

4.10.1 Introduction

To explore the understanding of complex phenomenon such as learning, teaching, information technologies in education and knowledge I designed an intervention. As part of the intervention, 24 lecturers at the Universidad del Norte were interviewed. The lecturers later participated in a face-to-face focus group and other group in an online focus group. The intention of the focus group was to deepen aspects extracted from the responses given by the lecturers on the questionnaires. In the focus group, lectures could talk freely about their beliefs and attitudes. Also they had the opportunity to give their opinions and to listen to the opinions of other lecturers, which also allowed appreciation of the subjects from different perspectives. During the focus group, lecturers were asked to elaborate, in small groups, schemes to represent their opinions. The lecturers answered 3 questions: What is learning, what is education and how can ICT support learning? A moderator facilitated the workshop and group discussions. This model was developed in a real classroom without the aid of any technology. Another intervention, this time online, was carried out to be used as a comparison.

The interviews were semi-structured and conducted individually. The interviews addressed three pre-determined themes: Beliefs about knowledge and knowing, beliefs about learning and teaching in your discipline and beliefs about Information and Communication Technology in Education. Each subject had a small number of open questions. These were:

Beliefs about knowledge and knowing:

- Sometimes people talk about 'searching for the truth' in a discipline. I'm not sure what they're talking about. What are your views?
- How do you know when you know something? How do you confirm your knowing?
- What role does an expert have in learning? What does the expert offer the learner?
- What do you do when experts in your field disagree? How do you determine what is right or wrong?

Beliefs about learning and teaching in your discipline:

- What is learning? What is understanding?
- How do you prefer to go about learning new material and how do you know when you have learnt something? What changes when you learn? How do you confirm your understanding?
- What is teaching? How do you know when you have taught something well?

Beliefs about Information and Communication Technology in Education: How can Information and Communication Technology help with student learning?

I used Phenomenography to understand and analyse the data obtained from individual interviews recordings and focus group recordings. The purpose of making a qualitative analysis was to provide order, structure and meaning to the data obtained from the interviews and the focus group. The objective of performing a phenomenographic analysis was to elaborate categories of description and outcome spaces of experience variations of the phenomena explored. The goal was not to analyse individuals, their personalities or their teaching styles, but to explore each group-level phenomenon, collectively, as a whole, finding similarities and differences among distinct experiences. As Marton & Booth (1997) assert, the aim is to look for qualitatively different conceptions of the phenomenon of interest collectively rather than the conceptions of individual participants. Thus, the transcriptions are not analysed or interpreted individually. They collectively constitute the overall data where the meanings are interpreted in relation with the others.

4.10.2 Steps of the analysis

The steps of the analysis I followed were:

1. Become familiar with the transcriptions.
2. Identify the variations in the ways of experiencing the phenomenon. Uncover similarities and differences. Look for qualitatively different global meanings.
    a. Identify the referential aspect of the phenomenon of interest.
    b. Identify the structural aspect of the phenomenon of interest.
3. Establish the categories of description.
4. Establish the outcome spaces.

To familiarise myself with the transcription I needed to read the entire transcript several times. The transcriptions were not submitted to a revision *a posteriori* by the lecturer participants. That is not necessary according to Marton & Pong (2005).

Although the process follows a sequence the analysis is primarily iterative. Firstly each interview was individually analysed and the expressions used by the lecturers were highlighted. I looked at whether the expressions related to the same experience or different experiences. They were then grouped together by similarity or difference. Then I extracted those "expressions of experiences" as "quotes" or literal comments, and separately wrote down similarities on another sheet. I repeated the process for each of the interviews. In this manner I created categories of different ways that teachers had experienced a phenomenon. At the same time as I was doing this, I was writing down a definition or meaning alongside each experience. All these expressions were part of my data pool. In this data pool the collective prevailed above the individual. The individual conceptions were giving way to the categories of description.

The following step was to identify the referential and structural aspects of the categories. A referential aspect denotes the global meaning of the object conceptualized and refers to the overall meaning of this object. The referential aspect, namely the "what" aspect or the global meaning is the particular meaning of an individual object (anything delimited and focused on by the subject). On the other hand, the structural aspect namely the "how" aspect or the structure, shows the specific combination of features that have been discerned and focused on by the subject (Saljo, 1996; Marton & Booth, 1997; Marton & Pong, 2005; Akerlind, 2005).

To discover the referential dimension of the expressions in the first place, now sorted by categories, some categories were compared with others on the same basis of similarities and differences. It is normal that conceptions change place and that new categories emerge and others disappear. During this step, the categories of description are typically expressed in the form "something (x) is seen as something (y)" or "something (x) is experience as something (y)" (Lybeck et al., 1988; Bruce, 1997).

To discover the structural dimension, I took the expressions with their global meanings and identified the elements that were focused on and discerned by the teachers. I wrote a description in prose for each category. Although these two aspects, the referential and the structural dimension, are presented separately in the analysis, they are actually two interrelated aspects that are experienced simultaneously by the subject (Marton & Pong, 2005).

After uncovering the referential and the structural dimensions I established the definitive categories of description. The questions to be answered in this step were what are the different ways of experiencing the phenomenon? What is the relationship between them? The categories found are defined as collective forms that lecturers have of experience the phenomena under study. It is very different to a conception, which is the way that a person has of experiencing a phenomenon. A conception is individual and a category is collective (Marton & Booth, 1997). The categories were named according to their features that were discerned and kept in the focal awareness by participating lecturers (Marton and Booth, 1997).

Finally, I created the outcome space. The question to answer was what is the logical relationship between the categories that describe the experience of the phenomenon under study? According to Marton & Pong (2005) and Akerlind (2005) the outcome space should be parsimonious (i.e., have few categories) and be organized hierarchically, the categories further up on the hierarchy include the lower one. However Laurillard (1993) asserts an outcome space also may represent a developmental progression in the sense that some categories offer broader, most comprehensive and convincing explanation than others. My outcome space reflects the view of Marton & Pong (2005) with contributions from Laurillard's view (1993). Higher views on my hierarchy provide more powerful ways of learning, teaching and ICTs.

The outcome space may be illustrated as a table, image or diagram and serves the purpose of depicting how each category relates to each other. Bruce (1997) describes the outcome space as a "diagrammatic representation" of the categories of description, while Säljö (1988) suggests it reflects a "map of a territory" interpreting how people conceive a particular aspect of reality.

4.10.3 Results of the analysis: Lecturers' experiences of learning, teaching, information and communication technologies and knowledge

a. Categories of descriptions

The answer to the question: what kind of variation did I find in the way of experiencing learning, teaching, Information and Communication Technologies and knowledge in lecturers at the Universidad del Norte is:

Four categories of descriptions were found in the way of experiencing learning. Learning is seen as:

1. A cognitive process of knowledge acquisition.
2. A cognitive process influenced by different factors.
3. Knowledge management.
4. Active construction.

Four categories of descriptions were found in the way of experiencing teaching. Teaching is seen as:

1. Knowledge transmission.
2. In teaching, the lecturer is seen as an expert.
3. Mediation.
4. Facilitation of the learning.

Three categories of descriptions were found in the way of experiencing Information and Communication Technologies. Information and Communication Technologies is seen as:

1. Uncertain and with skepticism.
2. A tool for supporting and enhancing the teacher's job.
3. Positive, they are a help to learning and teaching.

Two categories of descriptions were found in the way of experiencing knowledge. Knowledge is seen as:

1. Relative rather than absolute.
2. The search for practical, not theoretical, experience. It is the result of confronting theory with practice.

Next follows a wider description of the categories and subcategories found.

LEARNING IS SEEN AS…

1. A cognitive process of knowledge acquisition.

In this category learning is understood as a cognitive process (knowledge acquisition). It is also understood as a rather traditional method, i.e., one that sees the student as a receiver and accumulator of information transmitted by the teacher. It is one of the most widely extended or most predominant learning models in education. Traditional learning still takes place and it is characterized in that the learning is coming from an external source; the teacher has the mission of transmitting what he knows and the learning is of an accumulative nature.

Two subcategories have been focused on and discerned by participating lecturers:

a. Learning as the reception and accumulation of information: Focus is on seeing the student as a receiver and accumulator of information transmitted by the teacher.

b. Learning as transmitted by teachers: Focuses on seeing teachers as those who have the mission of transmitting what they know and seeing learning as having an accumulative nature.

2. A cognitive process influenced by different factors.

In this category, learning is seen as influenced by a set of variables that activate behaviour and are oriented in a particular way to achieve a goal. Motivation as one of these factors is a complex process that largely determines the ability to learn from individuals. Motivation is what moves the person toward a direction and with a specific purpose; it is the disposition to sustained effort to achieve a goal. It is, therefore, a factor that determines the ability to learn. Learning is also seen as a broader process that is influenced by academic institutions as such, teachers and the family of the students and by an adequate socio-economic environment that provides the student with all the tools they need to achieve a good learning outcome. According to this view, the basic needs must be satisfied for proper learning. Educational institutions and families must provide students with an environment that motivates them to learn.

Four subcategories have been focused on and discerned by participating lecturers:

a. Learning is seen as determined by the student's fundamental needs. Focus is on satisfaction of basic needs, having economic resources and an adequate familiar environment that allows good learning outcomes to be achieved.

b. Learning is seen as influenced by the student's intrinsic motivation. Focus is on the influences of thought processes, especially intrinsic motivation, understood as the interest or pleasure experienced by students through their own learning or through the activities leading to it.

c. Learning is seen as influenced by lecturers' motivation. Focus is on the impact that lecturers' motivation has on student learning.

d. Learning is seen as affected by the academic environment. Focus is on resources and materials that the university provides to students that enhances good learning and the achievement of good learning outcomes.

3. Knowledge management.

In this category learning is seen as a transfer of knowledge from the place where it is generated to the place where it will be used, and involves the development of the skills needed to share and use it. According to this view, learning as knowledge management seeks to organize existing knowledge to facilitate the creation of new knowledge and use it to achieve better performances.

Two subcategories have been focused on and discerned by lecturers involved:

a. Learning is seen as knowledge transfer. Focus is on the capability to put new knowledge into practice and apply it to new and different situations.

b. Learning is seen as competence development. Focus is on the development and strengthening of skills such as teamwork, problem solving, decision-making, communication skills and critical thinking for good learning.

4. Active construction.

In this category learning is seen as eminently active and involves assimilation. According to this view, the student is not limited in acquiring knowledge, but rather the student builds knowledge using previous experience to understand and give meaning to the new learning. Consequently, the teacher, instead of providing knowledge, participates in the process of building knowledge along with the student; it is about a constructed and shared knowledge.

In this category, it is understood that for true learning to take place knowledge must be apprehended. Apprehension is understood here as a higher faculty than simple learning, in which the student has the capacity to extract or understand the essence of a concept. It is also understood as the student's ability to grasp reality and internally assimilate it. Here there are various degrees of the depth of understanding.

Four subcategories have been focused on and discerned by lecturers involved:

a. Learning as a transformational process. Focus is on actions that guide a change in the student and, therefore, a modification in their behaviour and also on how they conceive, feel and influence the world that surrounds them.
b. Learning as actions to achieve the evolution of knowledge. Focus is on the development of academic centres as thinking institutions and in permanent learning. Learning is seen as actions whose purpose is to achieve evolution of knowledge, not only in the mind of

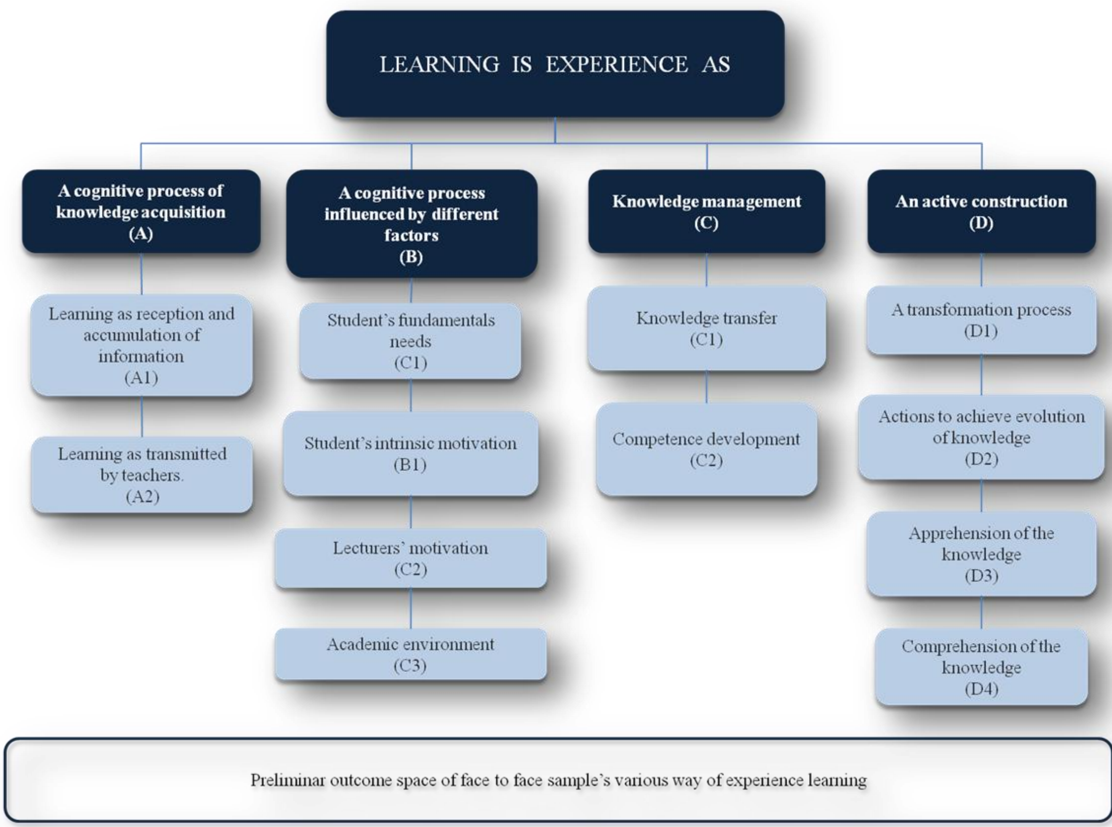
the student, but also in the institution as a "thinking body" in which the student is immersed.

c. Learning as apprehension of the knowledge. Focus is on a higher faculty than simple learning, in which the student has the capacity to extract or understand the essence of a concept.

d. Learning as comprehension of the knowledge. Focus is on the student's ability to grasp reality and internally assimilate it.

The learning categories and subcategories are next presented as a preliminary outcome space.

Graph 1: Preliminary outcome space: The learning categories and subcategories



TEACHING IS SEEN AS…

1. Knowledge transmission.

In this category teaching consists of clearly communicating specific knowledge, skills, ideas or experiences to students that they do not have, with the intention that the can understand it and can apply it at a given moment. This is an expositive teaching. From this point of view, the teacher and the act of communication play an essential role in the transmission of knowledge.

Two subcategories have been focused on and discerned by lecturers involved:

a. Teaching is understood as teacher-centred knowledge transmission. Focus is on the teacher who is seen as transmitting knowledge and the student as a receiver and accumulator of information.

b. Teaching is seen as a communicative activity. Focus is on language, which is the means of transmitting knowledge by the creation of interaction and dialogue between the teacher and the student, whose purpose is effective education.

2. In teaching, the teacher is seen as an expert.

In this category an expert teacher is seen not only as a master in their subject area but also as capable of handling teaching techniques or strategies that facilitate student learning in the classroom. An expert teacher should also know the social and cultural environments in which their students interact. They should carry out learning activities that enhance learning. According to this view, an expert teacher should provide education for the comprehensive development of student.

Two subcategories have been focused on and discerned by lecturers involved:

a. The teacher is seen as an expert in their subject area and as source of knowledge. Focus is on the teacher or lecturer who masters the practical and theoretical competences and who possesses skills.

b. The teacher is seen as the model that is to be observed and imitated. Focus is on the teacher's job that marks the way and takes the students along it. Focus is on the teacher inspiring their students. Focus is on the teacher helping in their learning process. They are responsible for the teaching and learning processes in classroom.

3. Teaching is seen as mediation.

In this category teaching is seen as the mediation of knowledge, cultural practices and learners. According to this view, teaching is seen as social mediation but also as a pedagogical mediation, this is, between what is taught and the individual or group. In the institutions the teacher is the mediator between knowledge and students. The teachers are those who adapt the knowledge to the capabilities, interests and needs of a particular group and to a specific socio-cultural context. To construct these bridges will require teachers' mediation.

One subcategory has been focused on and discerned by lecturers involved:

a. Teaching is seen as the mediation of knowledge, cultural practices and learners. Lecturers are not the centre of the process but the mediators among students, teaching contexts and learning situations with the intention of stimulating and encouraging the development and potential of the student. In other words the lecturer's role is to mediate between students and knowledge to achieve their personal and intellectual development.

4. Teaching is seen as the facilitation of the learning.

In this category teaching is seen as facilitation. It is seen as the process of leading a group through learning. According to this point of view, each person has something unique and valuable to contribute. Without the contribution and knowledge of each person, the group's ability to understand or respond to a situation can be reduced. In this category, teaching as facilitation involves sharing information between the facilitator and the group and between group members. The facilitator's role is to extract the knowledge and thoughts of different members of a group and encourage them to learn from each other, while also thinking and acting together. The teacher is seen as the facilitator.

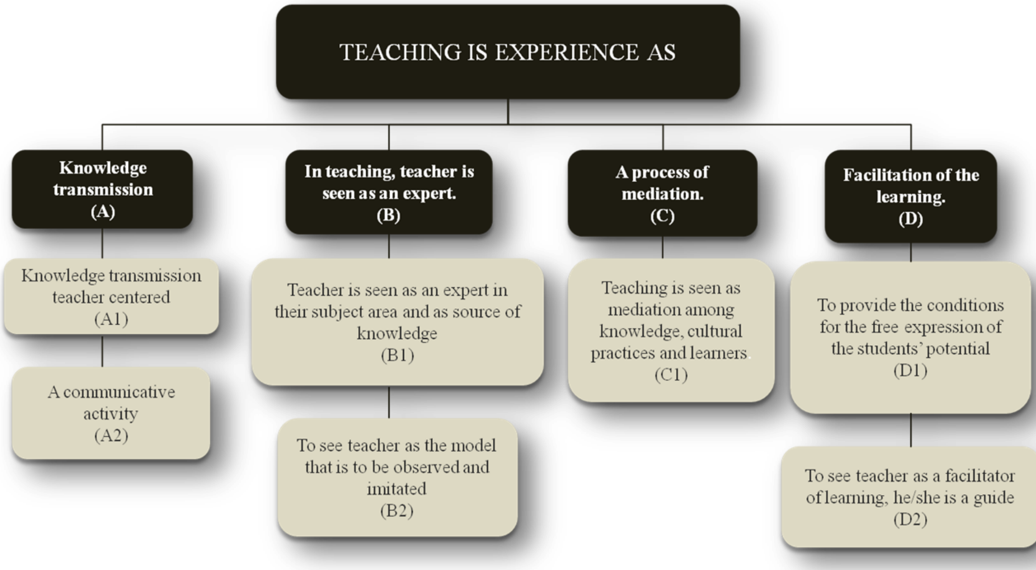
Two subcategories have been focused on and discerned by lecturers involved:

a. Teaching is seen as providing the conditions for the free expression of the students' potential. Focus is on teaching that has a participative character in which the student assumes an increasingly leading role in directing the learning and in which the teacher ceases to be the authoritarian figure that simply imposes knowledge and decides what and how things are to be learnt.

b. The teacher is seen as a facilitator of learning, they are guides. Focus is on the function of the teacher to facilitate the conditions in which the students' self-determination capacities can be updated in both the social and individual processes. The teacher is seen as a facilitator that must wait for each student to feel the need to express their values in order to create the conditions that favour that expression. It means accepting that each student is potentially different and, therefore, will manifest needs at different times and in different ways, and this requires totally individualized attention.

