Science and Mathematics Education Centre

Use of Concept Maps to Improve Saudi Pre-Service Teachers' Knowledge and Perception of Teaching Social Studies

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Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university. To the best of my knowledge and belief, this thesis contains no material previously published by any person except where due acknowledgement has been made.

Signature: 

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Date: 24 February 2010

ABSTRACT

This study investigated the influence of using concept mapping as a teaching and learning tool on Saudi Pre-Service teachers' knowledge of teaching social studies. It also investigated Saudi Pre-Service teachers' perceptions of their learning environment, attitudes towards social studies and confidence towards teaching social studies, while undertaking a Social Studies Teaching Methods course.

The Social Studies Teaching Methods course was delivered in the Education Faculty at Umm Al-Qura University, Makkah, Saudi Arabia. The 12-week course aimed at providing Pre-Service teachers with increased knowledge of teaching social studies.

An action research methodology was adopted for the study, with constructivism and concept mapping providing the theoretical framework. The sample consisted of 30 Pre-Service teachers enrolled in a Social Studies Teaching Methods course during semester 2, 2007. Multiple methods of data collection and analysis were incorporated into this study. These methods included individual and group concept maps, a modified Arabic version of the *Constructivist Learning Environment Survey* (CLES), a modified Arabic version of the *Test of Social Studies-Related Attitudes* (TOSSRA), a modified Arabic version of the *Social Studies Teacher Efficacy Belief Instrument* (SSTEBI-B), three detailed case studies obtained using semi-structured interviews and journals, class reflection, and researcher self-reflection. All three instruments were modified, translated, validated and then used to measure Pre-Service teachers' perceptions before and after using concept maps within the Social Studies Teaching Methods course.

From pre- to post-concept maps, Pre-Service teachers identified significantly more concepts, significantly increased the complexity of their concept maps, and were able to integrate and synthesise the course content in relevant and valid ways. The post-concept maps were found to be more extensive and complex than the pre-concept maps. All Pre-Service teachers moved from more general pre-concept maps to post-concept maps that incorporated more information, with more hierarchical organisation and more narrative detail. In general, the Pre-Service teachers had developed both a greater knowledge of teaching social studies in terms of

curriculum, process, and skills, and developed greater mapping skills as a consequence of using concept maps as an instructional tool in the Social Studies Teaching Methods course.

Using concept maps as part of the teaching and learning process, the Pre-Service teachers perceived that their learning environment had become more personally relevant, they had a greater critical voice, there was more shared control and greater student negotiation. They also acknowledged the evolving nature of social studies. At the same time, the Pre-Service teachers had developed better attitudes towards social studies, enjoyment of social studies lessons, and career interest in social studies. The Pre-Service teachers had developed strong personal beliefs in their own efficacy as social studies teachers and had high expectation of the outcomes of social studies teaching at the end of the Social Studies Teaching Methods course.

The three case studies further highlighted the use of concept maps as an effective teaching and learning strategy. More importantly, the case studies identified the interaction between the Pre-Service teachers as an important source of idea generation and knowledge construction within collaborative learning situations. The case studies highlighted the benefits of working in small groups, and emphasised expression of ideas, listening to others, and helping each other. The case study Pre-Service teachers expressed critical voice and negotiation with one another.

The Pre-Service teachers in the three case studies were enthusiastic about using concept maps as a teaching strategy in their practicum. However, they all faced substantial barriers in doing so primarily due to their lack of experience with concept maps. However, as they became more familiar with using concept maps over the period of the course, their confidence and their ability to use them increased. The time students needed to construct concept maps within the classroom and the large number of students in the classroom were identified as other limitations. These case study Pre-Service teachers believed that their secondary school students had developed positive attitudes towards working with concept maps and enjoyed and became more involved in their learning process.

Against the background of Saudi traditional teaching and learning strategies, the use of concept maps has developed a learning environment where opportunities for engaging in collaborative construction of knowledge and negotiation of meaning were enhanced. The emphasis placed on open dialogue, incorporating justification, explanation and elaboration, assisted the Pre-Service teachers to better understand their own ideas and subsequently build a greater knowledge of teaching social studies.

The findings reported in this thesis provide a detailed insight into a range of facets concerning the delivery of a Social Studies Teaching Methods course with Saudi Pre-Service teachers as perceived by the Pre-Service teachers and the researcher. This study makes a distinctive contribution to the understanding of how Pre-Service teachers' knowledge and perceptions change after using concept maps in their Social Studies Teaching Methods course. This study has implications for social studies teacher educators in the development and instruction of teacher education programs, particularly within a Saudi context.

In the Name of Allah, the Most Gracious, the Most Merciful

DEDICATION

This dissertation is dedicated to the memory of my father, who encouraged me to obtain this degree. I love you and miss you Father, here is the PhD.

This dissertation is also dedicated to the memory of my brother Abdul Samad, who I cannot stop thinking about day and night.

May Almighty Allah (God) have mercy on my father and brother and rest their souls in heaven.

It is also dedicated to my family, including my beloved mother, husband, brother, sisters and my wonderful daughters *Omniah* and *Eba*.

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CHAPTER 1

RATIONALE OF THE STUDY

1.1 Introduction

This thesis investigates the influence of using concept mapping as a teaching and learning tool on Saudi pre-service secondary teachers' knowledge of teaching social studies. It also investigates Saudi pre-service teachers' perceptions of their learning environment, attitudes towards social studies and confidence towards teaching social studies as a consequence of using concept maps during a Social Studies Teaching Methods course. This chapter introduces the thesis in seven main sections. The background and rationale of the study is presented in Section 1.2. Section 1.3 describes the research purpose. Section 1.4 introduces the specific research questions that guide the study. The significance of the study is explained in Section 1.5. Section 1.6 outlines the thesis structure. The chapter concludes with a summary of the chapter in Section 1.7.

1.2 Background and Rationale of the Study

Reform efforts regarding social studies have emphasised changing the ways in which social studies has been taught and learned (National Council for Social Studies, 1994). Past research has shown that social studies instruction has generally relied on teacher talk, memorisation of facts, passive learning, and a textbook (Shaver, Davis & Helburn, 1979). Therefore, most traditional social studies models and curricula are based on the transmission or absorption view of teaching and learning. This traditional form of knowledge transmission involves the students sitting passively and often silently in class and receiving information from teachers (Kent, Gilbertson & Hunt, 1997). Thus, the students develop a limited understanding of the subject. The Curriculum Standards from the National Council for Social Studies (1994) in the United States of America recommended that students be encouraged to process what they learn on several levels simultaneously, rather than always starting with low level

factual information and only later engaging in higher-order thinking. Such an approach encourages students to relate new learning to prior knowledge, to think critically about information, and to use information to construct arguments or make informed decisions (Rice & Wilson, 1999).

Forty years ago, Ausubel (1968) noted that the "most important single factor influencing learning is what the learner already knows" (p. 19). Known as constructivism, this approach focuses on students' prior knowledge and the new knowledge they construct by building on prior knowledge. One way to reform social studies education is to adopt teaching and learning approaches that focus on the students and the knowledge they bring into the classroom.

Most supporters of this constructivist approach to learning advocate instructional interventions that will not only match but also accelerate students' cognitive development. According to Copley (1992), the constructivist classroom requires a teacher who acts as a facilitator where learning is viewed as a social, collaborative activity (Rice & Wilson, 1999). When the educational philosophy of social constructivism is applied to a classroom environment, it has the potential to impact every facet of the class (Jadallah, 2000).

Teaching strategies to support social constructivism in the classroom include the use of cooperative learning activities and concept maps. Concept mapping is usually integrated into cooperative learning activities. Investigations into the effects of collaborative concept mapping have found that such an approach can lead to more effective conceptual discussions and enhanced meaningful learning (Okebukola & Jegede, 1989; Roth, 1994; Roth & Roychoudhury, 1992, 1993a, 1993b, 1993c, 1994).