The teaching categories and subcategories are next presented as a preliminary outcome space.

Graph 2: Preliminary outcome space: The teaching categories and subcategories



Preliminar outcome space of face to face sample's various way of experience teaching

INFORMATION AND COMMUNICATION TECHNOLOGIES ARE SEEN AS…

1. Uncertain and with skepticism.

In this category, ICTs are seen as lacking educational value in promoting learning. ICTs have still not demonstrated that student performance improves because of them. Some teachers believe that there is no evidence that proves learning is the consequence of the integration of ICT in education. According to this view, teachers believe that to achieve a change in student more integration and more comprehension is needed.

Two subcategories have been focused on and discerned by lecturers involved:

a. ICTs are viewed with distrust. Focus is on the incapability of the ICT to create learning. Some teachers claim that they do not guarantee quality education unless the ICTs are used within a coherent educational model. They are seen as a set of computerised and digital tools whose presence in the various doings of humans, particularly in education, are unquestionable, but that they contribute little or nothing to learning.

b. ICTs are seen here to have more limitations than benefits as a support for learning. It is not the technologies themselves that are limited, rather their applications. Among these limitations are that they are easily used by many but they are not adapted to the rhythm of learning. They are not taken into consideration for incorporation in educational programmes as people learn in different ways and at their own speed because they do not all have the same cognitive level. Free interaction by students with multimedia materials, which are not always of good quality and are often out of context, can lead to incomplete learning and simplistic, shallow visions of reality. Their use has become mechanical, with some lecturers using them on the basis of out-dated teaching and learning conceptions. Some believe that new technologies are the response to the questions and challenges of today's education, i.e., they are seen as the end more than the means. Finally, the economic cost they entail means that they are out of reach for many students.

2. A tool for supporting and enhancing teacher's job.

In this category, ICTs are seen as a tool to help lecturers in their various roles: as a teacher, as a researcher, as a consultant or as staff. ICTs are seen as part of our daily lives. We constantly use them to study, work, play, for leisure. According to this view, ICT is a tool that helps the teacher to prepare lessons and academic tasks for their students more effectively, also to develop content, to create reusable learning objects, to prepare and mark classwork and homework online, to communicate with other teachers in physically different places, to share resources and to exchange views or create virtual discussions. They can also be used to create blogs and to share knowledge with other teachers and their students. ICTs are seen as providing help to find information or analyse research data. Finally ICTs are seen as a support for academic staff that have administrative burdens.

One subcategory has been focused on and discerned by lecturers involved:

a. ICTs are seen as a support for the activities performed by teachers outside the classroom. Focus is on helping lecturers to prepare for their classes, to carry out research and to perform administrative tasks. Academic activities that used to be carried out in a rudimentary way are today performed rapidly, agilely and with better quality thanks to the functional nature of ICTs. This has saved lecturers dealing with repetitive, monotonous and routine tasks and has meant an increase in productivity and enhanced teaching and research management.

3. As positive, they are a help for learning and teaching.

In this category, Information and Communication Technologies (ICTs) are seen as tools that help to enhance learning and teaching processes. ICTs contribute to the development of creativity, ingenuity, teamwork and the collaborative and cooperative skills necessary for academic and personal success. According to this view, ICTs have become key tools to enhance learning and improve teaching. ICTs are seen as an essential component of XXI century education as they offer a richer environment for learning and a more dynamic experience for teaching. Using methodologies supported by ICT or using good quality digital content enriches learning and can, for example, through simulations and animations illustrate concepts and principles that are otherwise very difficult for students to understand. ICTs are seen as an aid and not the end.

Three subcategories have been focused on and discerned by lecturers involved:

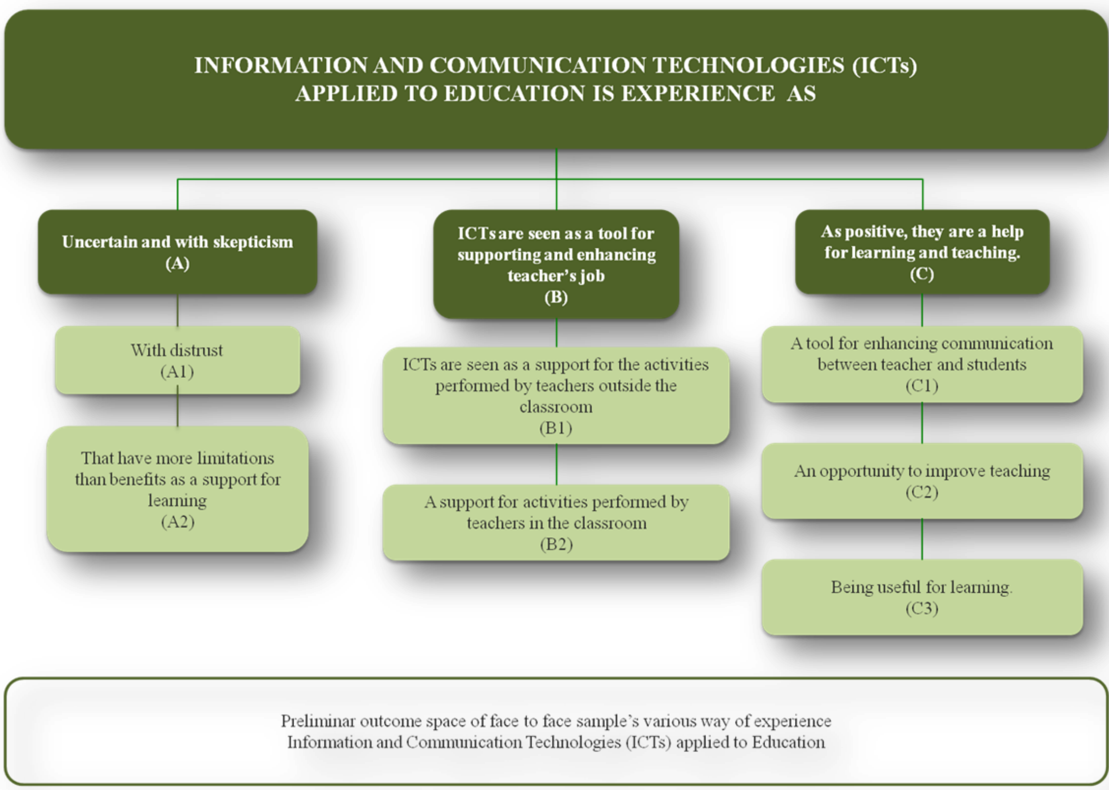
a. ICTs are understood as being useful for learning. Focus is on enabling the student to improve their skills by helping them to perform their learning tasks and activities; because they facilitate an understanding of concepts, because they speed up searching for and accessing information, and because they allow for collaborative work. Access to databases, e-journals and software for graphic representation of concepts, such as Cmap Tools or MindMap, significantly helps the student in the knowledge construction process.

b. ICTs are understood as an opportunity to improve teaching. Focus is on the creation of educational multimedia materials that can make the delivery of content more dynamic on account of its multi-sensory nature. Likewise, interaction through forums, email and chats favour the creation and enhancement of communication and collaboration skills. Also focus on different alternatives of teaching, e.g. online tutorials in real time or asynchronously, visual aids when presenting e-content. Teachers can back up their comments, their master classes, their role playing exercises and explanations about certain procedures with all types of resources, graphical representations, images, presentation programmes, multimedia materials, camcorders, educational software and Internet resources. They can also be used as a tool for underpinning arguments taken from the online press or to upload class content onto the course website. Using videos, cd rooms, reusable digital content, webpages, applets or virtual learning sessions promote learning and provides new opportunities for enhancing teaching and learning inside classroom.

c. ICTs are seen as a tool for enhancing communication between teachers and students. Focus is on ICTs as a support for face-to-face teaching. Focus is on new channels of communication with students via e-mail, forums, chats, news and mailing lists that encourage teacher–student interaction.

The Information and Communication Technologies categories and subcategories are next presented as a preliminary outcome space.

Graph 3: Preliminary outcome space: The information and communication technologies categories and subcategories



KNOWLEDGE iS SEEN AS…

1. Relative rather than absolute

In this category, scientific knowledge is seen as relative. According to this view, scientific truths are relative in the sense that they do not offer a full and complete knowledge of the object of study. According to this sophisticated view of knowledge, truth is relative, i.e., dependent or is made in connection with the subject, person or group who experiences it. Relativism holds that there are many truths about things, at least as many as people think they have knowledge of these things.

One subcategory has been focused on and discerned by lecturers involved:

a. Truth as relative. There is no way of understanding reality but many ways of appreciating and understanding it, and each allows us to see it from different angles, and so in some way it is in a more complete manner. Here truth is subjective, not absolute, and it is changeable. This perspective differs from the positive paradigm that seeks absolute truths.

2. The search for practical, not theoretical, experience. It is the result of confronting theory with practice.

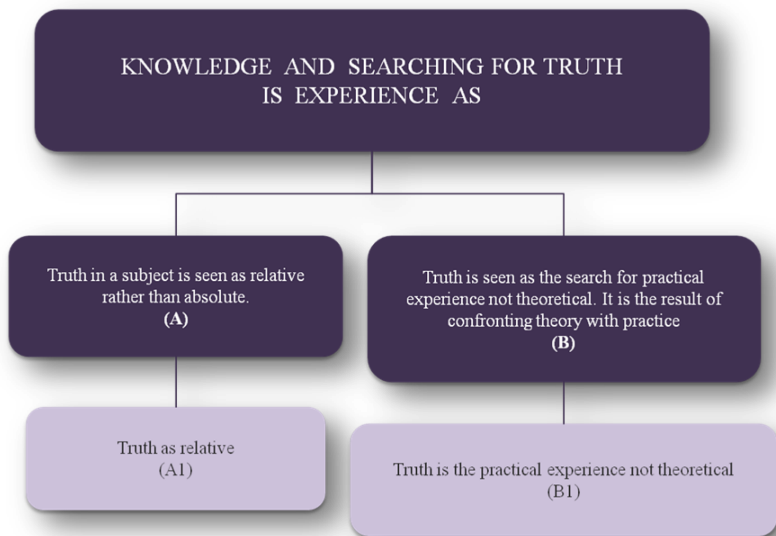
In this category, to verify the truth or falsity of a statement, hypothesis or theory, the criterion of truth lies in social practice (theory and practice). According to this view, scientific theories can be tested in practice. If the theory is successfully applied in practice, this means that it is valid. The procedures for checking this in practice, or that thought may be different, for example, is through experimentation, observation and measurement.

One subcategory has been focused on and discerned by lecturers involved:

a. Truth is practical, not theoretical, experience. In this category only what is demonstrable in practice is true, if it does not work in the real world it is not true.

The knowledge categories and subcategories are next presented as a preliminary outcome space.

Graph 4: Preliminary outcome space: The knowledge categories and subcategories



Preliminar outcome space of face to face sample's various way of experience knowledge and searching for truth

b. Variations

The next tables 31,32,33 and 34 summarizes the variations in the ways of experiencing learning, teaching, information and communication technology in education and knowledge including the referential and structural dimensions of lecturers at the University.

Table 30: Summary of the variations in the ways of experiencing learning including the referential and structural dimensions of lecturers at the University.

LECTURERS' CONCEPTIONS OF LEARNING

CATEGORY A: Learning is seen as a cognitive process of knowledge acquisition.

Experience	**Referential aspect (What)**	**Structural aspect (How)**	**Sample Statement**
A1	Learning as the reception and accumulation of information.	Focus is on seeing the student as a receiver and accumulator of information transmitted by the teacher.	*Subject 11: "What happens is that we understand learning as having two processes - learning and taking in information."* *Subject 3: "First of all the learning process is linked to mental options and as such requires abstraction."* *Subject 6: Learning is the capacity that we all have of applying received concepts to real life.* *Subject 10: Learning is part of life, it is a process of acquiring some basic knowledge.*
A2	Learning as transmitted by teachers.	Focus is on teachers who have the mission of transmitting what they know and the learning is of an accumulative nature.	*Subject 3: "For me to acquire some knowledge means I must somehow undergo a process that moves from outside to inside, from the physical world to the mental world."*

CATEGORY B: A cognitive process influenced by different factors.			
B1	Learning is seen as determined by the fundamental needs of the student.	Focus is on the satisfaction of basic needs, having economic resources and an adequate familiar environment that allows good learning outcomes to be achieved.	Subject 10: *"…some elements that favour the learning process are said to be positive, such as those proceeding from a medium like the individual's having minimum communicative competences, sufficient economic resources for texts and other materials is positive for learning as well as having other basic necessities for learning. All this may seem obvious to researchers in other contexts but here in the university our students do not always have all their basic needs covered, and it is something that we believe can, at any given moment, affect the learning process."* Subject 5: *"The part that has to do with motivation…, external and internal motivations for learning, external factors like domestic problems, the surrounding atmosphere, internal factors like internal motivations, doing it because I want to, because I want to study."*
B2	Learning is seen as influenced by the student's intrinsic motivation.	Focus is on influences of thought processes especially intrinsic motivation, understood as being the interest or pleasure experienced by students through their own learning or through the activities leading to it.	Subject 3: *"…here there are psychological processes in play like motivation, attention, and what is essential is that there is motivation in the process; without motivations or goals we cannot attain what we are seeking …"* Subject: *"This is not a mechanical process; it is not information input and output. It requires motivation and psychological factors."* Subject 11: *"Learning requires cognitive processes and emotional tools in order to gain a knowledge of the world itself"*
B3	Learning as influenced by lecturers' motivation.	Focus is on the impact that lecturers' motivation has on student learning.	Subject 10: *"…we believe that the learning process can be discouraged or slowed down by not being able to simulate the conditions students will encounter in the workplace closely enough in the classroom. The lecturer may lack stimulation, may not feel comfortable in the workplace, may be overworked, there may not be enough time for individual work with students, classes may be oversubscribed or there may be too little time to prepare for them and students may not be able to consciously participate in the process, or even be willing to commit themselves alongside us in the learning process."*

B4	Learning as affected by the academic environment.	Focus is on resources and materials that the university provides to students that enhances good learning and the achievement of good learning outcomes.	Subject 10: *"If only the University had the resources, and the individual too within the immediate environment so as to perform his or her learning process successfully, for example a computer and other resources in the home."*

CATEGORY D: Learning is seen as knowledge management.			
Experience	**Referential aspect (What)**	**Structural aspect (How)**	**Sample Statement**
D1	Learning is seen as knowledge transfer.	Focus is on the capability to put into practice and to apply new knowledge in different and new situations.	Subject 11: *"…learning is taking…transforming, and finally being able to apply that knowledge."* Subject 3: *"…we will know that we have learnt when I can explain the situation or apply it to a new situation, when to a problem comes up that I can transfer what is now knowledge because I have made it mine …"* Subject 3: *"Animals also learn, but the difference is that they neither represent nor construct models or schemes that are typical of humans. This property of taking something abstract and applying it to a specific situation has to be made use of; if I can't apply it, I cannot say that I have learnt it."* Subject 5: *"…and part 3 (referring to the schema), being able to explain, to deliver a final outcome, the part which sounds like learning, when knowledge can be applied in different forms, being able to apply, to interiorize, depending on the subject, it will be shown in one way or another, in some cases in practice, in others by memory."* Subject 5: *"Learning is when the person understands, interiorizes and puts into practice."*
D2	Learning as competence development.	Focus is on the development and strengthening of skills such as teamwork, problem solving, decision-making, communication skills and critical thinking	Subject 2: *"Learning is the students' ability to manage certain elements to solve problems of judgment. Students learn the extent to which they acquire the knowledge and use it in specific cases to solve problems."*

		for good learning.	*Subject 2: "Learning is the student's capacity to handle certain elements to solve legal problems. Students learn to the extent that they acquire this knowledge and use it in specific cases to solve problems"* *Subject 3: "When I achieve to transfer that knowledge to a problem situation. We are always solving problems and we solve them with knowledge. And I know I have learnt when I can apply that knowledge to solve problems."*

CATEGORY E: Learning is seen as an active construction.			
Experience	**Referential aspect (What)**	**Structural aspect (How)**	**Sample Statement**
E1	Learning as a transformation process.	Focus is on actions that guide a change in the student and, therefore, a modification to their behaviour, also on how they conceive, feel and influence the world that surrounds them.	*Subject 3: "A modification in which one always builds his/her schemes, which says constructivism is when we make models to explain the phenomena. There has to be cognitive development, it is something dialectical, there is a contradiction between what I think and the information that I have, then I learn when there is a conflict in our mind, when there is a change in my schemes. If I get in and get out thinking the same thing there is no learning."* *Subject 3: "In regards to transformation of knowledge, knowledge is transformed when it is processed by students and again insofar as they are learning it in a personal and, we might say, collective way. During this transformation not only is the knowledge transformed, so are the individuals because they know something, they know how to do, to say, to behave, they feel something they did not feel before. And in this same process the means are also transformed, how I use a medium to teach how to learn is also the process of transformation".* *Subject 9: "Opening the mind up to a universe of possibilities, to a world of knowledge, to reception from all sources, and then carrying out one's own process, reasoning, and adopting one's position."*

E2	Learning as actions to achieve an evolution of knowledge.	Focus is on the development of academic centres as thinking institutions and on permanent learning. Learning is seen as actions whose purpose is to achieve an evolution of knowledge, not only in the mind of the student, but also in the institution as a "thinking body" in which the student is immersed.	*Subject 1: "The possibility of solving daily problems, the capacity of the human being to perform harmoniously as a citizen in a certain society by taking things from and contributing to the environment, by not just adapting but by collaborating in the transformation of the context and of oneself."*
E3	Learning as the apprehension of knowledge.	Focus is on a higher faculty than simply learning, in which the student has the capacity to extract or understand the essence of a concept.	*Subject 5: "The thing is we understand that learning has two processes – learning and apprehending, which is internalizing and extracting the essential part..."* *Subject 5: "Learning is a process that first requires "grasping and extracting", followed by internalization and finally showing one remembers what was done. This is more extensive and addresses more than the first part, which is just learning."*
E4	Learning as comprehension of the knowledge.	Focus is on the student's ability to grasp a reality and internally assimilate it.	*Subject 7: "Learning means many things. There are several levels of which the highest is when what has been learnt serves to transform my understanding of the world and makes me act differently within the natural and social world (significant learning). Another level is understanding, recognizing concepts but not being able to apply them to daily life. The lowest level is when the concepts are separate from my actions in the world."*

Table 31: Summary of the variations in the ways of experiencing teaching including the referential and structural dimensions of lecturers at the University.

LECTURERS' CONCEPTIONS OF TEACHING

CATEGORY A: Teaching is seen as transmission of knowledge.