The definition of social studies has tended to change as knowledge of subject matter increased and developed and as more was learned about how children construct meaningful knowledge (Sunal & Haas, 2002). However, most educators agree that social studies, in essence, is the study of humankind from a multitude of perspectives and at the core of the field is citizenship education (Dynneson, Gross, & Berson, 2003). The National Council for Social Studies (NCSS), the leading national social

studies organization in the USA which has a strong international influence, has adopted the following formal definition for social studies:

> Social studies is the integrated study of the social sciences and humanities to promote civic competence. Within the school program, social studies provides coordinated, systematic study drawing upon such disciplines as anthropology, archaeology, economics, geography, history, law, philosophy, political science, psychology, religion, and sociology, as well as appropriate content from the humanities, mathematics, and natural sciences. The primary purpose of social studies is to help young people develop the ability to make informed and reasoned decisions for the public good as citizens of a culturally diverse, democratic society in an interdependent world. (NCSS, 1994, p. 3)

A Saudi Perspective

For Saudi Arabia, as for every other nation, education is a vital tool of advancement for both the individual and the national economy, affecting the standard of living of all people in the country. Saudi education has a long history involving important educational institutions, some of which date from the seventh century. Their main function was to educate people in Islamic culture and religion (Al-Shawan, 1985). However, in recent decades, considerable attention has been given to an adjustment in educational philosophy towards the provision of training for a technological future, in order to allow the country to compete more effectively in the world market.

The organisation of the education system in Saudi Arabia is based around five levels: kindergarten (for children aged 3-6 years), elementary (7-12 years), intermediate (13-15 years), secondary (16-18 years), and university (typically 19-24 years, depending on the specialised area studied and the form of higher education). The government of Saudi Arabia pays close attention to preparing teachers of all educational levels who are capable of teaching new generations to cope with global change, and achieve prosperity and progress. For this reason, the government established Schools of Education in almost all the 20 Saudi universities along with more than 30 teachers

colleges (Ministry of Higher Education, 2008). These colleges are training large numbers of prospective teachers in all subjects and assisting them to acquire the necessary teaching competences.

The quality of education has become a subject of major concern to Saudi planners and educators charged with developing education for all levels of public and higher education. The Ministry of Education has spared no effort in developing its curricula and programs, considering education as an investment in the future (Ministry of Education, 2008). While continuing to develop plans and to train teachers, the Ministry of Education acknowledges that the education system still requires further information to adequately prepare students for new challenges (Ministry of Education, 2008).

Saudi teachers have long emphasised a traditional teaching style with teachers at the centre of teaching-learning activities (Ministry of Education, 2008; Ministry of Higher Education, 2008). The general nature of a Saudi classroom is a six by five meter room with 40 students, and one teacher standing at the front of the class. The class is usually driven by 'lecturing style' teaching, maintaining classroom management for large classes. Only a few students initiate questions, express independent thoughts or engage in interactive learning. In the Saudi educational environment the role of the learner is to listen and accept the explanation of the teacher. Further, teachers believe there is a large amount of content in the curriculum which must be covered. Thus, teachers find it difficult to give individual attention to students and to determine student's prior knowledge before the start of any new topic.

Recognising the urgent need for education reform, the Ministry of Education (2008) and the Ministry of Higher Education (2008) have initiated major changes and introduced and promoted new teaching and learning strategies that emphasise student-centred methods. These changes address the importance of suitable learning environments and effective learning strategies. Consequently, Saudi educators and teachers are being encouraged to use teaching strategies that support constructivist learning in their classrooms. Educational reform aims to encourage students to perform complex and logical activities such as decision-making which relies on

critical and innovative deduction rather than on memorising facts. Thus, educational programs within schools should reflect this approach.

1.3 Research Purpose

The primary purpose of this research was to improve teaching and learning by incorporating concept mapping as a teaching strategy. In Saudi Arabia, as with most other countries, the government desires an education system that is both modern and effective. By focusing on the use of teaching strategies that support constructivist learning during teacher education, the consideration is that pre-service teachers will be better equipped to provide a modern and effective education for their students. Consequently, this thesis aims to evaluate the use of concept maps as a teaching strategy to improve pre-service teachers' knowledge of teaching social studies, perception of their learning environment, attitudes towards social studies and confidence towards teaching social studies. The pre-service teachers were enrolled in a Social Studies Teaching Methods course in the Education College, Umm Al-Qura University, Makkah, Saudi Arabia.

1.4 Research Questions

Four research questions address the purpose of this study. The responses to these four questions are primarily addressed in Chapters 5 and 6. Chapters 2 to 4 provide the background literature and the methodology, while Chapter 7 summarises the results by directly addressing each of the research questions.

Research Question 1

How does the use of concept maps in a Social Studies Teaching Methods course change Saudi pre-service teachers' knowledge of teaching social studies?

This question addresses Saudi pre-service teachers' knowledge of teaching social studies. Implicit in this question is knowledge of relevant curriculum content, processes, skills and a developing awareness of a range of instructional strategies that

enhance pre-service teachers' learning. To answer this question data was collected from individual concept maps, group concept maps, case studies developed through semi-structured interviews and journals, weekly class reflection and researcher self-reflections.

Research Question 2

How does the use of concept maps in a Social Studies Teaching Methods course change Saudi pre-service teachers' perceptions of their social studies learning environment?

This question directly addresses pre-service teachers' perception of their learning environment. It is answered using information from the *Constructivist Learning Environment Survey*, case studies developed through semi-structured interviews and journals, class reflection and researcher self-reflections.

Research Question 3

How does the use of concept maps in a Social Studies Teaching Methods course change Saudi pre-service teachers' attitudes towards social studies?

This question directly addresses pre-service teachers' attitudes towards social studies. It is answered using information from the *Test of Science-Related Attitudes* questionnaire, case studies developed through semi-structured interviews and journals, and researcher self-reflections.

Research Question 4

How does the use of concept maps in a Social Studies Teaching Methods course change Saudi pre-service teachers' confidence to teach social studies?

This question directly addresses pre-service teachers' confidence towards teaching social studies. It is answered using information from the *Science Teacher Efficacy*

Belief Instrument questionnaire, case studies developed through semi-structured interviews and journals, and researcher self-reflections.

1.5 Significance

This research is the first study of its kind in Saudi Arabia to implement concept maps with social studies pre-service teachers. Hence, this study is significant for several reasons. First, incorporating the most recent teaching and learning methods into Saudi Arabian universities are a key priority for the Saudi Arabian Ministry of Education. Concept mapping, as espoused by constructivism theory, fits into the national initiatives of supported teaching methods. The effective implementation of concept mapping for improved teaching and learning is highly recommended by the Saudi Arabian government. Second, the use of concept maps should assist pre-service teachers to achieve the expected outcomes of their classroom work. More importantly, this approach should also assist pre-service teachers develop better knowledge of teaching social studies through the use of concept maps to assist them in their future career as secondary school teachers. Third, this study encourages pre-service teachers to be involved in the research process, especially the steps of reflection and discussion. In this manner, the pre-service teachers learn how to work with others, thus developing their social and thinking skills. Fourth, the study is likely to contribute to the development of a trend in Saudi Arabia of improved constructivist approaches to teaching and learning. The fifth significance of this study was the use of three instruments to assess perception of the learning environment, attitudes towards social studies, and confidence towards social studies. This study is the first to translate and use these instruments in an Arabic context. Sixth, this study attempts to extend educational research relating to concept maps into the social studies teaching context. Finally, on a personal level as researcher-teacher, this study will allow for increased self-reflection on classroom events involving concept mapping approaches, how the concept maps were implemented in the classroom, and pre-service teachers participation and cooperation while developing the concept maps.

1.6 Structure of the Thesis

This section briefly describes the contents of each chapter of this thesis.

Introduction and Overview - Chapter 1

Chapter 1 has provided the background and rationale of the study. In this chapter, the purpose of the study was outlined, the research questions posed, and the significance of the study was presented. The structure of the thesis was described to enhance the readability and cohesion of the final document.

Literature Review – Chapters 2 and 3

Chapter 2 and 3 provide the literature review and background information for this thesis. Chapter 2 presents an overview of research related to constructivism and the use of concept maps as a tool for teaching and learning. There are two main parts within Chapter 2. The first part introduces constructivism and the constructivist view of learning, and implementing constructivism in the classroom. The advantages and limitation of constructivist learning in the classroom are also presented.