	Referential aspect (What)	**Structural aspect (How)**	**Sample Statement**
A1	Teaching is understood as teacher-centred knowledge transmission.	Focus is on the teacher who is seen as transmitting knowledge and the student as a receiver and accumulator of information.	Subject 2: *"The starting point is that the subject must be known. Theory and practice are fundamental. But the subject has to be taught through a master class, presenting problems and solving them and then giving out problems for them to solve. One must give them the techniques so that they know how to solve problems."* Subject 2: *Teaching is the possibility of transmitting an experience, not only laws.* Subject 3: *I teach in an expository way. I teach a master class*
A2	Teaching is seen as a communicative activity.	Focus is on language, which is the means of transmitting knowledge by the creation of interaction and dialogue between the teacher and the student, whose purpose is effective education.	Subject 14: *"We see teaching as a duality that goes hand in hand with learning, where there is a teacher and a disciple, i.e., a double way in which the student takes on the knowledge being transmitted by the teacher. There is an interrelation between both, which we call "mediation" by language."*

CATEGORY B: In teaching the teacher is seen as an expert.			
Experience	**Referential aspect (What)**	**Structural aspect (How)**	**Sample Statement**
B1	The teacher is seen as an expert in their subject area and as source of knowledge.	Focus is on the teacher or lecturer who masters the practical and theoretical competences and who possesses skills.	Subject 11: *"What we are trying to explain is that the teacher needs to have a profile, and that one of the things the person must have is knowledge, but other characteristics as well. It is not enough to be an expert on the subject; he or she must have knowledge of the student, of the thought processes if one is to teach what is to be taught…"* Subject 4: *"The examples given to the engineering students are not taken from theory or from books but from the real lives of each. In engineering one can, as an expert, advise and recommend because one has already travelled that road and knows more about the subject. It is a type of authority that students appreciate most.*
B2	The teacher is seen as the model that is to be observed and imitated.	Focus is on the teacher's job that marks the way and takes the students along it. Inspiring their students. Helping in their learning process. They are responsible for the teaching learning processes in classroom.	Subject 14: *"…there is a profile of a teacher which reveals what is going to be taught, i.e., an expert in the area, somebody who knows the "What", the material of the knowledge, someone who knows the psychology more or less, the scenario in which the person on which the teacher will have an impact is unfolding in our environment …"* Subject 13: *"The teacher becomes the model to imitate. Children learn by imitation"* Subject 9: *"The expert shows the disciples that his behaviour is appropriate. It is a person who knows what he or she is doing, someone with a wealth of accumulated, processed information that can guide." "The expert facilitates the learning process."* Subject 2: *Teaching is the possibility of impressing student, in this way they see us as a model and in this way they learn.*

CATEGORY C: Teaching is seen as mediation.			
Experience	**Referential aspect (What)**	**Structural aspect (How)**	**Sample Statement**
C1	Teaching is seen as mediation among knowledge, cultural practices and learners.	Focus is on teaching as a mediation between knowledge and learners. Lecturers are not the centre of the process but also the mediators among students, teaching context and learning situations with the intention of stimulating and encouraging the development and potential of the student. In other words the lecturer's role is to mediate between students and knowledge to achieve their personal and intellectual development.	Subject 11: *"…basically, we consider teaching as a process of intentional mediation because we said that we can all teach, but that as teachers of that teaching there exists the intention to achieve certain goals. In other words, the ultimate aim of that teaching is not just that the student learns that knowledge but that he or she can function as a person and that this knowledge may help to transform the student."* Subject 3: *"We also emphasize that in teaching there is mediation and that the main mediator is the teacher…"*

CATEGORY D: Teacher is seen as the facilitator of the learning.			
Experience	**Referential aspect (What)**	**Structural aspect (How)**	**Sample Statement**
D1	Teaching is seen as providing the conditions for the free expression of the students' potential.	Focus is on teaching that has a participative character in which the student assumes an increasingly leading role in directing the learning and in which the teacher ceases to be the authoritarian figure who imposes knowledge and who decides what and how things are to be learnt.	Subject 13: *"…what the teacher creates are conditions for learning, in other words, it is the student who learns, not the teacher who teaches."* Subject 13: *"Teaching does not exist..."* Subject 9: *"…To open the mind to a universe of possibilities, to a world of knowledge and to receive of all sources, and then students can make up their own process, give reasons and take a position"*

D2	The teacher is seen as a facilitator of learning, they are the guides.	Focus is on the function of the teacher as to facilitate the conditions in which the students' self-determination capacities can be updated in both the social and individual processes. The teacher is seen as a facilitator that must wait for each student to feel the need to express their values in order to create the conditions that favour that expression. It means accepting that each student is potentially different and, therefore, will manifest needs at different times and in different ways, and this requires a totally individualized attention.	*Subject 13: "...there are influences and there are needs. There are also positive results such as the joy of learning, the joy of teaching on the part of the teacher and on the part of the student that of being autonomous, and on the part of the teacher that of communicating the subject, what he knows from experience and from the theory ..."* *Subject 13: "...teaching also verifies the processes through the conscious attention of the student during the process itself and in this sense it uses materials to guide the teacher's enabling, the positive experiences and the best will possible ..."* *Subject 3: "A good teacher is one who guides this learning."* *Subject 7: "Accompanying is important. We can guide them in the conceptual aspects. It is a help until the learner is able to assess himself."*

Table 32: Summary of the variations in the ways of experiencing information and communication technology in education including the referential and structural dimensions of lecturers at the University.

LECTURERS' CONCEPTIONS ON INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTs) APPLIED TO EDUCATION			
CATEGORY A: ICTs are viewed as uncertain and with skepticism.			
Experience	**Referential aspect (What)**	**Structural aspect (How)**	**Sample Statement**
A1	ICTs are viewed with distrust.	Focus is on the incapability of the ICT to create learning. And on teachers claiming that it does not guarantee quality education unless they are used within a coherent educational model. They are seen as a set of computerized and digital tools whose presence in the various doings of humans, particularly in education, are unquestionable, but that they contribute little or nothing to learning.	*Subject 1: "First we agree that we are skeptical of new technologies; we say "no more PDFs! What this means is that what is available does not help as much as people believe."* *Subject 1: "From what we have seen, the use of technology is mechanical, i.e., to set things up, to set one thing that everybody has to solve at roughly the same speed. We think that is a mechanical way of working and one that does not, of course, solve the problem of teaching"* *Subject 1: "We focus above all on a call for careful use of new technologies, the belief that technologies are the panacea - that is a wall. But a belief has grown, especially in curricular administration, that technologies will solve the problem."* *Subject 1: "I have to see things like these models, these simulations, and I have to adapt them to various complexities and read the different learning processes. That is why the teacher has to know how learning goes on."* *Subject 11: "They are very useful in engineering; they are a means, not an end, to dazzle the students. There is a wealth of information at hand, but one must not forget other resources, like the spoken word, discussions, questions, group*

			work, and presentations."
A2	ICTs are seen here to have more limitations than benefits as a support for learning.	It is not the technologies themselves that are limited, rather their applications. Among these limitations are that they are easily used by many but they are not adapted to the rhythm of learning. They are not taken into consideration for incorporation into educational programmes as people learn in different ways and at their own speed because they do not all have the same cognitive level. Free interaction with multimedia materials by students, which are not always of good quality and are often out of context, can lead to incomplete learning and simplistic, shallow visions of reality. Their use has become mechanical, with some lecturers using them on the basis of out-dated teaching and learning conceptions. Some believe that new technologies are the response to the questions and challenges of today's education, i.e., they are seen as the end more than the means. Finally, the economic costs they entail means that they are not within the reach of many students.	*Subject 2: "I have my doubts. Law databases are complicated. I don't see how they help learning. For me the word is what is most important in learning; I don't use PowerPoint, but I do sometimes show videos."* *Subject 7: "I'm not that convinced. They are an enormous help in communication, especially for distance students, when you can upload information, use forums and emails. But I don't think they help the learning. I believe what Vigostky says: I need the face-to-face, expert-learner, interaction when learning, and I don't see how ICTs can achieve that. I may be wrong. My mind's not closed to this."* *Subject 8: "Mclohan says that means of communication are extensions of the senses but I agree with Rosa Maria Amparo who says that she prefers to use her "Power-Voice" rather than her "PowerPoint" because of its capacity to argue, to discuss, to give examples, to connect with the listeners. Sometimes it is better to write by hand because at times technologies muddle life. I believe that they are important but that ICTs are another point within the learning context and that one needs to look at closely in relation to the cultural context in which they are employed."* *Subject 3: "They help a lot, but it depends on how you use them. For example, I explain things in the traditional way but use software so that students can clarify issues more efficiently. New technologies should be used like new schemas to make students see that they do not solve learning problems. It's something that is being worked on in isolation and that should be integrated among all the actors: lecturers, students and administration."*

CATEGORY B: ICTs are seen as a tool for supporting and enhancing teacher's jobs.			
Experience	**Referential aspect (What)**	**Structural aspect (How)**	**Sample Statement**
B1	ICTs are seen as a support for the activities performed by teachers outside the classroom.	Focus is on helping lecturers to prepare their classes, carry out research and to perform administrative tasks. Academic activities that used to be carried out in a rudimentary way are today performed rapidly, agilely and with better quality thanks to the functional nature of ICTs. This has saved lecturers from having to undertake repetitive, monotonous and routine tasks and has meant an increase in productivity and enhanced teaching and research management.	*Subject 9: "...for me the question is also, what have I learn from the new technologies? (Facilitator: It serves both uses). Yes, both, of course, and I immediately thought about how it had helped me, for example, in my research, the many ways it has helped me and the many things I've been able to access, thanks to the Internet."* *Subject 12: "They help in visualizing things that before were not possible to visualize, such as mathematical functions or drawing surfaces. They also help in information seeking, but they should not be abused. That is bad. One should not become mechanical."* *Subject 1: "They create pleasant environments that invite expression in spaces, using ICTs in a personalized, human way."*

CATEGORY C: As a positive, they are a help to learning and teaching.			
Experience	**Referential aspect (What)**	**Structural aspect (How)**	**Sample Statement**
C1	ICT is seen as a tool for enhancing communication between teachers and students.	Focus is on ICTs as a support for face-to-face teaching. Focus is on new channels of communication with students via email, forums, chats, news and mailing lists that encourage teacher– student interaction.	*Subject 1: Creating warm environments that invite them to express themselves via the use of technology* *Subject 6: Widening boundaries, showing facets of different realities, being able to communicate and see each other, and for others to give their opinions..* *Subject 7: They provide great help in the aspect of communication. Especially for those students who are not on-campus to be able to upload information for them, be involved in forums, send emails.*
C2	ICTs are understood as an opportunity to improve teaching.	Focus is on the creation of educational multimedia materials, which can make the delivery of content more dynamic on account of its multi-sensorial nature. Likewise, interaction through forums, emails and chats favour the creation and enhancement of communication and collaboration skills. Focus is also on different alternatives for teaching, e.g. online tutorials in real time or asynchronously, visual aids when presenting e-content. Teachers can	*Subject 4: "They help tremendously. They can use software to practice something over and over again, and that cannot be done in the classroom, where things can only be done once. They can be used for simulations, for recording classes."* *Subject 10: "Tremendously. They open up new modes of access. Especially for young people, who we cannot teach with the methodology of the last century. Using technologies to serve the subjects is one more tool."* *Subject 5: "I use new technologies in my classes and we have interactive projects; we have used software and multimedia educational materials, educational videos with good results. New technologies do work; they have worked very well with my students."*

		back up their comments, their master classes, their role playing exercises and explanations about certain procedures with all types of resources, graphical representations, images, presentation programmes, multimedia materials, camcorders, educational software and Internet resources. They can also be used as a tool for underpinning arguments taken from the online press or to upload class content onto the course website. Using videos, cd rooms, reusable digital content, webpages, applets or virtual learning sessions promote learning and provide new opportunities for enhancing teaching and learning inside the classroom.	
C3	ICTs are understood as being useful for learning.	Focus is on enabling the students to improve their skills by helping them to perform their learning tasks and activities; because they facilitate the understanding of concepts, because they speed up searching for and accessing information and because they allow for collaborative work. The access to databases, e-journals and	*Subject 11: "We believe they help because they can speed up knowledge, for example, architects use AutoCAD to do things that used to take a lot of time"* *Subject 11: "They help to motivate learning, they mark out the learning and that allows information to be exchanged and confronted, to exchange information with other people in other parts of the world"* *Subject 11: "The new technologies allow hitherto unimaginable access, but one only learns if one wants to learn."* *Subject 6: "They extend the frontiers, they reveal facets of other realities; we can communicate visually and hear the opinions of others."*

		software for graphic representation of concepts, such as Cmap Tools or MindMap, significantly helps the student in the knowledge construction process.	Subject 5: *"We would never finish. They help with all the information one can get; it is limitless; it covers all styles of learning. One can get to know other cultures; they close the gap with the rest of the world; they are a way of reaching young people; software helps in learning with its immediate responses, its deciding of what is and is not of interest. It has no limits in the help it can give the students in their learning today."*

Table 33: Summary of the variations in the ways of experiencing knowledge including the referential and structural dimensions of lecturers at the University.

LECTURERS' CONCEPTIONS ABOUT KNOWLEDGE

CATEGORY A: Truth in a subject is seen as relative rather than absolute.

Experience	**Referential aspect (What)**	**Structural aspect (How)**	**Sample Statement**
A1	Truth as relative.	There is no way of understanding reality but many ways of appreciating it and understanding it, and each allows us to see it from different angles, and so in some way in a more complete manner. Here truth is subjective, not absolute, and it is changeable. This perspective differs from the positive paradigm that seeks absolute truths.	Subject 11: *"There is no absolute truth within a subject because it depends on historical contexts. It is the duty of all sciences to understand human problems, but it is not an absolute truth."* Subject 5: *"The search for truth is difficult because what is true today may not be true tomorrow; it changes with time; it is relative. Hence, it cannot be totalitarian. The only truth is God"* Subject 10: *"Truth should not be sought in a subject or a science. These are human products; there are instead many truths and paradigms, and since human beings change, there is no single truth."* Subject 1: *"Truth is relative and it has changed over time. And it changes because of the actions of skeptics. It has a duality that needs to be taken into*

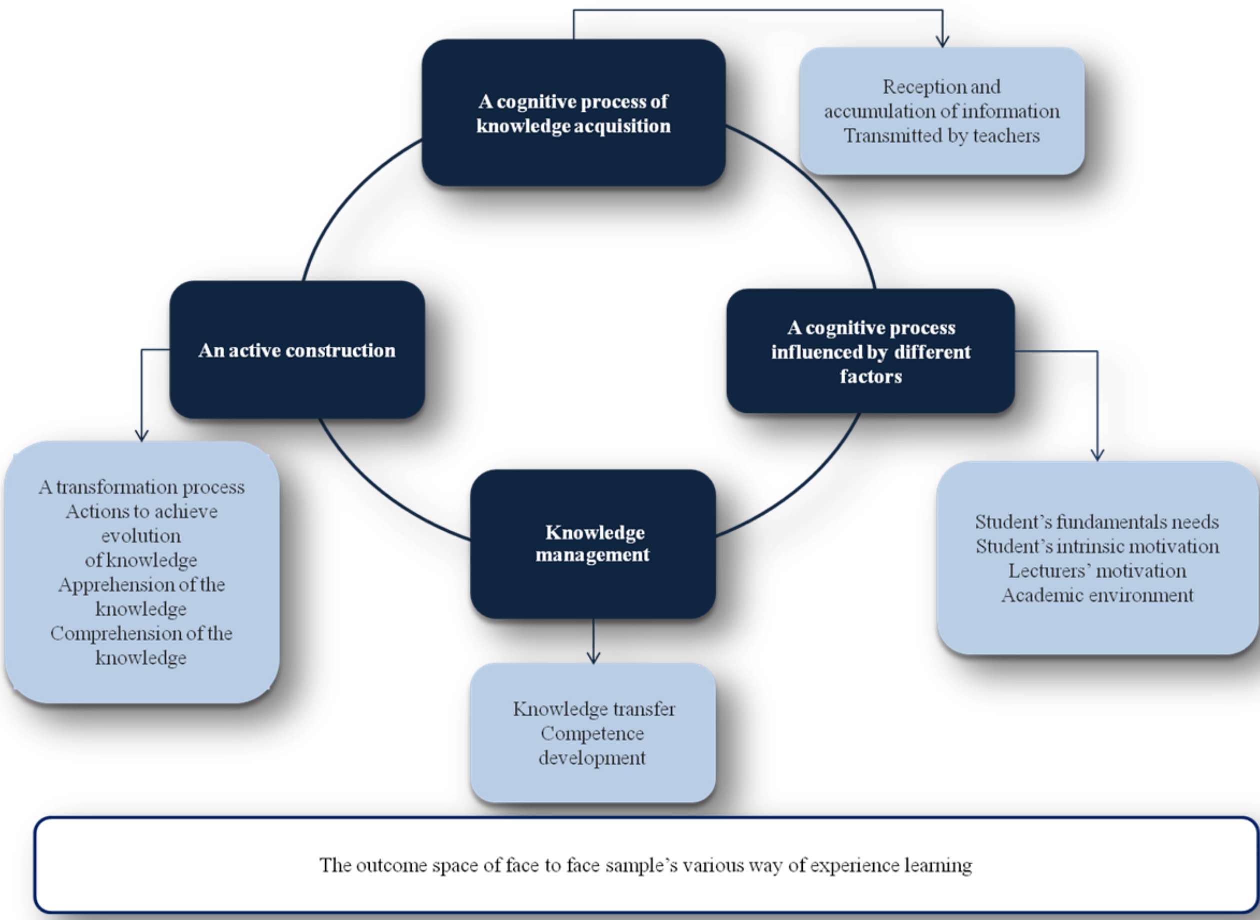
			consideration when tackling new knowledge." Subject 12: *"Truth is not absolute. It is relative. It changes."* Subject 7: *"When people talk of truth, they are thinking that there is only one way of researching and that this way leads to unique knowledge; it is a positivist concept. I do not share these views. I do not believe in a sole truth, rather that there are many and they depend on the context."* Subject 3: *"Truth is relative, absolute truths are God's truths, as Giambattista Vico says.*

CATEGORY B: Truth is seen as the search for practical, not theoretical, experience. It is the result of confronting theory with practice.			
Experience	**Referential aspect (What)**	**Structural aspect (How)**	**Sample Statement**
B1	Truth is practical, not theoretical, experience.	In this category only what is demonstrable in practice is true, if it does not work in the real world it is not true.	Subject 6: *It is facing reality with real experiences, applying some knowledge and concepts chords with the experience needed to deal with life and times, that's truth for me.* Subject 9: *Truth is collecting, processing and transmitting information. Guiding students to information that they can manage and seeing the importance as professionals. It is not a philosophical quest.*

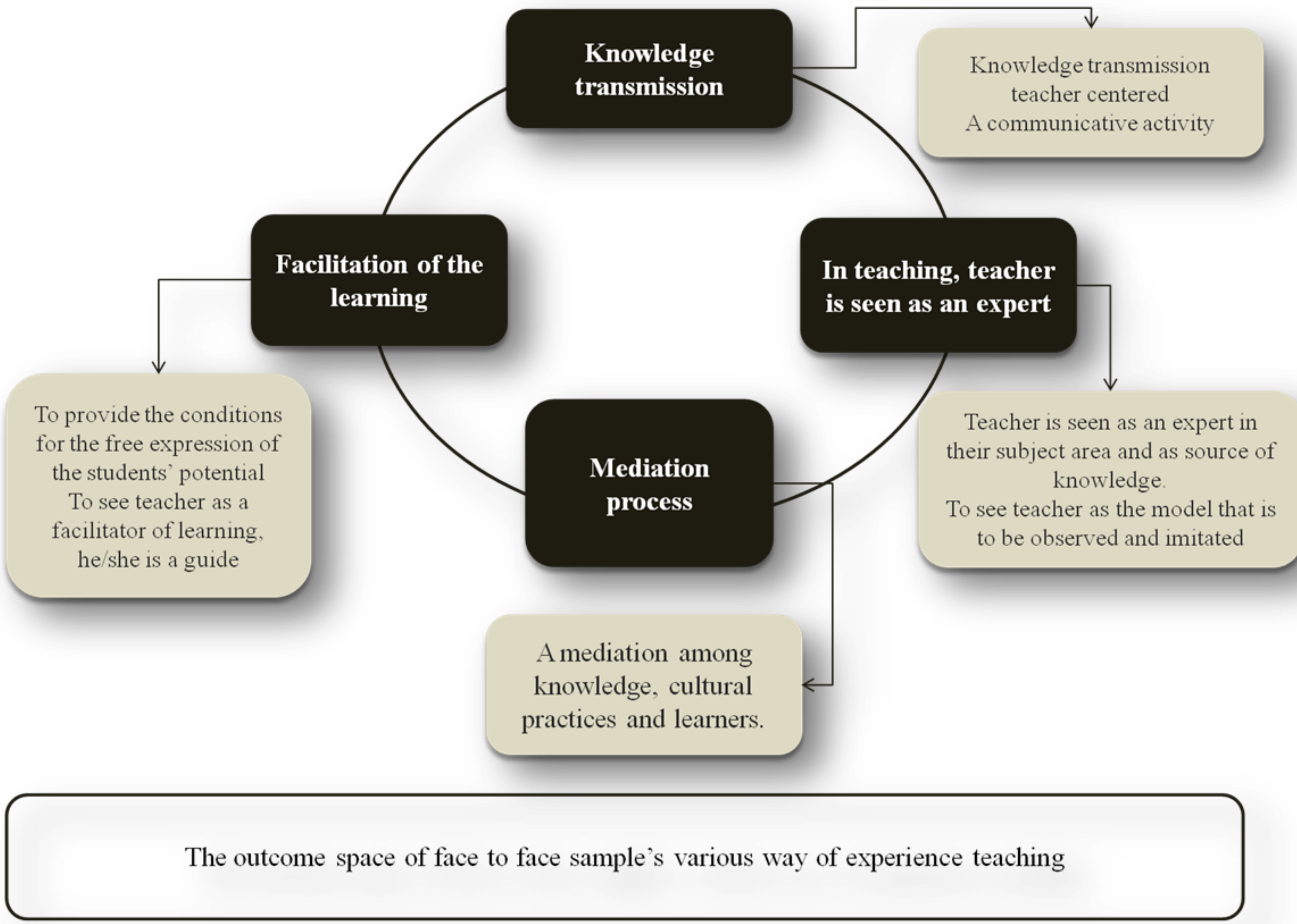
c. Outcome space

The answer to the question about what kind of global view can be constituted from various ways of experience learning, teaching, information and communication technologies, (ICT) and knowledge is given next in the form of a definitive outcome space (See Graphs 5,6,7 and 8)