In the second part of Chapter 2, concept maps are defined and the foundations of concept maps are presented. This part also describes the various methods of constructing and scoring concept maps, applications of concept map within educational settings, and the advantages and limitations of concept maps.

Chapter 3 presents a review of the literature related to classroom learning environments and the instruments used to measure that environment. This chapter also presents a review of literature related to instruments used to measure attitudes and confidence. Each of the three instruments used in this study is described in terms of their development and validation, followed by a review of the literature for the use of the instrument.

Methodology – Chapters 4

Chapter 4 outlines the research approach used in this study. An action research methodology was used, with multiple methods of data collection and analysis. The participants were 30 female pre-service teachers studying a Social Studies Teaching Methods course in the second semester 2007 in the Education College at Umm Al-Qura University, Makkah, Saudi Arabia. The position of the researcher within this study was that of researcher as teacher.

Chapter 4 closes with a description of the approaches taken to ensure trustworthiness of the study and the ethical issues that were addressed within the study.

Results – Chapters 5 and 6

Chapter 5 and 6 provide the results of this study. Chapter 5 presents the results of the concept maps in two sections. The first section presents the results of the individual concept maps, while the second section reports the results of the group concept maps. Chapter 6 presents the results of the questionnaires, case studies, class reflection and researcher reflections. Validation of the instruments used to collect data is reported in terms of validity and reliability. Change in the pre-service teachers' perceptions of the learning environment, attitudes toward social studies, and confidence towards teaching social studies are reported. The results of three individual case studies are presented, along with a cross case analysis. Pre-service teachers' perceptions of what they achieved from the weekly workshops are identified and described. Finally, the researcher's reflections on teaching with concept maps are presented.

Discussion and Conclusion – Chapter 7

The concluding chapter summarises the findings by addressing each of the research questions outlined in the first chapter. This chapter also provides a discussion of the results, implications of the study, limitations, and recommendations for further research.

1.7 Summary

This chapter has presented the rationale for the study by highlighting the research problem through background information of the study, stating the research purpose and questions. As well, the significance and structure of the thesis are identified. The following chapter presents the literature review relating to constructivism and concept maps. The second part of the literature review, presented in Chapter 3, provides an overview of research on specific instruments used to measure learning environments, attitudes and confidence.

CHAPTER 2

REVIEW OF THE LITERATURE – CONSTRUCTIVISM AND CONCEPT MAPPING

2.1 Introduction

Classroom teaching practice is likely to be more effective when it is informed by an understanding of how students learn. It is therefore important that the major implications of learning theory should be embedded in classroom practice. Although the use of constructivism in education has received much attention in recent years, the approach has existed for several decades and was the prominent perspective in the 1930s and 1940s among public educators. Constructivism is the dominant paradigm of learning in social studies, and a vast amount of social studies education research has been carried out from a constructivist perspective. This chapter presents an overview of constructivism and concept mapping, forming the major theoretical basis for this study. The following chapter presents a review of the specific instruments used in this study.

This chapter consists of five main sections. Section 2.2 addresses the nature of constructivism theory, deals with the constructivist view of learning, the teacher's role in a constructivist classroom, implementing constructivism in the classroom, obstacles in the take up of constructivism, and applied constructivist views to teaching and learning within social studies. Section 2.3 covers concept mapping, dealing with the definition of concept maps, goals of using concept maps, and the foundations of concept mapping. The various methods for constructing concept maps are described in Section 2.4. Section 2.5 describes methods of scoring concept maps. Section 2.6 presents applications of concept mapping within various educational settings. The chapter concludes with a summary in Section 2.7.

2.2 Constructivism

2.2.1 Definition of Constructivism

Constructivism is a theory of knowing. The origins of constructivism can be traced back to Kantian epistemology and the thinking of Giambattista Vico in the 18th century, American pragmatists such as William James and John Dewey at the beginning of the 19th century, and the great names of cognitive and social psychology: F.C. Bartlett, Jean Piaget, and L.S. Vygotsky (Tynjälä, 1999). Constructivism is not a unified theory, but rather a conglomeration of different positions with varying emphases (Tynjälä, 1999). According to Sunal and Hass (2002), constructivism is a learning theory based on the notion that people are 'active' knowledge seekers powered by innate curiosity. Unlike the traditional and/or behaviorist theories of learning, constructivism fundamentally promotes the idea that the learner constructs his or her own knowledge (Boyer & Semrau, 1995; Damarin, 2004; Jadallah, 2000; Jonassen, Howland, Moore & Marra, 2003).

According to constructivist theory, learning is not passive reception of information but the learner's active continuous process of constructing and reconstructing his or her conceptions of phenomena (Tynjälä, 1999; Doolittle & Hicks, 2003; Palmer, 2005). Constructivism relies on social interaction and collaboration in meaning making. Although common languages and cultures enable learners to understand things in basically the same way, their individual experiences may attribute the same things different meanings (Tynjälä, 1999). Teaching is not the transmission of knowledge. Rather, from a constructivist perspective, teaching is the process of helping students to actively construct their knowledge by assigning tasks that enhance the knowledge construction.

2.2.2 Different Types of Constructivism

In recent literature, the following branches of constructivist thought can be found: radical or cognitive constructivism, social constructivism, the sociocultural approach, symbolic interactionism, and social constructionism (Confrey, 1995; Derry, 1996;

Ernest, 1995; Marshall, 1996; Phillips, 1995; Richards, 1995; von Glasersfeld, 1984, 1995b). Common to these diverse views is that the acquisition of knowledge is metaphorically described as a building process in which knowledge is actively constructed by individuals or social communities (Tynjälä, 1999). According to the debate in the literature between those who place more emphasis on the individual cognitive structuring process and those who emphasise the sociocultural effects on learning, Steffe and Gale (1995) and Moshman (1982) divided constructivism into three main divisions; radical constructivism, social constructivism, and cognitive constructivism. Each of these three divisions addresses the nature of knowledge and knowing differently, as described below.

Radical Constructivism

Radical constructivism represents the most extreme form of constructivism, emphasizing the *internal* nature of knowledge (von Glasersfeld, 1995a). The foundation of radical constructivism is the concept that while a reality external to the individual may exist, the true nature of this reality is unknowable (Piaget, 1973, 1977; von Glasersfeld, 1995a). Extending this concept, knowledge then becomes the subjective construction of the individual, resulting from the cumulative experiences of the individual (Piaget, 1973, 1977; von Glasersfeld, 1995a). This subjective construction reflects the radical constructivist's supposition that knowledge is not passively transmitted from the environment to the individual, but rather that knowledge is the result of active cognising by the individual for the purpose of satisfying some goal (Ernest, 1995).

In addition, radical constructivism claims that the ultimate goal of knowing is not ontological 'truth', that is, the construction of internal mental structures that mirror or correspond to a world that exists outside of the individual (Ernest, 1995). Rather, radical constructivism supports the construction of internally coherent mental structures that are adaptive and that lead to efficient and effective thinking and behaving (von Glasersfeld, 1984, 1998). This positing of individual subjective knowing leads to a de-emphasis on social processing in favor of individual cognising (von Glasersfeld, 1998). Indeed, for radical constructivists, other humans are simply additional environmental entities with which one has personal experiences and must adapt. That is not to say that social interaction is useless. Rather, social interaction

may provide the impetus for an individual to rethink his or her ideas. It is, however, this rethinking that is responsible for the construction of knowledge, not the social interaction (von Glasersfeld, 1995b).

Ultimately, the world view for radical constructivism is that truth is a measure of the internal coherency of one's personal mental structures and therefore "the art of teaching has little to do with the traffic of knowledge, its fundamental purpose must be to foster the art of learning [and development]" (von Glasersfeld, 1995a, p. 192). Radical constructivism claim's that students are not free to construct any knowledge they wish (i.e., solipsistic, 'anything goes' knowledge), but rather, their constructions are constrained, influenced, and made valid by the materials with which they interacted (von Glasersfeld, 1995a). Thus, the goal of radical constructivism is an individual, viable model of understanding, not the acquisition of a predefined set of supposed reality-based concepts.

Social Constructivism

Social constructivism developed from the ideas of Lev Vygotsky and claims that knowledge is not solely constructed within the mind of the individual (Ernest, 1995). Rather, social constructivism claims that interactions within a social context involve learners in sharing, constructing, and reconstructing their ideas and beliefs (Jadallah, 2000). Indeed, for social constructivists "the process of personal meaning-making takes a backseat to socially agreed upon ways of carving up reality…the community is the prime source of meaning for objects and events in the world" (Prawat, 1996, p. 220). Therefore, social constructivism provides the necessary language skills and understanding of cultural norms that facilitate learning (Damarin, 2004; Jadallah, 2000) through the use of available tools. In any social interaction a negotiated meaning occurs between two or more participants causing the language to make sense. Language is context dependent. How language is used and perceived is determined by where the interaction occurs. The primary function of language in social interactions is to serve a communal function (Gergen, 1995). Language helps the participants to function within a community and interact with others.

There are various factors that can influence a social interaction other than language. One factor is culture. Cultures can influence social interaction by placing differing

values and beliefs on the participants (Gergen, 1995). Another factor that can influence the situation is a participant's perspective. Perspective is the point of view from which a participant sees the interaction. In social interactions knowledge is created between the participants, not in their minds.

Social constructivism also emphasises the situational and contextual nature of learning (Lave & Wenger, 1991; Kirshener & Whitson, 1997). The situations in which we learn and the way we learn affect what we learn and how we transfer this knowledge into new situations (Lave & Wenger, 1991; Kirshener & Whitson, 1997). Situativity theorists, therefore, emphasise that the information to be studied is being used and applied already in the studying phase in tasks that simulate the real-life situations where the knowledge is to be applied in future. Recently, the approach of situated cognition has been criticised for focusing on the use of concrete, episodic information and for ignoring the development of generalisable, abstract knowledge and higher-order thinking (Bereiter, 1997; Ohlsson & Lehtinen, 1997).

Cognitive Constructivism

The 'cognitive constructivist' viewpoint developed from the ideas of Jean Piaget emphasises the importance of the cognitive processes that occur within individuals (Osborne & Wittrock, 1983; Piaget, 1977). Cognitive constructivism, unlike radical and social constructivism, embraces the notion that one can come to know reality, or truth, as it exists external to the individual (Mayer, 1996; Prawat, 1996). Therefore, cognitive constructivism considers knowledge is objective and knowledge acquisition is the (re)construction of external reality into internal mental structures (Moshman, 1982).

Proponents of cognitive constructivism argue that individuals strive to make sense of the world (von Glasersfeld, 1984), and the metaphor of the 'child as scientist' is often used to describe how children investigate the world around them (Driver & Erickson, 1983). This type of learning can be triggered by experiences that can be physical, mental, or social: physical experiences include physical interaction with objects in the environment, mental experiences involve thinking about things that have been observed, and social experiences include interactions with adults and peers. Individuals interpret these experiences in order to make meaning and develop

their own personal understandings. Cognitive constructivism therefore emphasises the personal construction of knowledge. According to this view, teachers have the relatively peripheral role of providing suitable experiences that will facilitate learning.

Constructivism that primarily describes cognitive processes adheres to a system of explanations of how learners, as individuals, impose intellectual structure on their world (Piaget, 1971). Constructivism that emphasises social processes, on the other hand, views knowledge as having both individual and social components and hold that these cannot be viewed as separate in any meaningful way (Cobb, 1994; Cobb, Wood, & Yackel, 1990; Saxe, 1992). Whereas social constructivists see learning as increasing the learner's ability to participate with others in meaningful activity, cognitive constructivists focus on how individuals create more sophisticated mental representations and problem-solving abilities by using tools, information resources, and input from other individuals (Wilson, 1996).

There is an essential philosophical difference, ontologically and epistemologically, between cognitive constructivism and both radical and social constructivism. Specifically, cognitive constructivism is built upon objectivism and metaphysical realism; that is, the concept that reality is and possesses an independent identity, separate from and regardless of the thoughts and beliefs of the observer (Wilson, 1996). Radical and social constructivism, however, are built upon subjectivism and relativism; that is, the concept that knowledge is not a mirror image of reality, but rather is relative to the observer (Wilson, 1996). The cognitive constructivist and radical and social constructivist perspectives emphasise different paths towards knowledge construction.

As is evident from the preceding discussions of radical, social, and cognitive constructivism, the concept of constructivism is diverse, with varied interpretations. This diversity necessitates that the asserting of constructivist claims be made with caution and significant forethought.

2.2.3 Prior Knowledge in the Learning Process

Prior knowledge is an important component of constructivism. Driver and Bell (1986) suggested that people construct meaning by generating links between existing knowledge and new phenomenon. Resnick (l984) believed that people "seek sensible solutions and explanations within the limits of their knowledge" (p. 25).

Ausubel, in the late 1960s, stressed the relevance of prior knowledge for learning: in his view, the most important single factor influencing learning is what the learner already knows (Ausubel, 1968). Subsequently, many researchers have referred to the determining influence of prior knowledge on students' learning processes and learning performance (Dochy, 1992; Duit, 1999; Hegland & Andre, 1992). The main findings of this research can be summarised into four key points. First, that prior ideas and conceptions of the world are brought into the classroom by students. Second, these prior ideas and conceptions often differ greatly from the accepted scientific body of knowledge. Third, similar prior ideas and conceptions are held by students with similar backgrounds, thus, leading to a common set of alternative ideas and conceptions about the world. Finally, these prior ideas and conceptions can be used by the teacher as stepping stones to future ideas and conceptions (Tytler, 2002b).

Prior knowledge can be described as the knowledge learners have when entering a learning environment, and which is potentially relevant for constructing new knowledge. Conceptions reflect the way learners look at certain phenomena (Johansson, Marton, & Svensson, 1985). Thus, preconceptions can be defined as domain-specific conceptions constructed by students based upon their concrete everyday experiences or interactions with particular natural phenomena before formal instruction. Recent constructivist learning theories (Hegland & Andre, 1992) consider the active use of prior knowledge to be a key strategy for constructing rich and useful mental representations while studying new information. Some situations do not call on prior ideas. Students' preconceptions, in many learning situations, however, do not enter the learning process automatically and/or students do not succeed in activating and using their prior knowledge intentionally and actively (Dochy, 1992). Consequently, they may learn new information as 'isolated' bodies of

knowledge (Schmidt, 1982) and experience difficulties applying the new knowledge in novel situations (Saxena, 1991). In other words, in many cases students appear to need instructional support to activate their prior knowledge and to learn in a meaningful way (Rice & Wilson, 1999). Accessing existing knowledge provides the background for new knowledge.

Various models for constructivist learning all have the similarity of "…exploring student views" (Tytler, 2002a, p. 31). There are many techniques to do this. Glasson recommends that students complete surveys or participate in activities that, "…are designed to identify existing ideas" (Glasson & Lalik, 1993, p. 189). Student interviews, student journals and diagnostic multiple choice tests are techniques which have been used as probes of student understanding (Treagust, Duit & Fraser, 1996). As well as identifying preconceptions, the process of eliciting students' pre-instructional ideas can also offer an opportunity for student learning (Treagust et al., 1996). Other ways of eliciting learners' prior knowledge are through techniques such as brainstorming, concept cartoons (Stephenson & Warwick, 2002) and concept mapping (Novak & Gowin, 1984). Such techniques attempt to determine student's prior knowledge before instruction.

2.2.4 The Constructivist Classroom

A constructivist classroom provides the student with multiple methods from which to acquire new knowledge. In constructivist classrooms, learning is promoted through collaboration among the students and with the teacher, higher-order thinking and problem solving are encouraged, the teacher attempts to relate subject matter to the students' lives, the students are allowed to construct their own knowledge and avoid repeating a right or wrong answer, and the teacher acts as a facilitator and guide (Rice & Wilson, 1999). The role of the teacher and students are described below in further detail.