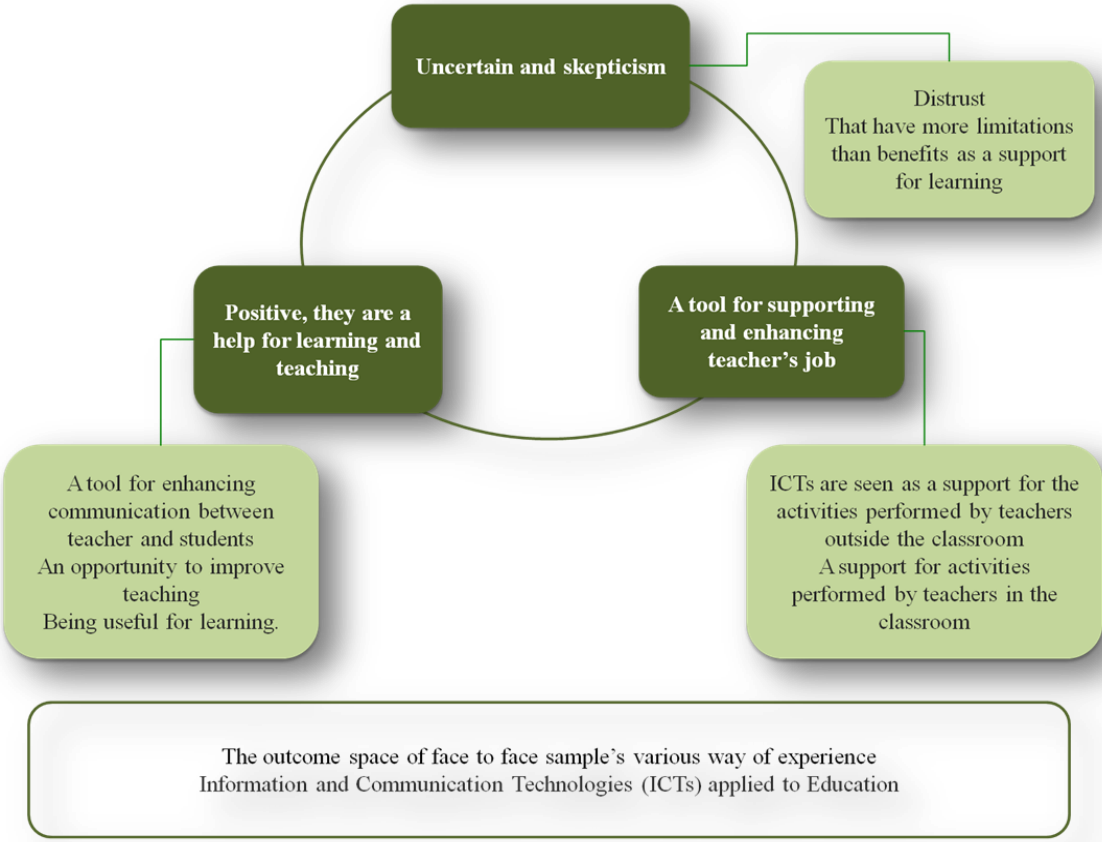
Graph 5: Outcome space of various ways of experience learning



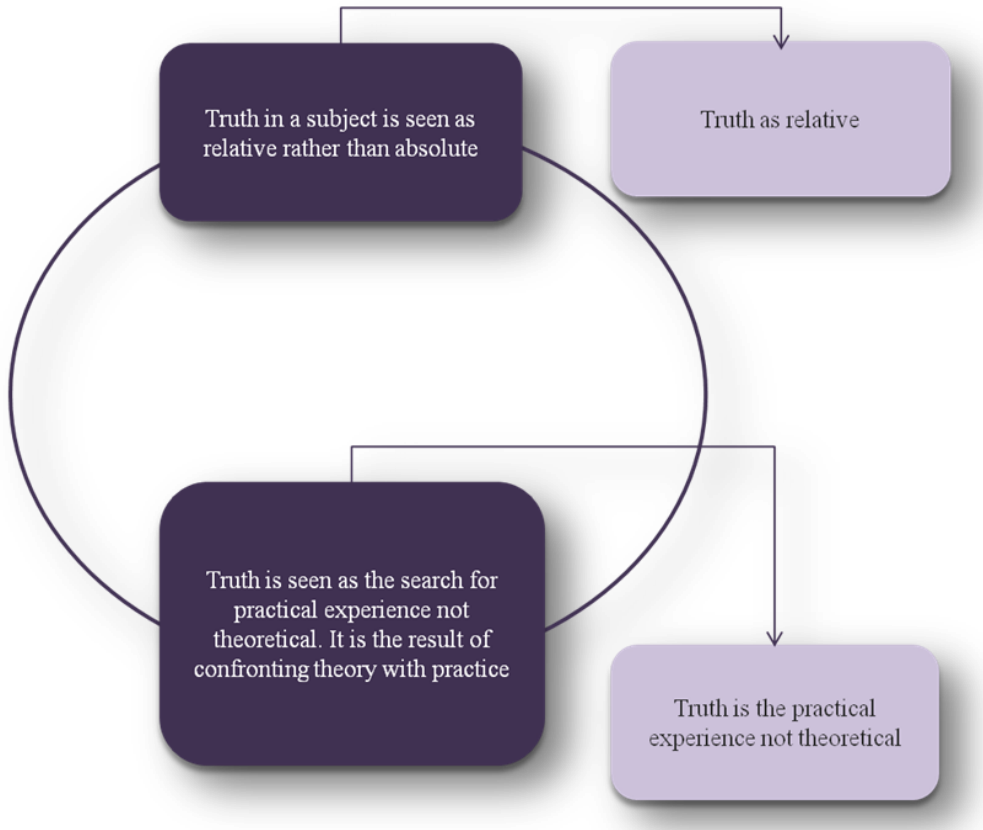
Graph 6: Outcome space of various ways of experience teaching



Graph 7: Outcome space of various ways of experience Information and Comunication Tecnology



Graph 8: Outcome space of various ways of experience knowledge



The outcome space of face to face sample's various way of experience knowledge and searching for truth

CHAPTER FIVE

DISCUSSION

5.1 Introduction

In order to promote a change to lecturers' beliefs about teaching and learning, and consequently an improvement in their teaching that encourages students to take a more sophisticated approach to learning to understanding their subjects, I explored the relationships between the epistemic beliefs about teaching and learning and the approaches to teaching in a group of lecturers at the Universidad del Norte in Colombia.

To access the knowledge and the distinct experiences about teaching and learning from those lecturers, I implemented a methodology (Fazey et al., 2005) that comprised qualitative and quantitative research techniques including participation in a face-to-face and in a online intervention in order to develop a shared group understanding of teaching and learning and to provoke a change of beliefs.

My hypothesis is that teachers hold a variety of epistemic beliefs (Hofer, 2001). At the same time, they experience the various teaching and learning situations in a certain way (Marthon & Booth, 1997). These beliefs and these experiences influence their conceptions about teaching and learning (Trigwell & Prosser, 1999). These conceptions of teaching and learning, in turn, have an impact on the approach the adopt to teaching (Trigwell & Prosser, 1996). Therefore, in order to change the way they conceive teaching and learning (Trigwell, 1995; Trigwell & Prosser, 1996), and to consequently change how teachers teach, we have to first understand how they conceive teaching and learning and then we have to understand the way in which they experience those things.

What I expected at the end of the research was to:

1. Establish whether there was a relationship between lecturers' epistemic beliefs and approaches to teaching.
2. Develop, through collaboration among peers, a shared understanding of learning, teaching and information and communication technology that will lead to changes in epistemic beliefs, and;
3. Confirm whether changes in epistemic beliefs lead to changes in approaches to teaching.

There were five variables that I measured and correlated:

1. Epistemic beliefs about certainty of knowledge
2. Epistemic beliefs about justification for knowing: Personal
3. Epistemic beliefs about source of knowledge: Authority
4. Information Transmission/Teacher-Focused Approach (ITTF)
5. Conceptual Change/Student-Focused Approach (CCSF)

This study was underpinned by two research perspectives: the epistemic metacognition and phenomenography. They represent two distinct but interrelated ways in which teachers conceptualize teaching and learning (Cano, 2005; Hofer, 2004; Moore, 2002).

Research in epistemic metacognition refers to the metacognitive employment of epistemic theories. These theories state that individuals develop a variety of beliefs about knowledge. The nature of these beliefs has the tendency to change from objectivist approaches to relativistic approaches, or in other words, from naive type of beliefs to more sophisticated types. Now, these beliefs have an influence on understanding, learning and teaching (Hofer, 2000). Most of the models proposed have declared that beliefs change according to permanent developmental stages (Perry, 1970: King & Kitchener, 1994). Others see it as a system of more or less independent epistemic beliefs (Schommer, 1990). The model I have used in my thesis is a more alternative and inclusive one, the "epistemic theories" by Hofer (2004) also named “epistemological theories” as previously called in Hofer & Pintrich (1997) and in Hofer (2002), which states that the individual beliefs about knowledge and knowing are organized inside personal theories, as related propositions structures which are connected and articulated with others. According to Hofer (2000) people hold theories on four essential dimensions of knowledge and knowing: Certainty, Simplicity, Source of Knowledge and Justification of Knowledge. Theories of the individuals on each of these dimensions span a scale moving from a naive, objectivistic view of knowledge, to a sophisticated, relativistic view of knowledge. For example, those individuals that have the tendency to understand knowledge in an objectivist way believe that knowledge is certain and simple, that knowledge’s source is external or rather comes from some kind of authority and that knowledge is self-evident and thus, it does not need any justification at all. On the contrary, those people with the tendency to understand knowledge in a relativistic manner will not believe that anything or something can ever be known with absolute certainty, take knowledge as a complex concept and believe that knowing something means accepting multiple perspectives. Moreover, they declare that the source of knowledge needs to be justified to reach the status of knowledge. To measure epistemic beliefs in teachers Hofer (2000) developed the Discipline-Focused Epistemological Beliefs Questionnaire (DEBQ). It is an instrument of four scales and 27 items on a 5-point Likert scale (1=strongly disagree; 5=strongly agree). I used this instrument in my research.

From the interpretative point of view, phenomenography asserts that a particular phenomenon, for example, teaching or learning, may be experienced in a limited number of ways that are qualitatively diverse. These different ways of experiencing may be expressed hierarchically, building in complexity (Marthon & Booth, 1997). A second principle states that to understand how people handle different situations, we need to understand the manner in which they experience these situations. According to this principle, the ability of people to act in a certain way depends upon their ability to experience these situations in a certain way. In other words, we act in relation to the way in which we experience the world (Marthon & Booth, 1997). The most important result in a phenomenographic research study is to reach the different manners of experiencing a phenomenon. These ways are presented in descriptive categories and as an outcome space. The teaching approaches were the result of a phenomenographic study with university science lecturers (Trigwell, Prosser and Taylor, 1994). The authors of this study identified two different ways of experiencing the teaching process. Two fundamentally different approaches to teaching: Information Transmission/Teacher-Focused Approach (ITTF) and Conceptual Change/Student-Focused Approach (CCSF) (Trigwell, Prosser & Taylor, 1994). ITTF is one in which the teacher adopts a teacher-focused strategy, with the intention of transmitting information about the discipline notes to the students (Prosser & Trigwell, 1999; Trigwell & Prosser, 1996, p. 80). CCSF is one in which teachers adopt a student-focused strategy to help their students change their world views or conceptions of the phenomena they are studying. This approach is related with good teaching practices and it is also associated with higher quality learning results. Afterwards, the authors designed the Approaches to Teaching Inventory (ATI) to capture the qualitative differences in approaches to teaching reported by the teacher in a particular context (Prosser & Trigwell, 1999). I used this instrument in my research.

I used the DEBQ and the ATI with my sample. Additionally, I used phenomenography as a technique to understand the experience of the teachers from the university in the areas of teaching, learning and information technology.

5.2 Summarizing the principal findings

5.2.1. Factor Analysis and Internal Consistency of ATI and DEBQ

a. Approaches to Teaching Inventory (ATI)

The factor analysis done with the ATI confirmed the two factors proposed by Prosser & Trigwell (1996, 1999). The interpretation of the two factors was consistent with literature on the ATI. The results of the analysis supported the use of the two factors as separate scales, as suggested by the authors (Trigwell & Prosser, 1996; Prosser & Trigwell, 1999;

Trigwell & Prosser, 2004). In general the scales have a good internal consistency and can be considered reliable with our sample (N=111) because the two-factor structure showed that individual variables loaded highly on the different factors for the sample, and it was reasonable to use the same labels to name the factors.

Factor 1: Information Transmission/Teacher-Focused Approach
(10 items: 1, 2, 4, 6, 9, 10, 11, 12, 16, 19)
Factor 2: Conceptual Change/Student-Focused Approach
(7 items: 7, 13, 17, 18, 20, 21, 22)

b. Discipline-Focused Epistemic Beliefs Questionnaire (DEBQ)

Three factors of the DEBQ remained after a factor analysis. To a limited degree, the results of this factoring fit with the literature on the DEBQ and supported the use of three factors as separate scales as suggested by the author (Hofer, 2000). Factor 4 "Perceived Attainability of Truth" as conceptualized by Hofer (2000) and Hofer & Pintrich (1997) emerged with a low eigenvalue and it was released. Because the three-factor structure showed that individual variables loaded highly on the different factors for the sample and it was reasonable to use the same labels to name the factors.

Factor 1: Certainty/Simplicity of Knowledge (seven items: 2, 4,5,7,9, 18, 24)
Factor 2: Justification for Knowing: Personal (five items: 12, 15, 21, 22, 23)
Factor 3: Source of Knowledge: Authority (two items: 25, 26)

5.2.2 Correlations

Relationships were found between variables, although these correlations were not very strong. Medium, positive correlations were found between Information Transmission/Teacher-Focused Approach and epistemic beliefs dimension certain/simplicity of knowledge. Also a small, negative correlation was found between Conceptual Change/Student-Focused Approach and epistemic beliefs dimension certain/simplicity of knowledge, and a small, negative correlation was found between epistemic beliefs dimensions justification of knowledge and certain/simplicity of knowledge.

5.2.3 Impact of the interventions

The online intervention had an impact on teachers' approaches to teaching. There was a statistically significant decrease in the ITTF scale from pre-test to post-test. There was a large effect size. As approaches to teaching and epistemic beliefs are correlated, this result indicates the possibility of a change from naive beliefs towards a more sophisticated one. It also indicates the possibility of changing approaches to teaching through a short-term intervention.

5.2.4 Disciplinary differences

Regarding disciplinary differences in approaches to teaching and epistemic beliefs, analysis indicated that lecturers did have different perceptions. There was no statistically significant difference between genders and between years of experience.

5.2.5 Variations and outcome space

There are variations in lecturers' ways of experience learning, teaching, ICTs and knowledge. As a consequence, there are differences in the structure of their conscience in relation to these phenomena in the academic context. The description of lecturers' experiences of learning, teaching, ICTs and knowledge in face-to-face intervention show 13 qualitatively distinct categories of descriptions were found:

4 categories of descriptions were found on the way of experiencing learning.
4 categories of descriptions were found on the way of experiencing teaching.
3 categories of descriptions were found on the way of experiencing Information and Communication Technologies.

2 categories of descriptions were found on the way of experiencing knowledge.

Also 13 holistic views were constituted in the form of an outcome space from the various ways of experiencing teaching, learning, ICT and knowledge, of the lecturers at Universidad del Norte. They show that:

a. Lecturers' ways of experiencing learning is a compound made up of knowledge acquisition, influenced by different factors, knowledge management and active construction.
b. Lecturers' ways of experiencing teaching is a compound made up of knowledge transmission, the lecturer being seen as an expert, mediation and facilitation of the learning.
c. Lecturers' ways of experiencing ICT is a compound made up of uncertainty and skepticism, as a tool for supporting and enhancing teacher's job, as positive, as being a help to learning and teaching.
d. Lecturers' ways of experiencing knowledge is a compound made up of being relative rather than absolute, the search for practical -not theoretical- experience, the result of confronting theory with practice.

5.3 Analysis and discussion of the study findings

5.3.1. Correlations

I found correlations between epistemic beliefs and approaches to teaching, although they were not very strong. Medium, positive correlations were found between Information Transmission/Teacher-Focused Approach and epistemic beliefs dimension certain/simplicity of knowledge. Also a small, negative correlation was found between Conceptual Change/ Student-Focus Approach and epistemic beliefs dimension certain/simplicity of knowledge, and a small, negative correlation was found between epistemic beliefs dimensions justification of knowledge and certain/simplicity of knowledge. What do these correlations mean?

The positive correlation between the variables Information Transmission/Teacher-Focused Approach (ITTF) and certainty/simplicity of knowledge indicate that those teachers that see teaching as transmitting information to the students about their subjects also see knowledge as fixed (a pre-established knowledge base acquired through an expert via transmission and reconstruction), certain and simple. They hold the beliefs that absolute truth exists with certainty and also view knowledge as an accumulation discrete, concrete and knowable facts. One example of a belief about knowledge as a certainty is what Legal Departments often teach in Roman Law courses. In one of my interviews, a lecturer of Roman Law declared: "*there is no such a thing as a relative truth in Law…*" then he said*: "…from the cognitive perspective on legal issues, legal norms have their own context, their own reason of being, their own explanations and sources of knowledge… therefore, one can reach the truth"*. Teachers that adopt the strategy of information transmission are generally more focused on their students knowing the facts and the constructs but not the relationships among them (seeing knowledge as highly interrelated concepts and facts is necessary for a deeper understanding of the subjects). Lecturers that approach their teaching as a transmission of information consider the prior knowledge of students being less important and it is assumed that students do not need to activate theses during learning and teaching processes.

The negative correlation between the variables conceptual change/student-focus and certain/simplicity of knowledge indicate that those teachers that see teaching as an instrument for the conceptual change of their students also believe that knowledge is not simple but complex, situational, relative and contextual. Furthermore, they see knowledge as tentative and evolving which means that knowing is to be open to new interpretations and to the possibility that their theories may be modified by genuine interchange. One example of a belief about knowledge as situational, relative and contextual is what Psychology departments often teach in Introduction to Psychology courses. In one of my interviews, a lecturer of Psychology stated: *"there is no such a thing as an absolute truth in any discipline because each discipline depends upon historical contexts"* Afterwards, she illustrated her statement by giving us, as an example, the Freudian Theories which today have been reappraised but, when established some years ago, were considered as the *"unique and sole truth"*. Those teachers see knowledge as highly interrelated concepts, relative, contingent, and contextual. Teachers that adopt the strategy of conceptual change are those who seek to change the students' knowledge from being superficial to a more academic and deeper one. They focus on what students do in different learning situations. They see students as responsible for their own learning to construct a new point of view or conception. Teachers understand that they cannot transmit a new perspective or conception.