Teacher Role

One primary function of the teacher in a constructivist classroom is that they take the role of a guide and a facilitator, or in simpler terms, a coach. Doolittle (2001) states that constructivism "requires that teachers become facilitators of knowledge not

conduits. The teacher's role is to create experiences within which students will learn and then guide the students through those experiences, a form of scaffolding" (p.11). In this role the teacher is responsible for guiding the students through the specific experiences or activities. This allows for the students to construct their own knowledge through exploration (Rice & Wilson, 1999).

Another role of the teacher in this knowledge exploration is that they redirect the focus and rationale of the lesson. Brown (1999) contends that the role of the teacher is to promote thinking in the classroom and the evaluation process. Such an approach should not diminish the content of the curriculum but should instead enhance the way that concepts are revealed. A key factor in the teacher playing the role of the facilitator and guide is to perform "in an interactive manner, mediating the environment for the students" (Brooks & Brooks, 1993, p. 6). The teacher provides the structure and example for the way classroom activities are conducted.

When implementing constructivism in the classroom, teachers need to evaluate their own skills and strengths as a teacher. Moreover, teachers need to assess their own understanding of constructivism. Putting constructivism into practice requires a host of teacher skills (Windschitl, 2002). For example, teachers must learn to capitalise on, rather than suppress, differences in students' existing understandings due to background; and they must become critically conscious of the dynamics of their own classroom culture (Windschitl, 2002).

Student Role

The constructivist view of learning suggests that learners construct their own knowledge, strongly influenced by what they already know. Constructivism emphasises the active role played by the individual learner in the construction of knowledge, the primacy of social and individual experience in the process of learning, and the realisation that the knowledge attained by the learner may vary in its accuracy as a representation of an external reality (Doolittle & Hicks, 2003; Palmer, 2005). In this way, learners build their own individual sense of 'reality' (Tobin, Tippins & Gallard, 1996). Self-awareness is important. Not only do the students need to know the subject, but they also need to know how they learn the subject, and what their position is on many subject matters. Probing student

understanding is crucial and can be done by teachers or students. Students must review and, if necessary, reform their strongly held personal views if they are to experience meaningful learning. Hence, the elicitation of student ideas is central to any teaching approach informed by constructivism (Driver & Scott, 1996).

Learning is a process in which a student changes his or her conceptions by capturing new conceptions, restructuring existing conceptions, or exchanging existing conceptions for new conceptions (Hewson, 1981). Sewell (2002) argued that when students come into a learning situation where they are presented with new information that differs from their prior knowledge, they deal with it in one of four different ways: delete the pre-existing knowledge, modify the pre-existing knowledge, modify the new knowledge so that it fits the old knowledge, or reject the new knowledge. The amount of learning that occurs in the classroom is largely determined by the prior knowledge that students bring with them to the classroom. This prior knowledge will either be a bridge to new learning or a barrier.

Overall, recent studies have focused upon changes to teachers' roles and perceptions of the classroom as they move to adopt constructivist approaches (e.g., Baird & Mitchell, 1987; Baird & Northfield, 1992; Gunstone & Northfield, 1988; Hand & Treagust, 1991, 1994; Simon, 1989). These studies have placed emphasis on the changing nature of student participation within classrooms: the need for students to persevere and take 'personal risks', the need for adequate time to pursue the activities within the classroom, and awareness by teachers that students' background experiences will play a role in their quality of learning (Baird & Northfield, 1992). Although social constructivist strategies place importance on the student-centered nature of learning, this does not imply a lack of teacher control (Gunstone, 1995). In fact, Gunstone and Northfield (1994) argued that the teacher's role is "much more demanding so as to allow and actively promote recognition, evaluation and re-construction" (p. 525). Consequently, the social constructivist classroom involves a much more dynamic relationship between teachers and students than exists in more traditional classrooms as they negotiate the construction of scientifically acceptable knowledge (Gunstone & Northfield, 1994).

2.2.5 Constructivism in the Social Studies Classroom

The National Council for Social Studies (NCSS) not only emphasises the social studies field precisely as "promoting knowledge of and involvement in civic affairs," but also defines it as *multidisciplinary* and *interdisciplinary* in nature (p. 3). Traditionally, the search for knowledge within the social studies consisted of the search for 'truth'; that is, the acquisition of knowledge that mirrors or corresponds to a singular 'reality'. Constructivism, however, employs a more flexible, culturally relativistic, and contemplative perspective, where knowledge is constructed based on personal and social experience. This relativistic perspective encompasses the belief that knowledge claims of truth, falsity, or viability are always dependent upon, or relative to, personal, cultural, or historical perspectives (Doolittle, 2001). According to Fosnot (1996), learning from a constructivist perspective is viewed as a self-regulatory process of struggling with the conflict between existing personal models of the world and discrepant new insights, constructing new representations and models of reality as a human meaning-making venture with culturally developed tools and symbols, and further negotiating such meaning through cooperative social activity, discourse, and debate.

When the constructivist view is applied to teaching and learning in social studies, the goal of education includes the development of a deep understanding of social studies problems and procedures, and rigorously defensible beliefs about important disciplinary issues (Scheurman, 1998). This developmental process is enhanced when students learn to view problems and issues from different angles and to identify multiple perspectives within and outside the field of study.

Social studies lends itself to teaching complex issues and multiple perspectives. These provide an ideal situation for introducing social constructivism. To implement social constructivism the teacher needs to provide the students with lessons that they can employ in real world situations (Jonassen, 1991). If the teacher addresses this effectively then they will be able to present material in complex learning environments that will foster authentic experiences (Driscoll, 1994). It is essential that the content and skills that the students develop are made relevant to the students (Doolittle, 2001). This will allow for the learning to become interesting to the student

and in turn it will assist the students to become more attentive and eager (Ediger, 2000). Additionally, this approach will make the learning experience more personal to the students, allowing then to feel ownership and to value the knowledge they have acquired. One method for illustrating this is for teachers to organise student learning and instruction around specific important events (Borich & Tombari, 1997). This is especially effective when teaching a lesson on a controversial issue. When a major controversy is involved it can provide the multiple perspectives required to form a wider understanding of an issue. A final result of this is that students may begin to process what they have learned on multiple levels, leading to higher level thinking (Rice & Wilson, 1999).

The teacher should also offer a variety of formats in which the information can be presented (Nuthall, 1999). Such an approach takes into account that individual learners possess diverse learning styles and intelligences (Ediger, 2000). The key element here is that not every student learns in the same way, and it is the responsibility of the teacher to determine the best way that his or her students learn. Social constructivism provides various ways to access students' multiple intelligences. Problem solving activities provide the student with an opportunity to be exposed to an authentic learning experience (Cole & Wilson, 1991).

Social constructivism also allows for a majority of the activities and lessons to be student-centered. Researchers place heavy emphasis on student-centered instruction in the constructivist pedagogy (Driscoll, 1994). If student-centered activities are employed the student will begin to develop a greater confidence in his or her knowledge and feel more connected to the work (Eggen & Kauchak, 1997). When this happens a teacher can then turn the classroom environment into a 'learning community' (Eggen & Kauchak, 1997). A learning community creates an atmosphere that is more interactive than that of the traditional class. One of the key functions of a learning community is that the students turn to each other and try to negotiate a solution when conflict in learning occurs.

2.2.6 Advantages and Limitations of Constructivist Learning in the Classroom

There are various advantages and limitations of using constructivism in the classroom. Each of these will discussed below.

Advantages

Constructivist learning has been found to be a valuable technique to increase the depth of understanding of ideas through students building their own knowledge through inquiry-based exercises (Brooks & Brooks, 1993). Knowledge cannot simply be transmitted from teacher to student or individual to individual. Rather, knowledge is built up through the synthesis of social experiences. That is, knowledge is constructed in response to social interactions through social negotiation, discourse, reflection, and explanation — all active processes. According to the NCSS's National Council for Social Studies (1997), active knowledge construction results from reflective thinking, decision-making, interactive discourse, and self-regulated learning.

A second advantage to constructivist learning is that students taught by this method learn concepts better than those taught even by talented lecturers using traditional methods (Christianson & Fisher, 1999; Hake, 1998; Lord, 1997, 1999; Tynjälä, 1999; Yuen & Hau, 2006). The nature and structure of constructivist learning activities are more likely to stimulate students to engage in learning. Using authentic tasks in real-life situations increases the likelihood that learners will invest the effort and time to construct their understandings on a topic (Vrasidas, 2000). Engaging in these different dialogues allows the student to construct knowledge through interacting with others and other's perspectives, by experiencing multiple contexts of language usage, and by using discourse to provide the next direction of inquiry. Thus, social studies teachers should hone the tool of language, in both themselves and their students, so that the tool of language may be used to create knowledge that is both meaningful and valid (Vrasidas, 2000).

Although the constructivist view of knowledge acquisition applies to all educational levels, it has been suggested that the constructive approach to learning is most advantageous and appropriate for advanced learners, that is, university students and

adults (Jonassen, Mayes, & McAleese, 1993). Furthermore, universities are communities for producing knowledge and, as a matter of fact, scientific activity in its very nature is a constructive learning process. Therefore, creating constructive learning environments for university students is in harmony with universities' other mission, conducting scientific research. Jonassen et al. (1993) suggest that the use of constructivist applications may promote the integration of research and teaching, which has been considered an important aspect in developing university instruction. At the same time, it may be seen as a precondition for producing competencies relevant to the acquisition of professional expertise for today's ill-defined and complex tasks (Jonassen et al., 1993).

Limitations

Despite the important advantages of constructivism, there are some obstacles in taking up this new approach. Treagust et al. (1996) presented various popular educational beliefs that were impediments to the constructivist view (Ferguson, 2000; Cobb, Yackel, & Wood, 1988; Windschitl, 2002). These beliefs included the idea that teaching and learning are separate, "doing an activity does not automatically mean understanding an activity, learning is hierarchical, and that curriculum needs to be learned as it is external and separate from the learners' prior ideas or internal thoughts" (Treagust et al., 1996, p. 5). Critics of constructivism have argued that constructivism is more like common sense than a teaching approach, whereas others have commented that constructivism puts too much focus on the students' knowledge construction and not on worldly knowledge (Crocco, 2001).

Principles of instruction derived from constructivist explanations for learning have not cohered into any comprehensible, widely applicable models (Fosnot, 1996; Noddings, 1990). Cobb et al. (1988) have warned that, "although constructivist theory is attractive when the issue of learning is considered, deep-rooted problems arise when attempts are made to apply it" (p. 87). This is not only because constructivism is a theory of learning rather than of teaching, but also because the implied precepts for instruction differ from the traditional educational model in which teachers themselves were schooled, making it especially hard for them to visualize constructivist pedagogy (Cobb et al., 1988).

Implementing constructivist instruction has proved more difficult than many in education realise. One of several specific limitations in designing constructivist lessons is that teachers must include conjectures about student thinking (Lampert, 1989; Noddings, 1990), as well as the "incomplete understandings, and naive renditions of concepts that learners bring with them to a given subject," as key elements of instructional decision making (National Research Council, 2000, p. 10). This is not a straightforward task. For example, in a study of teachers' efforts to help 10- and 11-year-olds develop an understanding of taxonomic categories of animals, Panofsky, Steiner and Blackwell (1990) found that children would actively engage in sorting and grouping but that their particular categorisations were frequently unknown to the teachers.

Lack of both planning and class time were major limitation to teachers in the implementation of constructivism in their classroom (Beck, Czerniak, & Lumpe, 2000). Some teachers may feel constructivist teaching takes too long to plan for and that students take too long to develop understanding of concepts. Teachers were also concerned that constructivism meant teaching less content (Beck et al., 2000).

Another limitation of using a constructivist learning approach relates to the language. McLane (1990) found that teachers routinely had difficulty in discerning the communicative intentions of a beginning writer. In working with young learners on geometric concepts, a second-grade teacher needed to use extensive conversations and deep probing to discover that her students would identify a three-sided shape as a triangle only if it was sitting on its 'base' (Bastable, Schifter & Russell, 1997).

Although all instructional approaches require some knowledge of the subject matter to be taught, constructivist approach demands an even more extensive content background. Insufficient knowledge of the subject matter can lead to alternative conceptions by both teachers and students. Perhaps just as problematic, teachers who do not have a thorough understanding of what they are teaching tend to control classroom discourse by privileging facts rather than treating concepts in a dialogic and interactive manner (Carlsen, 1992; McLaughlin & Talbert, 1993).

Despite the potential benefits of constructivism activities, research on group learning brought a number of practical problems to the surface. Learners are exposed to examples of the clear, cogent thinking of some peers as well as to the inevitable meandering, unreflective thoughts of others (Windschitl, 2002). Students require training to function effectively in these groups. Even with training, however, many capable students are patently uninterested in helping their peers; and negative consequences of group work such as bickering, exclusion, and academic freeloading are common (Slavin, 1995). Because working with others involves social as well as cognitive processes, interpersonal dynamics can work against group sense-making and the negotiation of meaning (Taylor & Cox, 1997). O'Connor (1998) examined this issue in a sixth-grade mathematics class. She found that ideas were often subordinate to social processes that arose from past interactions among students and that as a result, learning opportunities were diminished as they were filtered through complex interpersonal contexts. Other researchers have found various examples of students' discounting or dismissing the individual contributions of others and resisting the spirit of the entire collaborative enterprise (Anderson, Holland, & Palincsar, 1997).

2.2.7 Summary of Constructivism

Constructivism is a theory of how people develop and acquire knowledge. Its main premise is that knowledge and reality are based upon social consensus. The most effective forms of teaching for constructivist learning depend on nothing less than the re-culturing of the classroom, meaning that familiar relationships, norms, and values have to be made public and be critically re-evaluated (Fullan, 1993; Joseph, Bravmann, Windschitl, Mikel & Green, 2000). Constructivism challenges the traditional model of teaching which places emphasis on the memorisation of facts and concepts. A social constructivist approach would call for a number of changes to occur in the classroom. The teacher would have to change from his or her traditional role to that of a guide and facilitator. A key aspect of this would be to start presenting material in a fashion that shows the complexity and multiple perspectives of real world situations. The classroom environment would begin to take the shape of a ‘learning community’ where interaction is paramount. In order for changes of this

nature to occur in the classroom the teacher needs to be well versed in constructivism theory and understand its advantages and limitations (Brown, 1999).

2.3 Concept Mapping

Concept mapping is an effective strategy for constructivist teaching and learning as it allows individuals to express their own personal understandings and generate their own descriptions of a concept. The purpose of concept mapping is not the production of a map which represents in absolute terms the relationships between concepts, but the production of a visual layout. This visual layout can make a specific issue clearer and more understandable to the learner(s) who produced the map (Cicognani, 2000).

2.3.1 Definition of Concept Maps

A concept map is a visual representation of knowledge that is expressed as a hierarchical framework of concepts and their relationships (Iuli, 2004). Novak and Gowin (1984) defined a concept map as a "schematic device for representing a set of concept meanings embedded in a framework of propositions" (p. 15). Concept maps highlight the connections between concepts and ideas. Organisational strategies such as drawing internal links within new material, organising the material, and selecting important content assist students to make connections between concepts.

A *concept* is defined as a perceived regularity in events or objects, or a record of events or objects, designated by a label (Novak & Cañas, 2006). Within a concept map, each concept is usually enclosed in a circle or box, as illustrated in Figure 2.1 which presents a concept map pertaining to concept maps. Relationships between concepts are indicated by connecting lines that *link* them together. Words or phrases on the linking line specify the relationship between the concepts (Figure 2.1). Concept-link-concept triples form *propositions*, which are meaningful statements about some object or event. An example in Figure 2.1 is 'concept maps represent organized knowledge'. Sometimes these are called semantic units, or units of meaning. Concepts and propositions are the building blocks for knowledge in any domain.