The negative correlation between the variables certain/simplicity of knowledge and justification of knowledge indicate that those teachers that see knowledge as certain, simple, fixed and concrete, as an accumulation of facts, and believe that absolute truth exists with certainty, also justify knowledge through observation, individual opinion, firsthand experience, and when knowledge is uncertain, on the basis of what feels right. Also it indicates that those lecturers who understand or view knowledge as complex and relative, justified their idea of knowledge through rules of inquiry and begin to personally evaluate and integrate the views of experts understand knowledge as tentative and evolving. They are open to new interpretations and to the possibility that their theories may be modified by genuine interchange. They also see knowledge as highly interrelated concepts, relative, contingent, and contextual.

These results confirm the findings of a significant number of research studies that support the connection between teaching practices and teachers' beliefs and conceptions (Martin & Balla, 1991; Dall´Alba, 1991; Samuelowicz & Bain, 1992; Trigwell et al., 1994; Trigwell & Prosser 1996b; Trigwell et al., 1999; Kember, 1997, 2001; Hofer, 2000; Bain, 2000; Goddard et al., 2000; Brownlee, 2001, 2003, 2004; Brownlee et al., 2001; Bell & Linn, 2002; Berthelsen et al., 2002; Chang, 2004; Chan & Elliott, 2004; Brownlee & Berthelsen, 2004 ; Sinatra & Kardash, 2004; Norton et al., 2005; Kang & Wallace, 2005; Lidar et al., 2006; Cheng et al., 2009; Wong et al., 2009; Wong, 2009; Aypay, 2010; Hernandez Pina et al., 2010; Brownlee et al., 2011; Roth & Weinstock, 2013).

Brownlee (2001, 2003, and 2004) and Brownlee et al., 2001 found that teachers with relativistic epistemological beliefs (more sophisticated) are more likely to conceive of teaching as transformative (constructivist) and facilitating rather than transmissive. Berthelsen et al. (2002) and Brownlee & Berthelsen (2004) also found that early childhood teachers who hold relativistic beliefs and who are reflective about their own knowledge were more likely to engage in constructivist practices and seek to develop active teaching even with very young children. On the other hand, early childhood teachers who hold dualistic beliefs about learning and knowing, that knowledge is absolute and certain, were less likely to seek out new learning or reflect on their current practices. They were more likely to view teaching and learning as a transmissive approach assuming that children learn only from the direction and instruction of knowledgeable others. Bell & Linn (2002) reported that teachers with unsophisticated epistemic beliefs (simpler and naive) conduct less challenging classrooms and have less tendency towards the encouragement of teaching with a framework in high levels of epistemological comprehension. Thus, the encouragement of this kind of understanding is associated with the student-centred method of teaching. Chan & Elliott (2004) reported in their findings that epistemological beliefs have influences on teachers' judgements related to choosing which knowledge is important to share in particular learning situations. These epistemological beliefs have an influence on the way teachers process and hold back specific information. Likewise, this has an influence on the manner in which they deal with the teaching process. For example, when teachers have prevalence for objectivist beliefs and knowledge is a concept considered as true, transferable with no need to neither justify itself nor criticize it, there is a higher probability employing having the teacher-centred method of teaching. On the contrary, teachers with evaluativists beliefs (more sophisticated) view knowledge as a process of construction based on evidence and so, there are higher probabilities that their teaching approach will be a student-centred towards conceptual changes. Lidar et al., (2005) found that the classrooms of teachers with more sophisticated personal epistemologies involved a greater number of epistemological moves, consisting of cognitive activities designed to promote deeper learning and reflection, including generating, constructing and re-constructing. They also reported that the relative success of different epistemological moves largely depended on contextually-specific factors such as student knowledge, complexity of activity, and sophistication of students' conceptual understanding. Lawson, Fazey & Clancy (2007), in a study into university lecturers' belief systems and teaching approaches, found that teachers who focus their teaching on conceptual change have more sophisticated beliefs about the justification of knowledge. They also found that teachers who saw teaching as the transmission of knowledge held simpler epistemological beliefs about the certainty of knowledge, attainment of knowledge and source of knowledge. Wong (2009) found that teachers who believe that they possess knowledge and that this does not change spend more time trying to transmit that factual knowledge to their students than designing their teaching to kindle their students desire to explore the subject and to learn independently and critically. Teachers holding the belief that innate intelligence determines how much and how quickly something can be learnt will not see the necessity to help students to develop learning and meta-cognitive skills. Aypay (2010) studied teachers' epistemological beliefs and their teaching and learning conceptions, finding that future teachers who hold sophisticated epistemological beliefs use objects of teaching that are congruent with those beliefs. Specifically, teachers who saw science as a developing knowledge and learners as a seeker of answers to their own questions focus their teaching aims towards helping students to learn scientific knowledge and to develop the necessary thinking skills for scientific research. Those who consider science as facts, i.e., they hold simple epistemological beliefs, put more emphasis on thinking skills related to science. Hernández Pina & Maquilón (2012) found that the perception of the teaching context that primary school teachers have determines, or at least conditions, their way of teaching, their approaches, the way they structure their teaching, and their involvement with the students and the institution. Weinstock & Roth (2013) reported in their findings that teachers with more advanced epistemological beliefs view or understand knowledge as a subjective concept that requires an active construction. These teachers show a tendency to accept and encourage autonomous processes in the student learning process. Therefore, the concept of autonomy is related to epistemological beliefs with more advanced and relativistic characteristics. Autonomy is an ability that requires attitudes and actions involved with the act of assuming responsibilities, making decisions, as well as to act in an independent manner towards our own learning process. Extending this concept, it is possible to declare that focusing teaching approaches towards the development of autonomy represents a student-centred teaching method. This could give students the opportunity to experience a more profound approach towards the learning of their own subjects, among the other benefits.

In contrast, some other studies of authors such as Schraw & Olafson (2002) and Olafson & Schraw (2006) reported no relationship between personal beliefs and teaching approaches. They reported that teachers with relativist beliefs around knowledge, who value the individual construction of knowledge, used traditional teaching techniques with a passive methodology. Their findings suggest that teachers believe in student-centred, contextualist classroom practices but frequently opt for teacher-centred, transmissional practices to accommodate the demands placed upon them by their institution's principals, district, policymakers and students, and that most teachers adopt a teacher-centred, transmissional view of teaching even though sometimes they rarely support this position in theory. The possible barriers that the author mentions include the lack of experience, limited instructional time, mandated curriculum and testing, administrative obstacles, and the lack of a supportive school culture.

Schraw & Olafson (2002) assert, for instance, that new teachers have little explicit knowledge of their own epistemic beliefs, thus, it may be more difficult to use one's world view to guide classroom practice. They also state that teaching is affected by external constraints that teachers have little or no control over, so although teachers possess a clear understanding of their personal beliefs, they may be quite limited with respect to implementing classroom practices in line with these. Most new teachers are trained to be contextualists, constructivists, relativists and student-centred but when they get into the classroom they have to be realists in practice due to current mandates and testing requirements. Teachers often do not have time to explore their own beliefs or develop teaching practices to support more learner-centred beliefs as they comply with traditional standards and deal with the deficiencies of the system. Kang & Wallace (2005) also found that a teacher's naive epistemological beliefs are clearly reflected in their teaching practices. However, a teacher's sophisticated epistemic beliefs are not always clearly connected to the practice. This is related to the necessary negotiation among their epistemic beliefs, teaching contexts, and instructional goals. According to Hernandez-Pina et al., 2012 inconsistencies between teachers' beliefs (espoused theories of action) and teachers' practices (theories in use) should be taken seriously.

What I think is that although there is robust material from the results of research and studies that show a significant correlation between epistemic beliefs and teaching approaches, there are some other studies that show inconsistencies in their findings between teachers' beliefs and teachers' practices, even more than I had expected. These results highlight the existence of barriers that teachers face in translating their beliefs into practice such as: the lack of teacher understanding about their own beliefs (Hockings, 2005; Gibbs, 1992). If we want to enhance teaching and learning quality through training for teachers this needs to be taken into consideration.

My view is that there are incongruences between what teachers say and do. As Hofer (2002) said, "*there is a long history in psychology of finding that attitudes do not conveniently predict behaviour and a host of reasons why the move from cognition to action is not a straight path. The absence of congruence between espoused theory and theory in use (Argyris & Schon, 1977; Argyris, 1980) is a problem in many professions, not just education*". It is possible, then, as declared by Norton et al., (2005), that teachers' intentions thus reflect a compromise between teachers' concepts of teaching and their academic and social contexts. However, although solving the considerable dilemma of the disjunction between the stated aims and educational practice is not the objective of this research study, I do believe that consistency between belief and practice is critical and will help in the understanding of the process of enhancement of effectiveness in the teaching and learning processes (Trigwell & Prosser, 1996a). When belief and practice are congruent (e.g. contextualist beliefs and student-centre-approach-to-teaching) a teacher is able to move fluidly between practices. This would mean that congruency is a requisite for developing an effective teaching method (Olafson & Schraw, 2006). If teachers use teaching strategies not consistent with their intentions as teachers, or, indeed, not consistent with the evaluation system used, then their students will be unable to focus their learning process in an adequate way (Hernandez-Pina et al., 2012).

The transmission model of teaching or, direct instruction pedagogy, which emphasizes the transmission of contents by an expert and represents a more passive kind of instruction, include strategies that are still valid and current today. These strategies are widely used in today's on campus courses at all universities worldwide (Laurillard, 2005, pg. 174) Teachers used these strategies acting with conviction or following an administrative order. However they are only as good as the input from the experts they are based on. In the lecture class model, knowledge construction and understanding takes place but it is a process limited by the expert's knowledge, which constrains the quantity and quality of information. In reference to this model, Biggs (2003) and Vermunt & Verloop (1999) suggest that, regardless of the reasons behind the selection of a transmission model of teaching, a teacher should aim to be a teacher focused on the learning process that helps students in the construction of knowledge.

My view is that a teaching method focused on conceptual change, and a learning process focused on the student, collaborates in giving the students a deeper and more active approach to their learning process. Coffey & Gibbs (2002) found that teachers who adopted a student-focused approach reported using a wider repertoire of teaching methods than teachers who adopted a teacher-focused approach did. Trigwell et al. (1999) demonstrated that students whose teachers adopted a student-focused approach according to their scores on the ATI were more likely to show a deeper approach to learning, and less likely to show a surface approach to learning, than students whose teachers adopted a teacher-focused approach.

Regarding the barriers that teachers face in putting their beliefs into practice, change should begin through actions taken by the institution. These changes should integrate or combine as many factors as is possible, such as: context, motivation and cognitive aspects (the different knowledge structures and ways of teacher thinking). On the other hand, I believe that the encouragement of a teaching culture where teachers support one another in their professional development is required. A strategy that supports this teaching culture includes sharing the metacognitive processes each teacher goes through when preparing a class and as they make pedagogical decisions. Another strategy is using teacher formation not only to develop more sophisticated beliefs about practice and instruction for a deeper learning in students, but to develop actions and strategies congruent with those beliefs.

Instead of imposing any epistemic belief or a specific kind of teaching model on a teacher, we should examine and identify teachers' own beliefs and barriers. In this way, the staff development area within institutions shall give teachers some space to allow them to analyse and reflect upon their own epistemic beliefs so that they are able to recognize these beliefs in themselves rather than simply speaking about techniques in the abstract. Nevertheless, we need to study the nature of the relationship between teachers' epistemic beliefs and their teaching practices in more depth, taking these barriers into account.

5.3.2. Impact of the interventions

My results show a significant relationship between epistemic beliefs and teaching models. These relationships points out that to foster the use of a learning and student-centred teaching model, teachers need to change the way in which they conceive learning and teaching (Marthon & Booth, 1997). Teachers must change their conceptions and beliefs for more sophisticated ones (Kitay & Prosser, 2008). Taking into account my hypothesis that a change in beliefs could occur through epistemic doubt, reflection or collaboration among peers involving the questioning of the validity of current beliefs and the focus on solving the cognitive conflict (Bendixen & Rule, 2004), from this point forward, I developed a face-to-face intervention and an online intervention. The strategy used in both interventions was peer collaboration so that I could develop a common belief understanding of knowledge. There was no significant result in the face-to-face intervention but the online intervention had an impact on teachers' approaches to teaching. There was a statistically significant decrease in the ITTF scale from pre-test to post-test. There was a large effect size.

The change in the epistemic beliefs and approaches to teaching as a result of the educational intervention supports the work conducted by Hofer et al., 2001; Brownlee et al., 2001 and Mason & Scrivani, 2004. Also the change in the epistemic beliefs and the approaches to teaching as a result of an intervention facilitated by online learning environments supports the work conducted by Tolhurst, 2002; Marra, 2002; Hofer, 2004; Kienhues et al., 2008 and Smith, 2010.

Tolhurst (2002) reported that students' epistemic beliefs were influenced by their experiences of a web-based course, in the relatively short period of just twelve weeks. Also Smith (2010), in a phenomenographic research, found out that collaborative learning environments online presented epistemic challenges for the adult graduate participants (doctoral and masters students) and promoted the use of new strategies, such as the trust in themselves, in their peers and in their teachers that is needed to reach a deeper learning and adopt a student-centred teaching method in the student. Hofer (2004) found that exploring students' thought processes during online searches allowed for the examination of personal epistemology not as a decontextualized set of beliefs, but as an activated, situated aspect of cognition that influences the knowledge construction process. Marra (2002) suggested that effective online learning environments can encourage epistemic development and Kienhues et al., 2008 found the possibility of changing domain-specific epistemic beliefs through a short-term online intervention.

On the other hand, working at an institution where virtual collaboration among peers is used as a strategy, means that the members of the group work together to reach a common goal. As a consequence, only when each member carries out their tasks and achieves their goal, can the common goal be attained. Now, about the strategy, this is provided by online learning environments. These virtual learning environments are settings prepared to fit all types of learning which is consistent with the characteristics of virtual learning, always located on the borderline of teaching practices and as a result, requiring the use of a diversity of various pedagogical methodologies, especially the student-centred methodologies or models (Salinas, J., 2013). Consequently, there is an array of virtual collaboration tools, which include: videoconferencing, audio conferencing and computer-mediated communication tools such as email, chat rooms, discussion boards and instant messaging.

For my online intervention the participants used the computer-mediated communication tools to interact through the virtual learning environment. These tools are more effective because the participants are familiar with the technology. It also has a disadvantage around the relatively lower level of synchronization and interaction felt by its participants compared to videoconferencing or audio conferencing. Now, for the interviews the other two tools: videoconferencing and audio conferencing were used.

Some authors have underlined the online collaboration among peers as an educational asset to promote changes in beliefs and teaching approaches. Online collaboration among peers may be a positive strategy to enhance interaction between teachers as well as to contribute to improving institution-wide teamwork. This type of collaboration facilitates knowledge sharing as well as the development of abilities and skills among the members of the community. Roschelle & Teasley (1995, p. 70), stress the role of knowledge and understanding sharing and stating that collaboration is "*a coordinated and synchronized activity resulting from the sustained attempt to construct and maintain a shared vision or conception of a problem*". The shared understanding focuses on the social plane, where emergent conceptions are analysed as a group product. For instance, it has been observed that providing explanations leads to improving knowledge (Webb, M., 1991). From a 'group' perspective, explanation is not something delivered by the explainer to the explainee. It is instead constructed jointly by both partners trying to understand each other (Baker, 1991).

A big number of authors support the belief about the role and effectiveness of virtual environments in the teacher formation process and in the encouragement of fostering new teaching and learning models and approaches. Virtual environments when used adequately result in helpful and positive strategies for the development of learning environments. Laurillard (2002, 2013) asserts that digital environments can help and the environments allow teachers to share their ideas within a professional community. Salinas (2004) and Cabero & Rodríguez (2013) have reported the benefits of technology information and communication in teachers' training and in fostering new learning and teaching methods and approaches. Castañeda & Adell (2011) declare that professional teacher development processes have benefit through the use of information technology and communication. These authors believe that the creation and administration of virtual learning environments have expanded the process of professional development as well as the interaction and communication between colleagues. Barnett (2002) declares that communication mediated by computers has shown to be an effective tool for fostering professional development in teachers. According to Dixon (2001) and Visser & Woolford (2002), virtual learning environments are perceived as positive and as opportunities for training and formation supported by a community. In a research study about preparing teachers to supervise educators, Steckelberg et al., (2007), demonstrated that an online model for the delivery of instruction could increase knowledge and awareness of the participants about issues related to supervision for educators. Vonderwell & Turner (2005) found out that learning activities mediated by computer seem to have a big potential especially if they involve people with different backgrounds and degrees of experience. Clark et al., (2003) asserts that computer-supported collaborative learning environments have been argued to foster collaborative knowledge construction.

In comparison, Hammond (2011) declares that technology does not contribute to the development of beliefs. This author reported that beliefs are not projected on technology and, at the same time, technology is not a catalyst (does not benefit nor accelerate the development) of changes in pedagogical beliefs. This state of uncertainty about virtual learning environments is shown through the answers of some of the teachers that participated in the online and face-to-face interventions designed to be carried out in this research study. Here are some examples of teachers' answers:

Participant 2: "*I have reasonable doubts about virtual learning environments. Databases are complicated. I do not see how they can help in the learning process. In relation to learning processes, in my opinion, words and language, in general, is still more important. I do not use PowerPoint, just some videos once in a while.*"

Participant 7: "*I am not convinced about those strategies. It helps very much in relation to communication, specifically for those students who are distance learning. Emails, discussion forums, E-walls for sharing information help in the communication aspect but not in the learning process. I believe in Vygotsky: When it comes to learning processes, I need the face-to-face interaction between an expert and learner and I do not see virtual learning environments reaching that interaction. Perhaps I could be wrong. I am not a narrow-minded type of person*."

Participant 8: "*I believe virtual learning environments benefits when trying to reach an effective level of communication, when, instead of acting as an obstacle, it is required in a process to be successful. It is an obstacle when it is used as an in-style fashion accessory. Mclohan states that communication media are an extension of our senses but I agree with Rosa Maria Amparo's opinion. She prefers using her "Power-Voice" instead of her "PowerPoint" because abilities such as arguing, actions such as speaking, and strategies such as giving examples, are possible using her voice in the auditorium. Sometimes it is easier to write using your own hand instead of using technologies that could confuse all the processes. I believe virtual learning environments are important but it is just another factor that makes up the learning context and as such, it is important to analyse in which cultural context it is inserted.*"

Participant 18: "*…technology has just increased the number of tasks - that is the only goal it has reached…*"

Richardson (2009) also found that there were no significant differences between the students who received face-to-face tuition and those who received online tuition, in either their perceptions of the academic quality of their courses or in the approaches to studying that they adopted in those courses. Yet, although this result may seem discouraging for virtual training, it may be analysed in some other way. Just as the author declares: "*you may be confident about introducing online tutorial support in campus-based or distance education*" because there are no differences between them.

Anyway, as a conclusion I can state that as epistemic beliefs and approaches to teaching are correlated, my results indicate the possibility of a change from naive beliefs towards a more sophisticated one. It also indicates the possibility of changing approaches to teaching through an online intervention or facilitated by online learning environments. However, this possibility should be taken with precaution because there are a lot of factors such as: knowledge of technology, teachers' and students' motivation towards virtual learning environments and the length of the intervention, among others, so that success of the implementation of an online intervention designed to obtain changes in beliefs and teaching approaches could be reached (Alexander & McKenzie, 1998; Alexander, 2001).

I agree with teachers' comments and concerns related to the virtual learning environments because these concerns are valid and are well founded. Due to this fact, I believe that more research is needed to develop better conceptual models. I also believe that the centres of administration of virtual learning environments of the areas of education at the institutions should originate or continue promoting the use of virtual collaboration to obtain changes in beliefs and teaching approaches towards more sophisticated ones.