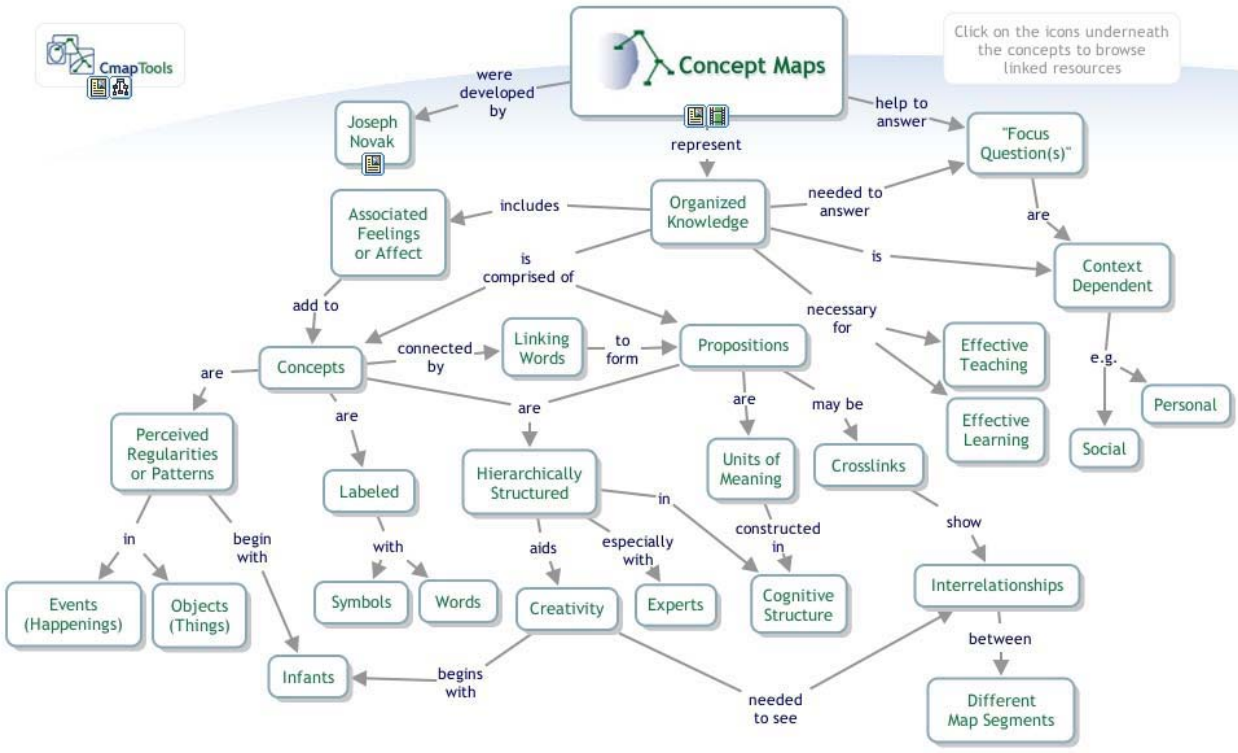


Figure 2.1 A Concept Map Showing the Key Features of Concept Maps (Novak & Cañas, 2006, p. 2).

Concept maps contain certain elements such as concepts, links, propositions, hierarchy, cross links, branching, and examples. Concept maps are represented in a hierarchical fashion with the most inclusive (or general) concepts at the top of the map and the more specific (or detailed) concepts at the bottom of the map. Concept maps tend to be developed around a specific context or focus question. These can be developed around a situation or event that requires understanding, through the organisation of relevant knowledge (Novak & Gowin, 1984).

Hierarchies refer to the branching structures within maps that show superordinate-subordinate categorical relationships among concepts (McClure, Sonak, & Suen, 1999). The greater the number of hierarchies within a map, the greater the level of knowledge structure. An example in Figure 2.1 is 'associated feelings or affect' which represents one hierarchical level, while 'concepts' represents a subordinate hierarchical level.

Cross-links make relationships between or among concepts in different segments or domains of knowledge within the concept map more explicit. Cross-links show how a concept in one domain of knowledge represented on the map is related to a concept in another domain shown on the map. In the creation of new knowledge, cross-links often represent creative leaps on the part of the knowledge producer (Novak & Gowin, 1984). An example in Figure 2.1 is 'creativity needed to see interrelationships'.

Branching of concepts refers to the level of differentiation among concepts; the extent that more specific concepts are connected to more general concepts. In Figure 2.1, 'organised knowledge' has five branches, implying that five specific concepts are related to one general concept.

A final aspect of the structure of concept maps is the inclusion of specific *examples* of events or objects that do not represent concepts (Novak & Gowin, 1984). Examples are labelled and connected to the related concept in the most subordinate position on the map (Ruiz-Primo & Shavelson, 1996, West, Pomeroy, Park, Gerstenberger, & Sandoval, 2000). These can help to clarify the meaning of a given concept. Examples within Figure 2.1 are 'personal' and 'social'.

2.3.2 Goals of Using Concept Mapping

Three basic goals of using concept mapping have been identified: fostering meaningful learning, promoting critical thinking, and determining prior knowledge and alternative conceptions.

Fostering Meaningful Learning

One of the most fundamental goals in the use of concept mapping is to foster meaningful learning. Ausubel (1968) made the very important distinction between rote learning and meaningful learning, and stated that meaningful learning requires three conditions. The first condition stated that the material to be learned must be conceptually clear and presented with language and examples relatable to the learner's prior knowledge (Ausubel, 1968). Concept maps can meet this condition, both by identifying general concepts prior to instruction in more specific concepts,

and by assisting in the sequencing of learning tasks though progressively more explicit knowledge that can be anchored into developing conceptual frameworks (Ausubel, 1968). Ausubel's second condition stated that the learner must possess relevant prior knowledge. The third condition stated that the learner must choose to learn meaningfully. The one condition over which the teacher or mentor has only indirect control is the motivation of students to choose to learn by attempting to incorporate new meanings into their prior knowledge, rather than simply memorising concept definitions, propositional statements or computational procedures. The creation of concept maps supports the incorporation of new meanings into prior knowledge.

Concept mapping may allow students to learn in more meaningful ways. Meaningful learning underlines the constructive integration of thinking, feeling, and acting leading to empowerment for commitment and responsibility (Niehaus, 1994). As students progressively reconstruct their knowledge and construct a complex framework of interrelated concepts with many levels of hierarchy, branching, and cross-linking using visual tools, individual learners engage in meaningful learning (Quinn, Mintzes, & Laws, 2003). This process refers to grafting new knowledge onto an old framework to create meaningful learning (Niehaus, 1994). Thus, concept mapping is a useful process for mediating shared cognition and meaningful learning.

Promoting Critical Thinking

The use of concept mapping will enhance learning and promote the use of various critical thinking cognitive skills, such as analysis, interpretation, inference, explanation, and self-regulation (Vacek, 2009). These strategies will challenge students to think more critically. Daley, Shaw, Balistrieri, Glasenapp, and Piacentine (1999) evaluated the use of the concept map as a strategy to teach and evaluate critical thinking in the culminating clinical course in a baccalaureate nursing program. Concept maps were graded according to the use of hierarchal organization, progressive differentiation, and integrative reconciliation of concepts. For the purpose of this study, critical thinking was defined as "the process of purposeful, self-regulatory judgement. This process gives reasoned consideration to evidence, contexts, conceptualizations, methods, and criteria" (American Philosophical Association, 1990, p. 2). The authors concluded that there was statistically significant

improvement in critical thinking with the use of concept maps as a metacognitive learning strategy over one semester.

Determining Prior Knowledge and Alternative Conceptions

Concept maps drawn by students express their alternative conceptions of a topic and can assist the teacher to diagnose these alternative conceptions (Ross & Munby, 1991). Newsorn-Stewart (1993) asserted that concept maps are useful in representing the knowledge held by a group of people, as well as in identifying alternative conceptions (Novak, 1991). An important by-product of concept mapping is its ability to detect or illustrate the alternative conceptions learners may have as explanations of content matter. The conceptions students may develop are often incomplete and deficient, leading to misunderstandings. Concept mapping was developed as an educational tool for externalising and ascertaining what the learner already knows.