Some of the strategies included should be: sharing positive experiences of teachers using virtual learning environments, encouraging teachers to undertake projects involving the use of technology or virtual strategies, or, helping teachers to overcome preconceptions or fears related to the efficacy of virtual learning environments in education. My view is that technology just represents a tool and a resource to be used for the benefit of teaching and learning processes. I am optimistic about the potential power of virtual collaboration. I believe that instead of perceiving this collaboration as a threat, we need to perceive it as an opportunity. Technology, solely and exclusively in itself, is not enhancing teaching and learning processes - that is for sure. Change is a process that could only be reached through the encouragement of a change in beliefs and teaching models. It is the only way to obtain significant progress in the process.

5.3.3 Disciplinary differences

To determine whether there were any differences between disciplines on approaches to teaching and epistemic beliefs I performed a one-way between-groups multivariate analysis of variance (MANOVA). According to the results, lecturers did have different perceptions on epistemic beliefs and approaches to teaching.

Tukey post-hoc tests revealed that for Certainty/Simplicity of Knowledge scores, lecturers from the Humanities Faculty had statistically significantly lower mean scores than lecturers from either the Basic Sciences ($p = .004$) or Engineering ($p = .003$). Also lecturers from the Social Sciences Faculty had statistically significantly lower mean scores than lecturers from either the Basic Sciences ($p = .017$) or Engineering ($p = .011$). For Conceptual Change/Student-Focused Approach scores, Tukey post-hoc tests showed that lecturers from the Humanities Faculty had statistically significantly higher mean scores than lecturers from Engineering ($p = .018$).

With reference to epistemic beliefs, my results mean that lecturers from Humanities (History, Art, Literature, Philosophy, Languages) and from Social Science (Education, Psychology, Journalism, Economy, Law, Business Administration, Accounting, Finance, Marketing) Faculties saw knowledge as tentative and evolving and open to new interpretations and also viewed knowledge as highly interrelated concepts, relative, contingent, and contextual, than lecturers from Basic Sciences (Physics, Maths, Chemistry, Biology, Statistics) or Engineering.

In relation to approaches to teaching, my results mean that lecturers from the Humanities adopt a student-focused strategy to help their students change their views or conceptions of the phenomenon under study than did lecturers from Engineering. According to this, lecturers from the Humanities focus on the students and the intention is to develop or change their learning conceptions. This approach sees teaching as a facilitator of learning (Trigwell et al., 1994; Trigwell & Prosser, 1996; Prosser et al., 1999). The students are seen as builders of their own knowledge. Teachers cannot transmit a new vision of the world;

students have to create it on their own. (Trigwell & Prosser, 1996; Prosser & Trigwell, 1999 and, Trigwell et al., 1999). The emphasis lies on the learner, their learning processes and the understanding that is generated regarding course contents. The teacher ceases to be the centre of the teaching; the student is more active, more involved in the learning and a builder of their own knowledge (Trigwell & Prosser, 1996; Prosser et al., 2003).

There was no statistically significant difference in genders and years of experience on approaches to teaching and epistemic beliefs. It is probably that data were insufficient to test that hypothesis. More research is needed.

The results on epistemic beliefs confirm the findings of Hofer (2000), Cobb (2002), Buehl & Alexander (2001, 2006), Schoenfeld (2002), Pape & Woolfolk Hoy (2002), and McCombs (2002). Their results suggest that beliefs are multidimensional and particular to specific disciplines. Schoenfeld (2002), Pape & Woolfolk Hoy (2002), and McCombs (2002) provide evidence supporting domain specificity using examples from elementary teachers' mathematics instruction. Hofer (2000) found that first year college students hold differing epistemic beliefs about disciplines such as science and psychology. Disciplinary differences were strong, suggesting that students see knowledge in science as more certain and unchanging than for psychology, are more likely to regard personal knowledge and firsthand experience as a basis for justification of knowing in psychology than in science, view authority and expertise as the source of knowledge in science more than in psychology, and perceive that in science, more than in psychology, truth is attainable by experts.

The results on approaches to teaching confirm the findings of Trigwell (2004) and Lueddeke (2003). As to whether scientific disciplines have any effect on the teaching approaches it has been reported that teachers who represented hard disciplines, such as the physical sciences, engineering, medicine, were more likely to apply an information transfer/teacher-focused (ITTF) approach to teaching, whereas teachers from soft disciplines (such as social sciences and the humanities) took a more conceptual change/student-focused (CCSF) approach to teaching (Trigwell, 2004; Lueddeke, 2003). In another study on teaching approaches with teachers of design and physics, Trigwell (2002) found that the former were more oriented toward student-centred teaching than the latter.

Analysing the results with respect to the contrast in the means, it shows that teachers of the Humanities got the highest mean in conceptual change and also got the lowest mean in the knowledge belief categorized as "simplicity/certainty". On the other hand, teachers in the area of Engineering got the lowest mean in conceptual change and got the highest mean in the knowledge belief categorized as "simplicity/certainty". This could lead to the conclusion that teachers focused on teaching methods such as: student-centred or conceptual change methods, hold sophisticated epistemic beliefs. They saw knowledge as tentative and evolving and open to new interpretations and also viewed knowledge as highly interrelated concepts, relative, contingent, and contextual.

In relation to the differences in disciplinary areas of my sample of 111 universities teachers, the fact that they belong to a specific disciplinary area did have an impact and influence on epistemic beliefs and approaches to teaching. This confirms my hypothesis that the teachers have different perceptions according to their disciplinary area. I also reach another conclusion: neither differences in the number of years of experience nor differences in gender had any influence or impact on my sample. Finally, I conclude that the epistemic beliefs of lecturers do influence the way universities professors' approach the different teaching methods.

5.3.4. Variations and outcome space in lecturers' ways of experience learning, teaching, information and communication technologies, and scientific knowledge

As Marton & Booth (1997) assert, the aim of phenomenography is to look for qualitatively different conceptions of the phenomena in question, to analyse global rather than individual conceptions of participants. Its concern is not the phenomenon itself but rather, people's view of it and how they describe that phenomenon. This is known as second order perspective. These experiences are transformed by the researcher using some categories for the description related between each other and organized hierarchically from the simplest to the most sophisticated. In this way, the area for the results represents the experience of the participants from the research on a collective level not an individual one.

A requisite to address the problems in teacher's approaches to teaching, in a concrete manner, is to understand the way that teachers experience and conceive phenomena (Marthon & Booth, 1997; Trigwell & Prosser, 1996). To do this I explored the experience of teaching and learning in a group of lecturers through interviews. I intended to create a new understanding of the phenomena in a holistic way to promote more accurate and more specific effective methods for training teachers. I found conceptions that I expressed as categories of description and as outcome space. The phenomenographic analysis revealed variations in lecturers' ways of experience learning, teaching, Information and Communication Technology and scientific knowledge. The description of lecturers' experiences of these phenomena show 13 qualitatively distinct categories of descriptions as follows:

Four categories of descriptions were found in the way of experiencing learning.
Four categories of descriptions were found in the way of experiencing teaching.
Three categories of descriptions were found in the way of experiencing Information and Communication Technologies, and;
Two categories of descriptions were found in the way of experiencing knowledge.

To answer the question: what kind of global view can be constituted from various ways of experiencing learning, teaching, information and communication technologies and, knowledge? The answer comes in the form of 13 holistic views, that were constituted in a form of outcome space, from the various ways of experiencing these phenomena of lecturers at the Universidad del Norte, Colombia as follow:

LEARNING was experienced as a composition of cognitive process of knowledge acquisition, influenced by different factors such as students' fundamentals needs, students' intrinsic motivation, lecturers' motivation and the academic environment, also is knowledge management and active construction.

The first dimension the Cognitive Process of Knowledge Acquisition is focused on a rather traditional method, i.e., one that sees the student as a receiver and accumulator of information transmitted by the teacher. It is one of the most widely extended or most predominant learning models in education. Traditional learning still takes place and it is characterized by the learning coming from an external source; the teacher has the mission of transmitting what they know and the learning is of an accumulative nature.

Two subcategories have been focused on and discerned by participating lecturers: (a) Learning as a reception and accumulation of information: Focus is on seeing the student as a receiver and accumulator of information transmitted by the teacher. (b) Learning as transmitted by teachers: Focus is on teachers who have the mission of transmitting what they know and the learning is of an accumulative nature.

The second dimension a Cognitive Process Influenced by Different Factors was seen as influenced by a set of variables that activate the behaviour and are oriented in a particular way to achieve a goal. Motivation as one of this factors is a complex process that largely determines the ability to learn from individuals. Motivation is what moves the person toward a particular direction and with a specific purpose; it is the disposition to sustained effort to achieve a goal. It is, therefore, a factor that determines the ability to learn. Learning is also seen as a broader process that is influenced by the academic institution and as such, teachers and the family of the students and also by an adequate socio-economic environment that provides the student all the tools they need to achieve a good learning outcome. According to this view, the basic needs must be satisfied for a proper learning. Educational institutions and families must provide students with an environment that motivates them to learn.

Four subcategories have been focused on and discerned by participating lecturers: (a) Learning is seen as determined by student's fundamentals needs. Focus is on satisfaction of basic needs, having economic resources and an adequate familiar environment that allows good learning outcomes to be achieved. (b) Learning is seen as influenced by student's intrinsic motivation. Focus is on influences of thought processes especially intrinsic motivation, understood as the interest or pleasure experienced by students through their own learning or through the activities leading to it. (c) Learning is seen as influenced by lecturers' motivation. Focus is on the impact that lecturers' motivation has on student learning. (d) Learning is seen as affected by the academic environment. Focus is on resources and materials that the university provides to student that enhances good learning and the achievement of good learning outcomes.

The third dimension Knowledge Management is seen as transfer knowledge from the place where it is generated to the place where it will be used, and involves the development of the skills needed to share and use it. According to this view, learning as knowledge management seeks to organize existing knowledge to facilitate the creation of a new knowledge and use it to achieve a better performance.

Two subcategories have been focused on and discerned by lecturers involved: (a) Learning is seen as knowledge transfer. Focus is on the capability to put new knowledge into practice and to apply it in different and new situations. (b) Learning as competence development. Focus is on developing and strengthening skills such as teamwork, problem solving, decision-making, communication skills and critical thinking for good learning.

The fourth dimension Active Construction was focused on as a learning that is eminently active and involves assimilation. According to this view, the student is not limited to acquiring knowledge, but rather the student builds knowledge using previous experience to understand and give meaning to the new learning. Consequently, the teacher, instead of providing knowledge, participates in the process of building knowledge along with the student; it is about a constructed and shared knowledge.

It is understood that for true learning to take place knowledge must be apprehended. Here apprehending is understood as a higher faculty than simple learning, in which the student has the capacity to extract or understand the essence of a concept. It is also understood as the student's ability to grasp a reality and internally assimilate it. Here there are various degrees of depth of understanding.

Four subcategories have been focused on and discerned by the lecturers involved: (a) Learning as a transformation process. Focus is on actions that guide a change in the student and, therefore, a modification in their behaviour, also on how they conceive, feel and influence the world that surrounds them. (b) Learning as actions to achieve evolution of knowledge. Focus is on development of academic centres as thinking institutions and on permanent learning. Learning is seen as actions whose purpose is to achieve evolution of knowledge, not only in the mind of the student, but also in the institution as a "thinking body" in which the student is immersed. (c) Learning as apprehension of the knowledge. Focus is on a higher faculty than simple learning, in which the student has the capacity to extract or understand the essence of a concept. (d) Learning as comprehension of the knowledge. Focus is on the student's ability to grasp a reality and internally assimilate it.

TEACHING was experienced as a composition of knowledge transmission, the lecturer being seen as an expert, mediation among knowledge, cultural practices and learners and, facilitation of the learning.

The first dimension Knowledge Transmission had the focus on clearly communicating to students a specific knowledge, skills, ideas or experiences that they do not have, with the intention that they could understand and apply it at a given time. It is an expositive teaching. From this point of view, the teacher and the act of communication play an essential role in the transmission of knowledge.

Two subcategories have been focused on and discerned by lecturers involved: (a) Teaching is understood as knowledge transmission/teacher-centred. Focus is on the teacher who is seen as transmitting knowledge and the student as a receiver and accumulator of information. (b) Teaching is seen as a communicative activity. Focus is on language, which is the means to transmit knowledge by the creation of an interaction and dialogue between the teacher and the student, whose purpose is effective education.

The second dimension addresses a teacher being seen as an expert, and focuses on the view that teachers are not only masters of their subject area but are also seen as capable of handling teaching techniques or strategies that facilitate student learning in the classroom. An expert teacher should also know the social and cultural environments in which their students interact. They should carry out learning activities that enhance learning. According to this view, an expert teacher should educate for the comprehensive development of student.

Two subcategories have been focused on and discerned by lecturers involved: (a) The teacher is seen as an expert in their subject area and as source of knowledge. Focus is on the teacher or lecturer who masters the practical and theoretical competences and who possesses skills. (b) The teacher is seen as the model that is to be observed and imitated. Focus is on the teacher's job that marks the way and take the students along it. Focus is on the teacher inspiring their students. Focus is on the teacher helping with their learning process. They are responsible for the teaching learning process in classroom.

The third dimension was teaching as mediation among knowledge, cultural practices and learners. According to this view, teaching is not only seen as social mediation but also as a pedagogical mediation, this is, meditation between what is taught and the individual or group. At the institutions the teacher is the mediator between that knowledge and students. The teachers are those who adapt the knowledge to the capabilities, interests and needs of a particular group and to a specific socio-cultural context. Building those bridges will require teachers' mediation.

One subcategory has been focused on and discerned by lecturers involved: (a) Teaching is seen as mediation among knowledge, cultural practices and learners. Lecturers are not the centre of the process but mediators among the students, teaching context and learning situations with the intention of stimulating and encouraging the development and potential of the student. In other words the lecturer's role is to mediate between the students and knowledge to achieve their personal and intellectual development.

The fourth dimension, teaching seen as a facilitator of learning, was focused on the views about the process of leading a group through learning. According to this point of view, each person has something unique and valuable to contribute. Without the contribution and knowledge of each person, the group's ability to understand or respond to a situation can be reduced. In this category, teaching as facilitation involves sharing information between the facilitator and the group and between group members. The facilitator's role is to extract the knowledge and thoughts of different members of a group and encourage them to learn from each other, and to also think and act together. The teacher is seen as that facilitator.

Two subcategories have been focused on and discerned by lecturers involved: (a) Teaching is seen as providing the conditions for the free expression of the students' potential. Focus is on teaching that has a participative character in which the student assumes an increasingly leading role in directing the learning and in which the teacher ceases to be the authoritarian figure who imposes knowledge and who decides what and how things are to be learnt. (b) The teacher is seen as a facilitator of learning, they are the guides. Focus is on the function of the teacher as to facilitate the conditions in which the students' self-determination capacities can be updated in both social and individual processes. The teacher is seen as a facilitator that must wait for each student to feel the need to express their values in order to create the conditions that favour that expression. It means accepting that each student is potentially different and, therefore, will manifest needs at different times and in different ways, and this requires totally individualized attention.

INFORMATION AND COMMUNICATION TECHNOLOGIES was experienced as a combination of uncertainty and skepticism, a tool for supporting and enhancing teacher's jobs and a positive tool that helps to enhance the learning and teaching process.

The first dimension Uncertainty and Skepticism was seen as ICTs lacking educational value to promoting learning. ICTs have still not demonstrated that student performance improves as a result of them. Some teachers believe that there is no evidence proving that learning is the consequence of the integration of ICT into education. According to this view, teachers believe that to achieve a change in the student more integration and more comprehension is needed.

Two subcategories have been focused on and discerned by lecturers involved: (a) ICTs are viewed with distrust. Focus is on the incapability of the ICT to create learning. Teachers claiming that they do not guarantee quality education unless they are used within a coherent educational model. They are seen as a set of computerised and digital tools whose presence in the various human activities, particularly in education, are unquestionable, but that they contribute little or nothing to learning. (b) ICTs are seen here to have more limitations than benefits as a support for learning. It is not the technologies themselves that are limited, rather their applications. Among these limitations are that they are easily used by many but they are not adapted to the rhythm of learning. They are not taken into consideration for incorporation in educational programmes as people learn in different ways and at their own speed because they do not all have the same cognitive level. Free interaction by students with multimedia materials, which are not always of good quality and are often out of context, can lead to incomplete learning and simplistic, shallow visions of reality. Their use has become mechanical, with some lecturers using them on the basis of out-dated teaching and learning conceptions. Some believe that new technologies are the response to the questions and challenges of today's education, i.e., they are seen as the result more than the means. Finally, the economic costs they entail mean that they out of reach for many students.

The second dimension, a tool for supporting and enhancing teacher's job was seen as something that can help lecturers in their various roles: As a teacher, as a researcher, as a consultant or as a staff member. ICTs are seen as part of our daily lives. We use them constantly to study, work, play, for leisure. According to this view, ICT is a tool that helps the teacher to prepare lessons and academic tasks for their students more effectively, also to develop content, to create reusable learning objects, to prepare and mark classwork and homework online, to communicate with other teachers in physically different places to share resources and exchange views or create virtual discussions, and to also create blogs to share knowledge with other teachers and their students. ICTs are seen as a help for finding information or analysing research data. Finally, ICTs are seen as a support for academic staff that have administrative burdens.

One subcategory has been focused on and discerned by lecturers involved: (a) ICTs are seen as a support for the activities performed by teachers outside the classroom. Focus is on helping lecturers to prepare their classes, carry out research and perform administrative tasks. Academic activities that used to be carried out in a rudimentary way are today performed rapidly, agilely and with better quality thanks to the functional nature of ICTs. This has saved lecturers having to undertake repetitive, monotonous and routine tasks and has meant an increase in productivity and an enhancement to teaching and research management.

The third dimension ICT are positive was focused on ICTs being tools that help to enhance learning and teaching processes. ICTs contribute to the development of creativity, ingenuity, teamwork or collaborative and cooperative skills necessary for academic and personal success. According to this view, ICTs have become key tools to enhance learning and improve teaching. ICTs are seen as an essential component of XXI century education as they offer a richer environment for learning and a more dynamic experience for teaching. Using methodologies supported by ICT or using good quality digital content enriches learning and can, for example, through simulations and animations, illustrate concepts and principles that are otherwise very difficult to understand for students. ICTs are seen as an aid and not the answer.

Three subcategories have been focused on and discerned by lecturers involved: (a) ICTs are understood as being useful for learning. Focus is on enabling the student to improve their skills by helping them to perform their learning tasks and activities because they facilitate the understanding of concepts, because they speed up the search for and accessing of information and because they allow for collaborative working. Access to data bases, e-journals and software for graphic representation of concepts, such as Cmap Tools or MindMap, significantly help the student in the knowledge construction process. (b) ICTs are understood as an opportunity to improve teaching. Focus is on the creation of educational multimedia materials, which can make the delivery of contents more dynamic on account of its multi-sensorial nature. Likewise, interaction through forums, emails and chats favour the creation and enhancement of communication and collaboration skills. Also focus is on different alternatives to teaching, e.g. online tutorials in real time or used asynchronously, visual aids when presenting e-content. Teachers can back up their comments, master classes, role playing exercises and explanations about certain procedures with all types of resources, graphical representations, images, presentation programmes, multimedia materials, camcorders, educational software and Internet resources. It can also be used as a tool for underpinning arguments taken from the online press or to upload class content onto the course website. Using videos, cd rooms, reusable digital content, web pages, applets or virtual learning sessions promote learning and provide new opportunities for enhancing teaching and learning inside the classroom. (c) ICT is seen as a tool for enhancing communication between the teachers and students. Focus is on ICTs as a support for face-to-face teaching. Focus is on new channels of communication with students via email, forums, chats, news and mailing lists that encourage teacher–student interaction.

SCIENTIFIC KNOWLEDGE was experienced as a composition of relative knowledge rather than an absolute, the search for practical – and not theoretical- experience, the result of confronting theory with practice.

The first dimension Relative rather than Absolute was focused on the view that scientific truths are relative in the sense that they do not offer full and complete knowledge of the object of study. According to this sophisticated view of knowledge, truth is relative, i.e., it is dependent or is connected with the subject, person or group who experiences it. Relativism holds that there are many truths about things, at least as many as people think they have knowledge of these things.

One subcategory has been focused on and discerned by lecturers involved: (a) Truth as relative. There is no way of understanding reality but many ways of appreciating it and understanding it, and each allows us to see it from different angles, and so in some ways in a more complete manner. Here truth is subjective, not absolute, and it is changeable. This perspective differs from the positive paradigm that seeks absolute truths.

The second dimension the search for practical experience not theoretical and as the result of confronting theory with practice was focused on the view that verifying the truth or the falsifying of a statement, hypothesis or theory, the criterion of truth lies in social practice (theory and practice). According to this view, scientific theories can be tested in practice. If the theory is successfully applied in practice, this means that it is valid. The procedures for checking this or that thought in practice may be different, for example, through experimentation, observation and measurement.

One subcategory has been focused on and discerned by lecturers involved: (a) Truth is the practical experience not theoretical. In this category only what is demonstrable in practice is true, if it does not work in the real world it is not true.

Findings are coherent with previous phenomenographic research (Saljo 1979; Marton et al, 1993; Prosser & Trigwell, 1999; Roisko, 2008) which has identified similar ways of conceiving teaching and learning ranging from information transmission/increasing knowledge/teacher-centred to conceptual change/student-centred/active construction ways of teaching and learning. Also Roisko (2008) in a phenomenographic research about conceptions of learning in Adult Learners' Learning in a university Setting reported that adult learners viewed teaching as a matter of pure cognition. They believe it begins on a less sophisticated level, such as the collection of knowledge passing through the process of rope learning until it reaches the stage of knowledge transformed into meaningful knowledge and a change of view of reality. Some other dimensions of variation in learning found in this research were the integration from theory into practice, self-regulated learning and learning as development and professional growth. These categories are congruent with the ones I developed and shared here. For instance, across my sample of lecturers, learning was experienced as a combination of cognitive process of knowledge acquisition, and also as knowledge management and active construction. In both aggregation and acquisition are the simpler levels to move towards Integration of theory that is also coherent with Knowledge Management inasmuch as according to this view, what is sought is to organize existing knowledge to facilitate the creation of new knowledge and use it to achieve better professional performance.

From the results of my qualitative data, I conclude that there are variations in the way teachers from the Universidad del Norte, at Colombia experience the analysed phenomena. The found dimensions represent a way to understand teaching and learning from a simpler level towards a more sophisticated one. The result, seen as a whole, tells us that for the teachers, the concepts and processes of learning, teaching, ICTs and knowledge are seen as progressive visions.

According to phenomenography, this means that for every phenomenon, teachers are simultaneously on different levels and aware of all the elements present in the outcome space. Now, knowing this information, it will help in the designing and developing of teacher's professional development that is really focused on their needs. If we know how teachers view and experience these phenomena, we will be able to succeed in the intervention and in obtaining a more effecting change.

This also means that if we want to see a more effective change in the way teachers approach their teaching we will need, as Marton & Booth (1997) assert, to introduce variation in one or two dimensions focused on by them. Introducing variation helps to break down what phenomenographers call the "natural attitude"—our habitual assumption that what we experience is reality—rather than the attitude that it is reality experienced in a particular way (Fazey & Marton 2002). That is, it helps to demonstrate that what we experience is not the same reality as that which others experience. Trying to look at a problem from different perspectives is, therefore, possibly one of the most crucial elements of variation that needs to be practiced (Marton & Wenestam 1988). Lecturers will not only be better teachers if they are open to how an experience changes their current understanding, but also if they are open to how others have perceived the same experience.

One of the benefits resulting from this type of phenomenographic analysis is the awareness of referring to professional teacher development as a process aimed at encouraging our teachers to develop more sophisticated beliefs about practice and instruction that offer advantages to a deeper learning in students but, more importantly, this analysis, emphasize in the development of instructional activities coherent to these types of beliefs.

In the search and following the desire to adapt and adjust to contemporary and global pedagogical trends, and keeping in mind the fact that we are a developing country, we have been suggesting to teachers, as part of our professional teacher development program, the use or development in their teaching approaches of the current epistemic beliefs or the latest, most up-to-date teaching models. In this way, we have been putting aside the fact that we are first required to understand how our teachers experience the diverse teaching and learning situations and which barriers are found when trying to use a deeper student-centred learning approach.

The administration and promotion of centres of professional teacher development in educational institutions should provide areas for teachers to analyse and reflect on their epistemic beliefs and ways of teaching. These centres need to give them time and place for teachers to learn to acknowledge themselves as educators, agents of change, rather than simply having them speak about techniques in the abstract. Phenomenographic research can and may make some contribution to this debate. Marton (1986) claims that a careful account of the different ways people think about phenomena may help uncover conditions that facilitate the transition from one way of thinking to a qualitatively better perception of reality. Thus, phenomenographic analysis about the different conceptions that lecturers hold about a particular phenomenon may be useful to help them to experience or understand a phenomenon from a given perspective. Another benefit of this kind of research is that lecturers may become conscious of contradictions in their own reasoning and become more open to alternative ideas as they reflect on their perceptions and understandings of their world experiences.

CHAPTER SIX

CONCLUSIONS, IMPLICATIONS AND CONTRIBUTIONS

6.1 Introduction

At the beginning of the research I aimed to:

Establish whether there was a relationship between lecturers' epistemic beliefs and approaches to teaching.

Develop, through collaboration among peers, a shared understanding of learning, teaching and information and communication technology that will lead to changes in epistemic beliefs, and;

Confirm whether changes in epistemic beliefs lead to changes in approaches to teaching.

6.2 Conclusions

Based on the findings of this study, the following conclusions are made:

The Approaches to Teaching Inventory (ATI) and the Discipline Focus Beliefs Questionnaire (DEBQ) are suitable to measure epistemic belief and teaching approaches of teachers in educational research. Further research into the differences in the structure of the DEBQ and ATI when used in different cultures would be valuable.

As I found correlations between epistemic beliefs and approaches to teaching in university teachers, I conclude that the lecturers' epistemic beliefs do influence the way they approach teaching and also it plays an import role on lecturers' approaches to teaching.

As there was a statistically significant decrease in the Information Transmission/Teacher-Focused Approach through online intervention and as epistemic beliefs and approaches to teaching are correlated, my result indicates the possibility of a change from naive beliefs towards a more sophisticated one, and it also indicates the possibility of changing epistemic beliefs and approaches to teaching through an online intervention or facilitated by online learning environments.

In terms of disciplinary differences, I conclude that the type of discipline did have an influence and did have an impact on epistemic beliefs and approaches to teaching; my hypothesis about teachers having different perceptions according to their disciplinary beliefs is verified. Teachers from the Humanities and Social Science Faculties saw knowledge as tentative and evolving and open to new interpretations and also viewed knowledge as highly interrelated concepts, relative, contingent, and contextual, moreso then lecturers from Basic Sciences (Physics, Maths, Chemistry, Biology, and Statistics) or Engineering. Lecturers from the Humanities Faculty adopted a student-focused strategy to help their students change their views or conceptions of phenomenon under study than lecturers from Engineering did. According to this, teachers from the Humanities focus on the students and with intention to develop or changes their learning conceptions. Finally, I conclude that teachers focused on teaching methods such as student-centred or conceptual change hold more sophisticated epistemic beliefs.

The results on epistemic beliefs confirm the findings of Hofer (2000), Cobb (2002), Buehl & Alexander (2001, 2006), Schoenfeld (2002), Pape & Hoy (2002), (2002), and McCombs (2002). Their results suggest that beliefs are multidimensional and particular to specific disciplines. As they did, I also found that my sample of teachers hold differing epistemic beliefs according to their disciplines. The results confirm the findings of Trigwell (2004) and Lueddeke (2003). As to whether scientific disciplines have any effect on the teaching approaches it has been reported that teachers who represented hard disciplines, such as the physical sciences, engineering and medicine, were more likely to apply an Information Transfer/Teacher-Focused (ITTF) approach to teaching, whereas teachers from soft disciplines (such as social sciences and the humanities) took a more Conceptual Change/Student-Focused (CCSF) approach to teaching (Trigwell, 2004; Lueddeke, 2003). In another study on teaching approaches with teachers of design and physics, Trigwell

(2002) found that the former were more oriented toward student centred teaching than the latter.

I also conclude that the number of years of experience or gender had no impact on my sample. The data is probably insufficient to test that hypothesis.

About the phenomenographic analysis of the interviews I conclude that there were variations in lecturers' ways of experience learning, teaching, ICTs and knowledge. The description of lecturers' experiences of learning, teaching, ICTs and knowledge showed 13 qualitatively distinct categories of descriptions. Also 13 holistic views were constituted in the form of an outcome space from the various ways of experiencing teaching, learning, ICT and knowledge, of the lecturers at Universidad del Norte. I also conclude that phenomenography is a good method to understand experience on learning, teaching, ICTs and knowledge in a university setting.

6.3 Implications

This research confirms the relationship between two concepts in two distinct but interrelated approaches of research with empirical evidence: Epistemic beliefs and approaches to teaching. Confirming previous research on the influence of beliefs about teaching strategies.

An implication that is derived from the results is that the methodology designed is a new methodology that has been used for the first time in a country (Colombia) which has not been used before. Indeed, this thesis is an attempts to replicate an foreign research in a Latin American context. In terms of replications, my results are similar to those reported by other researchers in other cultural contexts (Hofer, 2000; Prosser & Trigwell, 1999) which leads me to reflect on several aspects: The cultural context although can influence is not decisive in the application of this methodology. There are aspects that I have observed along this research needs taking into account as the economic reality in Colombia as compared to the UK, the lack of opportunities for teachers to acquire a more updated training learner-centered and less teacher-centered. However, my reflection points to even though the cultural context be different (Europe/America/Latin-American), the hypothesis and the methodology of this thesis remains valid for a British university and for a Colombian university. Perhaps some socio-cultural adaptations will be needed, for example, taking into account the resistance to change that Colombians have for fear of failure. But what I mean is that although the role of culture in the development of our theories of teaching and learning plays a key role, and it does, the mechanisms is perfectly valid in a British university or Colombian university and this is value of this research: The versatility of this methodology. The novelty is in highlights the relevance of epistemic beliefs in the teaching Processes, and shows how if we are looking for improvement in teaching quality standards, we need to acknowledge beliefs and take a deeper look into them.

If we want to improve the teaching process and to change how our teachers teach, a change to the way of conceiving teaching and the learning processes are required first of all. As a consequence, these changes will improve the academic performance of our students. When designing and applying an effective professional teacher development program, it is important understanding how our teachers conceive and experience teaching and knowing their epistemic beliefs about the teaching and learning process is a requirement.

Another implication of my research points towards professional teacher development programmes. Not only do we seek a change toward more sophisticated epistemic beliefs and teaching strategies, but beyond that we want the teachers to develop consistent and congruent attitudes to achieve real conceptual change despite the barriers and limitations. Teacher development centres in educational institutions should offer spaces for teachers to analyse and reflect on these issues and learn to recognize their own beliefs. Although teachers' beliefs are often difficult to change and sometimes professional teacher development programmes have had little or no impact on teachers' beliefs about teaching, as Olafson & Bendixen (2002) affirm, when designing training and professional teacher development courses, where appropriate conditions are provided, i.e., teachers are given the opportunity to make explicit and to articulate their beliefs about teaching and learning processes, and implications of holding such beliefs are discussed, the programmes have shown a small but positive impact on changing teachers' beliefs. If we want to enhance teaching and learning quality through training for teachers this needs to be taken into consideration.

Implications for research on educational technology focus on the use of Information and Communication Technologies in changing beliefs. The results show the possibility of changing approaches to teaching through an online intervention or facilitated by online learning environments. It also shows the possibility of access to the knowledge and the distinct experiences about teaching and learning in lectures through my proposed methodology based on peers collaboration in order to develop a shared group understanding of teaching and learning and provoke a change of beliefs.

I agree with the concerns of all teachers about Information and Communication Technology; I believe these concerns are valid and are based on real facts. As a consequence, the Information and Communication Technology administrative and promotional centres should begin or continue promoting the use of virtual collaboration for the development of more sophisticated teaching models and change of beliefs. Some of the strategies include: sharing experiences of teachers with positive results around the use of Information and Communication Technology, encouraging teachers to undertake projects using technology or virtual environments, or helping them in overcoming preconceptions about efficacy of Information and Communication Technology in education.

Technology may be used as a tool and a source that works together with education to the benefit of teaching and learning processes. I am confident in the potential power of virtual collaboration. I think that instead of perceiving this collaboration as negative, or as a threat, we need to see it as an opportunity, as something good and useful. Technology in itself will not improve teaching and learning processes, that is almost a fact. Change is a process to be obtained through the promotion of a change in beliefs and teaching models. I believe this is the only way to obtain significant progress in the process.

6.4 Contributions

The results of this thesis making a significant contribution to knowledge to the research area and studies in epistemic metacognition in university settings. They also act as a fundamental or basis to form research studies about phenomenographic research in Colombia. This is a novel project supporting itself on a quantitative and qualitative research type of methodology, which in its collection of data obtained the purpose of this research and realised its goal to obtain more reliable and durable data. Given the wide range of the phenomenon that I study in this thesis, I believe there is no possible way to pretend that there is one single theory or approach that addresses all the issues and problems facing education. Therefore, I made use of different approaches and methodologies to study the distinct topics. This research is going to allow me to provide a significant contribution to knowledge that allows me – from a different, but at the same time complementary perspective - to regularly reflect on what we do, to improve our work and to contribute to the development of the education system in Colombia and it will also allow me to test a new methodological and educational model in e-learning, which can be applied not only at the Universidad del Norte but at other Colombian universities also.

From a phenomenographical point of view, the major implication for the research on educational technology in this thesis is discovering the variation existing in the experiences of the learning and teaching processes in teachers: discovering different teacher conceptions. Some other implications of phenomenographical analysis for research on educational technology found throughout this study are that when designing teachers professional development programmes or courses aiming for effective change in teaching processes, the centres of administration of virtual learning environments of the area of education at the institutions need to design teaching and learning experiences around the concept of variation. These institutions of the area of education need to design experiences to help teachers simultaneously distinguish and focus on fundamental aspects of the teaching process using variation. When knowing what the concept or belief that varies is, institutions may be able to create room for variation that persuades teachers' focal conscience making the experience of all the possible phenomenological variations in the process, in this case, the teaching process, possible.

CHAPTER SEVEN

LIMITATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

7.1 Limitations

A limitation of this study is the fact that it could only include teachers from one university. Recommendations for future research include more participants from other universities and, from diverse cities also, and where possible, from other countries. A suggestion related to this limitation is to use a triangulation research methodology using additional types of measures including structured observation techniques inside the classroom. However, I was not aiming to, or interested in observing the behaviour of teachers, but in gaining a deeper understanding of the teacher's experience of teaching. Also as a suggestion, more collaborative and comparative studies could be done in this area.

7.2 Recommendations

Recommendations for future research may include the study of how epistemic beliefs influence student teachers, or what the impacts of these beliefs in their professional development and in their learning communities are.

A short-term intervention is not enough to obtain a long-term deeper and more lasting change. To achieve this kind of change, a design of mid and long term interventions need to be carried out.

My findings are cross-sectional in nature rather than longitudinal. My object of study includes complex aspects and so, as a consequence, because of its nature, it is only logical that the ways to live experiences change over time. As a result, as a recommendation for future research, I suggest implementing more research of this type that track teachers over time as well as track how their beliefs and world views have changed over time.

I also suggest verifying the findings of the phenomenographic analysis to check their consistency and stability. Additionally, phenomenography is a relatively new research approach, which needs to check and strengthen its theoretical and empirical foundations. This new area is in permanent evolution and development. As a result, it needs to standardize terms or create its own terminology.

I wonder whether this research could be replicated using the same instruments? What generalizations can be properly made from the data? I am talking about the reliability and validity of my research. Although in previous chapters I covered this topic, I stress that the reliability and validity of my data are given by the psychometric solidity of my questionnaires (Cohen & Swerdlik, 2001). I conducted a factor analysis and internal consistency in order to examine the internal structure of the questionnaires by analysing the items and also by establishing consistency through Cronbach's alpha coefficient. In general, the scales had a good internal consistency and were considered reliable with the sample (n=111). Furthermore, both instruments can be used to measure approaches to teaching and academics epistemic beliefs at a Latin American university and suggest its use for research purposes. Further research should continue to include other important variables in the research on epistemic metacognition and phenomenography. Regarding interventions, there was a verification process at every stage of the methodology to assure the reliability and validity of the results. Finally, concerning the variations found, once the outcome space of a phenomenon has been revealed, it should be disseminated in such a way that other researchers can recognize cases of different forms of experiencing the phenomenon in question. Once an outcome space has been developed, another researcher should be able to judge what description categories to apply to each individual case in the material analysed. It is suggested that two independent, competent researchers should reach a "reasonable degree of agreement", i.e., they agree in at least two thirds of cases.

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List of Appendices

Appendix 1 Letter

(Translated into English)

Bangor, Gales (UK) 20 September 2006

Dr
Beatriz Anaya de Torres
Directora Oficina de Desarrollo Profesoral
Leonor Jaramillo de Certein
Directora Instituto de Estudios Superiores en Educación, IESE
Universidad del Norte
Barranquilla, Colombia

Dear Beatriz and Leonor:

Good wishes!

As I told you by email, I am carrying out my doctoral thesis at University of Wales, Bangor in United Kingdom. The research has as objective to know the beliefs about nature of learning and knowledge and the approaches to teaching of the university professors; and to determine if there is a relationship between both concepts. The final purpose would be to generate a change of attitude of these professors toward the teaching in order to that they encourage to their students to take a deep approach to understanding.

To achieve this we are design an intervention which is carry out in three phases:

The first phase consists in applying two questionnaires to a population of Lectures. The questionnaires are: Approaches to Teaching Inventory, ATI 22 by Pacheco and Garavito (2006) based on Prosser and Trigwell (2006) and Beliefs about Teaching and Learning in your Discipline Questionnaire - DEBQ - Hofer (2005) adapted version by Clancy and Fazey (2006)-.

In the second phase of the intervention we will select from the population of professors before chosen a stratified sample with whom we will carry out a deepest work. This sample will be divided into two groups. With one group we will work the Marshes Methodology face to face and with the other group the Marshes Methodology Online. During this phase we will administer a third instrument to the students of the professors that are participating in the Marshes Methodology, to measure their approaches to learning. This instrument is the Approaches to Study Inventory. By ending the intervention process we will produce a causal loops diagram.

The Marshes Methodology is an action-research technique which uses several instruments for gathering information: Questionnaires, Interviews, Informal Discussions, Focal Groups, Observation, Autoreport. The results are presented in a Causal Loops Diagram. There is a verification process in every stage of the Marshes Methodology to assure the reliability and validity of the results.

The <u>third and last phase</u> of the intervention will consist in administer again the two questionnaires ATI 22 and DEBQ to all the population to compare and to analyze the changes produced in the sample.

To ending, I wish to ask your support for work my project with the professors of the Universidad del Norte. I only require that the professors are giving classes at present, which be of different areas of knowledge and in equal number of both sexes if you can.

I thank a lot all the contribution that you can give me to carry out my doctoral research. I am sure of this study will contribute to orient the professional development of our professors and improving their performance in their discipline.

With my best regards,

Ivonne Pacheco Daza.
Estudiante de Doctorado en Educacion
Universidad de Gales, Bangor, UK

Appendix 2 Letter

(Translated into English)

Barranquilla, 20 September 2006

Dear teacher
XXX

I am writing to invite you to take part in the study: *Exploring Understanding on Personal Epistemology and Approaches to Teaching in Lecturers: Comparative Case Studies in Colombia, South America.* This is a project that we carry out the Universidad del Norte in Barranquilla, Colombia and the University of Wales, Bangor in United Kingdom.

The research has as general objective to know the belief about nature of learning and knowledge and the approaches to teaching of the lectures; and to determine if there is a relationship between both concepts. The purpose is to generate with a group of teachers a shared understanding of the knowledge with the intention that they encourage student to take a deep approach to understanding.

This research more than an exploratory study is especially a pedagogic intervention that look for to generate an impact on teaching through dialogue, discussion and reflection at the time that we are doing a contribution to the professionalization of teaching.

Your participation is voluntary and it will consist in complete two questionnaires web-based. We will be sending both questionnaires to you by email at Universidad del Norte with the instructions for to be completed.

Later, from the teachers that completed the two questionnaires, we are going to select a stratified sample. This sample will be conformed only with those teachers that desire to gain a deepest understanding of their teaching and improving the capacity of learning of their students.

Thank you very much in advance for your help. Your contribution will be of great value in this research.

Yours faithfully,

Ivonne Pacheco.

Appendix 3

INFORMATION SHEET

CONSENT FORM

(Translated)

Title of Project: Exploring the Understanding of Epistemic Beliefs and Approaches to Teaching in Lecturers at Universidad del Norte, in Colombia, South America.

Name of Researcher: Ivonne Pacheco Daza

Introduction

My name is Ivonne Pacheco, I work at IESE and I am doing my PhD in Bangor University, UK. I am doing a research: Exploring the Understanding of Epistemic Beliefs and Approaches to Teaching in Lecturers at Universidad del Norte, in Colombia, South America. It is an information sheet for you who are invited to participate in the study.

Purpose of the research

The overarching purpose of this study is to gain an insight into the epistemic beliefs of in-service university teachers and to examine how their epistemic beliefs might influence their approaches to teaching. The main idea of this project is to create a pedagogic tool for the professionalization of teachers at the University. I want to explore other ways of growing and continuous improvement processes for our teachers, and to contribute to educational innovation, to encourage changes to beliefs that lead to changes of attitude through a shared understanding of their knowledge and experience. This study is sponsored by Programme Alban programme of high-level scholarships for Latin American (European Union) and The Universidad del Norte.

Procedures

Your participation in this project involves answering two online questionnaires and the participation in a focus group. The purpose of the focus groups is to test the efficacy of a collaboration model between peers to develop a shared understanding of knowledge in teaching and learning and to provoke a change of attitude in approaches to teaching and epistemic beliefs in a group of in-service university teachers in Barranquilla, Colombia. There will be two focus groups: A face-to-face and an online one. The results will be compared. The virtual collaborative model will be developed in a virtual environment with synchronic (interview) and asynchronic (focus group) interactions. The face-to-face collaborative model will developed in a real classroom without use of electronic technological resources. The digital resources that we will use for the online intervention are the following:

Electronic mail because it is a asynchronic service that makes for easy communication and interaction among users that they are not found physically in the same place, neither in the same time zone. 'Chat' because it is an Internet tool that allows having real-time text communications. Communication can be between two people, or among groups. 'Electronic forum' because is a service that allows the discussion of a subject to distance and asynchronically. The electronic forum support the collaborative work and the construction of knowledge by permiting the interaction and the exchange of ideas. The videoconference because is a service with a high level of interaction by providing in real-time a permanent interaction including image and sound among different points, making possible that, different professors, different students, different educational institutions, etc. participate in the communication process without need of any displacement. The reason for the selection of these resources is that they allow greater interaction with teachers. They are used widely in the academy world and almost all the teachers in the target institution are highly familiar with their use.

Participant Selection

We need in-service teachers for our study. You were chosen randomly from a database provided for Human Resources because of you are teacher at the Universidad del Norte. Tha database were supplied with permission of the Rectoría and the Vicerrectorías Academica y Administrativa

Risks

Participating in this study will involve no personal risks to you as a participant. Your identity will not be revealed in any research published from the results. The costs involved included the feeling of losing time, feeling judged by their beliefs, that their beliefs may be subject to public scrutiny and of perhaps a little embarrassment when faced with unfamiliar situations.

Benefits of this Project

In more general terms and after the study is completed the results will be published in a PhD thesis which will be available from the National Library of Wales library for your review. You will also be informed of any technical reports or other articles arising from the study that are accepted for publication. If you have any questions concerning the results, you may contact us. There will be no direct benefit to you, but your participation is likely to help us find out more about how improve teaching and learning in higher education. I assure you that after the focus group you will feel satisfied at having contributed to education and science.

Privacy

We will need your email address, forename and surname. These details will not be disclosed to any third party.

Duration

I will visit you one time for interviewing you. Interview will last for about one hour. The group discussion will be held once and will take about one and a half hour.

Freedom to Withdraw

You may withdraw your participation at anytime and for any reason. To withdraw, contact one of the investigators:

Ivonne Pacheco (edp3aa@bangor.ac.uk , ivonnepatricia@hotmail.com , ipacheco@uninorte.edu.co) or

Dr John Fazey (john.fazey@bangor.ac.uk).

You do not have to take part in this research if you do not wish to do so, and choosing to participate will not affect your job or job-related evaluations in any way. You may stop participating in the [discussion/interview] at any time that you wish without your job being affected. I will give you an opportunity at the end of the interview/discussion to review your remarks, and you can ask to modify or remove portions of those, if you do not agree with my notes or if I did not understand you correctly

Confidentiality

We will not be sharing information about you to anyone outside of the research team. The information that we collect from this research project will be kept private. Any information about you will have a number on it instead of your name. Only the researchers will know what your number is and we will lock that information up with a lock and key. It will not be shared with or given to anyone. We will ask you and others in the group not to talk to people outside the group about what was said in the group. We will, in other words, ask each of you to keep what was said in the group confidential. You should know, however, that we cannot stop or prevent participants who were in the group from sharing things that should be confidential

Permission

I have read and understand the informed consent and the conditions of this project. I have read and understand what you want me to do for this study, and my right to withdraw at any time. I hereby voluntarily agree to participate in this project. I may withdraw my consent at anytime without penalty.

If you are willing to participate please reply to this email with '**Consent**' in the subject line and keep a copy for your own records. Thank you for considering helping us with our research.

Ivonne Pacheco and John Fazey

Appendix 4

CONSENT FORM

CONSENT FORM

Title of Project: Exploring the Understanding of Epistemic Beliefs and Approaches to Teaching of Lecturers at Universidad del Norte, in Colombia, South America.

Name of Researcher: Ivonne Pacheco Daza

1	I have read and understood the information about the project, as provided in the Information Sheet dated __________	☐
2	I have been given the opportunity to ask questions about the project and my participation.	☐
3	I voluntarily agree to participate in the project.	☐
4	I understand I can withdraw at any time without giving reasons and that I will not be penalised for withdrawing nor will I be questioned on why I have withdrawn.	☐
5	The procedures regarding confidentiality have been clearly explained to me.	☐
6	I consent the interview be tape recorded with possible use of verbatim quotation	☐
7	I consent to use photographic, video and audio recordings	☐
8	The use of the data in research, publications, sharing and archiving has been explained to me.	☐
9	I understand that other researchers will have access to this data only if they agree to preserve the confidentiality of the data and if they agree to the terms I have specified in this form.	☐
10	I, along with the Researcher, agree to sign and date this informed consent form.	☐

Name of Participant	Date	Signature
Name of Person	Date	Signature

Appendix 5

APPROACHES TO TEACHING INVENTORY 22 (ATI 22)
Michael Prosser and Keith Trigwell, 2004 (adapted version)

This inventory is designed to explore a dimension of the way that academics go about teaching in a specific context or subject or course. This may mean that your responses to these items in one context may be different to the responses you might make on your teaching in other contexts or subjects. For this reason we ask you to describe your context.

Please name the subject/course of your response: . . . .
For each item please circle one of the numbers (1-5). The numbers stand for the following responses:

1 - this item was **only rarely or never** true for me in this subject.
2 - this item was **sometimes** true for me in this subject.
3 - this item was true for me **about half the time** in this subject.
4 - this item was **frequently** true for me in this subject.
5 - this item was **almost always or always** true for me in this subject.

Please answer each item. Do not spend a long time on each: your first reaction is probably the best one.

Only rarely almost always

1.	In this subject students should focus their study on what I provide them.	1	2	3	4	5
2.	It is important that this subject should be completely described in terms of specific objectives that relate to formal assessment items.	1	2	3	4	5
3.	It is important to present a lot of facts to students so that they know what they have to learn for this subject.	1	2	3	4	5
4.	In this subject I concentrate on covering the information that might be available from key texts and readings.	1	2	3	4	5
5.	I encourage students to restructure their existing knowledge in terms of the new way of thinking about the subject that they will develop.	1	2	3	4	5
6.	I structure my teaching in this subject to help students to pass the formal assessment items.	1	2	3	4	5
7.	I think an important reason for running teaching sessions in this subject is to give students a good set of notes.	1	2	3	4	5
8.	In this subject, I provide the students with the information they will need to pass the formal assessments.	1	2	3	4	5
9.	I should know the answers to any questions that	1	2	3	4	5

	students may put to me during this subject.					
10.	I make available opportunities for students in this subject to discuss their changing understanding of the subject.	1	2	3	4	5
11.	In this subject my teaching focuses on the good presentation of information to students.	1	2	3	4	5
12.	I see teaching as helping students develop new ways of thinking in this subject.	1	2	3	4	5
13.	In teaching this subject it is important for me to monitor students' changed understanding of the subject matter.	1	2	3	4	5
14.	My teaching in this subject focuses on delivering what I know to the students.	1	2	3	4	5
15.	Teaching in this subject should help students question their own understanding of the subject matter.	1	2	3	4	5
16.	Teaching in this subject should include helping students find their own learning resources.	1	2	3	4	5
17.	I present material to enable students to build up an information base in this subject.	1	2	3	4	5

Appendix 6

BELIEFS ABOUT TEACHING AND LEARNING IN YOUR DISCIPLINE - DEBQ

Barbara K. Hofer (2000) adapted version

Instructions:

Please answer the following questions as best you can on a scale from **1** to **5**, with 1 being **strongly disagree** and 5 being **strongly agree**. We are interested how you think about your subject area. When you are answering these questions, please give us your beliefs about your disciplinary area

Discipline: ____

Years of teaching experience: ________________________

	SD **SA**
1. In this subject, most work has only one right answer.	1-----2-----3-----4-----5
2. What is accepted as knowledge in this field is based on objective reality.	1-----2-----3-----4-----5
3. All experts in this field would probably come up with the same answers to questions in this field.	1-----2-----3-----4-----5
4. If you read something in a textbook for this subject, you can be sure it it is true.	1-----2-----3-----4-----5
5. Most of what is true in this subject is already known.	1-----2-----3-----4-----5
6. Correct answers in this field are more a matter of opinion than fact.	1-----2-----3-----4-----5
7. Students know the answers to questions in this field because they have figured them out for themselves.	1-----2-----3-----4---5
8. Principles in this field are unchanging.	1-----2-----3-----4-----5
9. There is really no way to determine whether someone has the right answer in this in this field.	1-----2-----3-----4-----5
10. Expertise in this field consists of seeing the interrelationships among ideas.	1-----2-----3-----4-----5
11. Answers to questions in this field change as experts gather more information.	1-----2-----3-----4-----5

12. All experts in this field understand the field in the same way.	1-----2-----3-----4-----5
13. Students are more likely to accept the ideas of someone with first-hand experience than the ideas of researchers in this field.	1-----2-----3-----4-----5
14. Students are most confident knowing something when they know what the experts think.	1-----2-----3-----4-----5

Appendix 7

PUBLIC AGENCIES IN COLOMBIA REFERENCED IN THE THESIS

The Colombian Institute for Educational Evaluation (ICFES, *acronym in Spanish*), is a specialized entity that offers educational assessment in all educational levels. They support the Ministry of National Education of Colombia in the development and administration of state assessments and in systematic investigation about the factors that influence the quality of education, to provide useful and timely information that contributes in the improvement of the quality of education. Webpage: www.icfes.gov.co

National Administrative Department of Statistics (DANE in Spanish), is the Colombian Administrative Department responsible for the planning, implementation, analysis and diffusion of the official statistics of Colombia. DANE is also in charge of carrying out the national census every ten years. Webpage: http://www.dane.gov.co (in Spanish)

National System of Higher Education Information (SNIES) provides reliable data on Colombia`s higher education institutions and the programmes they offer, while facilitating the generation of consolidated statistical data and indicators. Webpage: www.mineducacion.gov.co/snies

The 2006-2016 Ten-Year Education National Plan. It is elaborated by Ministry of National Education of Colombia. It is defined as a social pact for the right to education and its purpose is to become the route and horizon for the education development of the country while in force, an obligatory planning tool reference for all governments and education entities, as well as an instrument of social and political mobilization around the defence of education which, in turn, is understood as an individual's fundamental right and as a service to the public which, consequently, becomes a social service.
http://www.plandecenal.edu.co/html/1726/w3-propertyvalue-41518.html

The National Development Plan (PND, acronym in Spanish) is the document that serves as the basis and provides guidelines for strategic public policies formulated by the President of the Republic through his government team. Its development, socialization, evaluation and monitoring is the responsibility of the National Department of Planning (DNP, acronym in Spanish). The National Development Plan is the formal legal instrument by which plotted the objectives of the Government allowing the subsequent evaluation of their management. Webpage: https://www.dnp.gov.co/Plan-Nacional-de-Desarrollo/Paginas/Que-es-el-Plan-Nacional-de-Desarrollo.aspx#googtrans/gl/en

Appendix 8

EXAMPLE OF THE INTERVIEW

SUBJECT #2

Beliefs about knowledge

1. **Some people talk about the "quest for truth" in a discipline. I'm not clear what they mean by this. What is your view?**

From a legal perspective there are two schools of thought -the cognitive (positivist) school of thought, according to which legal norms have their own context, their own rationale, their own explanation and source of knowledge, and consequently, the legal rule can be known by anyone, by everyone and therefore it is possible to reach truths; and the skeptic (school of thought), which says no - that the legal rule is valid depending on the economic, social, cultural, historical context, from which various criteria for interpretation and legal schools have been generated. My position is eclectic. That is, there are universal concepts on human rights for example, but there are a number of issues where it is not possible to get to the truth, and the question is: what is the role of a lawyer? It is not the quest for truth, their role is to construct arguments to defend their client's rights under the law, so the lawyer applies subjective law, but judges must lean toward objectivity. But the truth lies with the judge. But the sentences vary over time. The real truth is not always possible in legal matters.

2. How do you know you have learned something? How can you confirm that knowledge?

From a law perspective this is a problem because there are many norms, we follow a positivist model that comes from the Roman-Germanic model- these are abstract norms that are then applied to individual cases, but there is a knowledge, or learning when you have learned the norm and you are capable to detect the essential aspects of the norm, but anyone can know the norm and still remain ignorant, (because) some technical and legal criteria are needed to analyse the rules differently to how those who are not lawyers do. You have learnt when you are able to interpret realities and solve legal problems.

3. What role does an expert play in the learning process? What does the expert offer the learner?

It is assumed that one must know the discipline. It is essential that (learners) know it, the theory and the practice. But when teaching, it is necessary to transmit this by presenting problems and solving them, and then giving them problems and making them solve them. Provide them with techniques so that they are able to solve problems. People learn in different ways. The expert facilitates the learning process.

4. What is your attitude when another expert in your field differs from your point of view? How can you determine who is wrong or who is right?

The essence of legal work is confrontation. What the student is taught is to confront opinions and solve problems through reasoning, not to learn the rule and nothing else, because norms change, but to support arguments through the use of reasons.

Beliefs about learning and teaching in your discipline

5. What does learning mean to you?

It is the students' ability to handle certain elements to solve legal problems. Students learn to the extent in which knowledge is acquired, and then they use it in specific cases to solve problems. Law goes beyond logic, it requires a more complete understanding of reality, of the social and historical context in order to confront the norms with legal criteria.

6. What is understanding?

It is an inherent element of learning. It is not only being able to recite the norm. It is the ability to define the scope of that norm, to understand the norm in its context. That is why having knowledge of reality, of history, is required.

7. How do you prefer to approach learning new material, and how do you know when you have learnt something? What changes do you see when you learn? How do you confirm this understanding?

We are learning all the time, because what we lawyers do is solve problems. In order to do that I write, I research, read, specify concepts, try to solve all the questions about the norm using the techniques of the profession.

I confirm my knowledge when I can support and sustain my ideas before others and solve the case.

8. What does teaching mean to you? How do you know when you have taught your students something well?

It is the ability to convey an experience, not only rules. To impress students. An admiration that makes students see you as a model, and therefore learn. And then I confront them, and make them find their own way, and then for them to do different things to the things I do.

Questions about ICTs

9. How can Information and Communication Technology help students' learning process?

I have my doubts that they do. Legal databases are complicated. I do not see them as an aid to learning. What is related to learning, -words-, remain, for me, the most important. I don't use PowerPoint, but I sometimes some videos.

Appendix 9

EXAMPLE OF THE INTERVIEW

SUBJECT # 7

Beliefs about knowledge

1. **Some people talk about the "quest for truth" in a discipline. I'm not clear what they mean by this. What is your view?**

When they speak of truth they are of the mind-set that there is a single way to undertake research and that that way will give us a unique knowledge- this is a positivist concept. I do not share those views. I do not believe in one single truth, but that there are many truths and truth depends on the context.

2. How do you know you have learned something? How can you confirm that knowledge?

When I see that I can use it for a purpose. And, when I put it into practice and it gives me results. When I can teach, explain it to others and invent activities so that others understand.

3. What role does an expert play in the learning process? What does the expert offer the learner?

I take a Vygotskian approach. The role of the expert is important. Accompaniment is important. We can guide them in the conceptual aspects. It is helpful until learners can evaluate themselves.

4. What is your attitude when another expert in your field differs from your point of view?

We sit and talk. What do I think? and why? Discussions are very rich.

How can you determine who is wrong or who is right??

It is not possible to know it. Because there is no unique truth. He/she just has a way of seeing things differently.

Beliefs about learning and teaching in your discipline

5. What does learning mean to you?

It means many things. There are many levels. The highest level is when I can use what I have learnt to transform my understanding of the world and act differently within the natural and social world (meaningful learning). Another level is to understand, to recognize the concepts, but I am not able to apply this to my everyday life. And the lowest level is when the concepts are separate from my behaviour in the world. I have an academic knowledge but I cannot use it for anything, only to pass exams. But even at that level there is still an initial learning, error and mistakes are necessary because they indicate that the learner is processing the information. It is very bad when the student repeats verbatim or literally, because it indicates that there is no processing, only literal reproduction. Errors are part of the learning process.

For that reason the methodology I follow in class is to start with work, with conceptual readings, expositions of what they have understood and for them to prove that they can apply the knowledge. First understanding what is being read, (followed by) processing and (then) the application of concepts.

6. What is understanding?

When they can define and explain a concept using their own words, not using the same ones I gave them.

7. How do you prefer to approach learning new material, and how do you know when you have learnt something? What changes do you see when you learn? How do you confirm this understanding?

My way of understanding the texts I read and hear changes. It is the gradual approaching of a concept (Vygotsky). I'm approaching the concept progressively, and use conceptual networks.

8. What does teaching mean to you? How do you know when you have taught your students something well?

I believe in education. Some people say that education does not exist, I do not believe that. Teaching is sharing something I know how to do, so those people can change and so that ultimately they can do what I can do and even more. For them to have the same tools I have. To provide them with a broad view of the possibilities that are open to them and to use those tools for different things than I use them for. And when I see that they are doing that well and differently, independently, then I know they are learning.

Questions about ICTs

9. How can Information and Communication Technology help students' learning process?

I'm not too convinced of that. They greatly help in the aspect of communication. Especially for students who are far away, to upload information for them, the forums, email, but I don't think they are a help to learning. I believe in what Vygotsky says: I need face-to-face interaction for learning or between the expert-learner, and I have not seen how ITCs can achieve that interaction. Perhaps this is wrong. I'm not closed (to the idea).