2.3.3 Foundations of Concept Mapping

In education, learning theories about how people came to develop, know things and see and do things differently, evolved from various foundations (Claxton, 1984). Early theorising about how people develop their personal maps and how they come to know things provided a base model of learning theory. Over the past fifty years, the basic model generally described learning as a process through which the world we experience is manifested in our thoughts and expanded and broadened to include ‘associative learning’ and ‘information processing’ (Claxton, 1984). Acknowledging the need to identify how concepts were related and understanding how information is processed served as the foundation from which learning tools used in various educational settings were constructed. The principles of concept mapping can be traced back to psychological, sociological and philosophical foundations. Each of these foundations is explained below.

Psychological Foundations

Work in cognitive theory by Ausubel (1968) played a key role in establishing the psychological foundations from which contemporary concept mapping theory and methods have evolved. However, preliminary cognitive mapping theory development

extends back several decades to work by Tolman (1948). Like pictures, concept mapping today produces a visual representation of accessible information in a specific orientation. Special knowledge can be delineated as a sequential process to increase learning and integrate knowledge into general cognition (Chown, Kaplan & Kortenkamp, 1995).

Generally, in schemata theory as discussed by Milligan (1979) and Sholl (1987), concept mapping processes parallel the schema system. Schema systems are active processes by which mental pictures or understanding of something learned is developed (Srnilkstein, 1991). People acquire knowledge only to the degree that they have constructed schemas from learning experiences. These schema systems are integral to the process by which configurations of new information are remembered in terms of a schema derived in conjunction with collections of previous thoughts. People classify new experiences into general classes and then specify the exceptions or existence of any relationships these ideas may have to other classes within their schema (Milligan, 1979).

Concept mapping technologies are embedded in cognitive learning theory as described by Tolman (1948) and Ausubel (1968). In general, the acquisition and storage of knowledge delineated in cognitive learning theory parallels concept mapping steps defined by Trochim (1989). In learning theory, learners are stimulated to activate related knowledge in a particular area. Similarly, participants in concept mapping processes are encouraged to access related knowledge on the area under focus during initial brainstorming. Guiding learners to develop new structures or knowledge about the structures is paralleled by the processes in concept mapping of generating and developing items and interconnections. Like cognitive learning theory, concept mapping processes consolidate new structures and knowledge. In cognitive learning theory under appropriate conditions, learners acquire a more unified, complex understanding of the phenomena in question. In concept mapping, the consolidation of information is demonstrated by the aggregation of information displayed using individual and group maps (Micheli, 1998). These maps help participants develop broader, common understandings of the information displayed. Opportunity to encourage the creative use of this knowledge is of core significance in cognitive learning. Learners are encouraged to use this information in a way that

makes sense to them (Trochim, 1989). Similarly, concept mapping assimilates this use of information to explore the phenomena under focus. By interpreting the information individuals and/or groups are encouraged to explore, clarify, verify and apply the results derived from the actual maps generated. As in learning theory, this refinement of ideas simulates the opportunity for people to clarify and enrich the complexity of the knowledge acquired (Micheli, 1998).

In summary, special knowledge principles support concept mapping processes in visual patterning and orientations. Concept mapping appears to utilise these basic principles by evoking visual representations of thoughts in a systematic, relational process. In adhering to the way people integrate concepts into cognition, concept mapping manages to simplify the complex tasks of achieving, retaining, and transforming concepts through cognitive schematic work.

Sociological Foundations

While cognitive theory provides structure for the perceived acquisition and integration of knowledge, sociological principles provide processes for understanding the connections in terms of social processing (Garling, 1984). Theoretical work on concept mapping moved away from an earlier emphasis on cognitive measurements required by cognitive theory to theoretical concerns involving the nature and structure of constructs within a socially interactive environment (Holahan, 1986). This perspective is consistent with the views of Huberman and Cox (1990) who contend that the acquisition of knowledge is an interactive reciprocal process between and within individuals in the environment.

Interactive networks are the foundations on which concept mapping variations rely. That is to say, group and individual constructs are established during an interactive process in conjunction with individual experiences and strategies. Concept mapping relies heavily on these interactions in creating construct maps that reflect these communications. Similarly, information becomes knowledge through an interactive process between people and their environment. This position is consistent with a long line of psycho-sociological research emphasising the importance of socially constructed thoughts that makes learning at both the individual and group level possible (Bandura, 1986).

In social processing, the acknowledgement and rationalisation of thought construction is defined through the interactions of people. Construction favouring emergent methodologies and less structured approaches directly embraces principles of social processing. These constructions rely heavily on interactions between concept mapping participants and researchers throughout the process. Knowledge is constructed through an interactive link between people involved in the concept mapping process (Micheli, 1998). Open discussions, interviews and focus groups generate the items to be used in the construction. Similarly, ongoing communications between individuals is crucial during the construction and interpretation of the maps. In group concept mapping, people construct and understand the maps as networks among thoughts of individuals within groups (Micheli, 1998). Individuals within groups are encouraged to share their knowledge and inevitably develop group constructs of knowledge on a particular area. In essence, the final group map is a visual representation and acknowledgement of thoughts constructed through social interactions between people (Micheli, 1998).

In general, all concept mapping constructions require participants to generate items. These people are involved in an interactive process with others undergoing the same concept mapping process. Basically, al1 concept mapping constructions rely on social processing. Some constructions integrate these principles throughout the process while others maintain less socially interactive processes as concept mapping constructions are implemented.

Philosophical Foundations

Concept mapping processes can be situated in a variety of epistemological stances. Traditionally, cognitive theory relied heavily on scientific inquiry and was immersed in decidedly positivistic or logical empiricist approaches and principles (Novak & Cañas, 2006). Positivism is associated with objective realities that could be investigated through experimental methods (Lincoln & Guba, 1990). Positivist epistemology viewed knowledge as that which had been proven, confirmed and acquired through concrete evidence. This stance allowed the social sciences to simulate the apparent objectivity assigned to the natural sciences (Robertson, 1994).

Historically, at least, interpretivist epistemology arose from the critiques of positivism in the social sciences. Specifically, interpretivists disagreed with social science attempts to import standards and procedures of the natural sciences in order to study human beings in society (Schwandt, 1994). Arguably, interpretivists held that cultural sciences differed from the natural sciences and should thus be studied to gain understanding of social phenomena rather than scientific explanations associated with the physical sciences (Schwandt, 1994).

Philosophically, interpretivist researchers construe meaning as the primary focus in exploring the nature of social reality (Ferguson, 1993). Facts are not entities waiting to be discovered in the natural, objective world. Instead, they are social constructions of the ways human beings experience actions through interpretive activities (Ferguson, 1993). Qualitative methods are often associated with interpretivist research. Concept mapping approaches that reflect these structures support the interpretivist paradigm most effectively.

While interpretivists emphasised the world of experience as it is lived, felt and undergone through social interactions, constructivists stressed the construction of knowledge (Schwandt, 1994). As concept mapping evolved over the decades more adherences to sociological principles surfaced and variations in concept mapping procedures continued to emerge. Constructivist inquiries adhered to more interactive approaches and value-laden perspectives that sought to construct social knowledge (Schwandt, 1994).

At the risk of oversimplifying, constructivists assume that the terms by which the world can be understood is predicated by social interchanges among people. Realities and therefore knowledge is constructed as the result of social processes accepted in a specific context within a particular community. Variations in concept mapping approaches that surfaced in constructivist inquiries adhered to these more adaptive, social functions of cognition. More interactive processes with individuals and groups were evidenced in these concept mapping applications. Maps constructed about particular phenomena resulted from the direct interactions of people within the group (Micheli, 1998).

While concept mapping as a tool tends to be used in ways consistent with interpretivist and constructivist paradigms, as a methodology it is free of ties to any particular philosophical orientation to knowledge and ways of knowing. In this respect, it is similar to several so called qualitative methodologies that could be applied in decidedly preordinate (Miles & Huberman, 1994) or emergent (Lincoln & Guba, 1990) ways. On the one hand, a conceptual framework might be constructed and used as a standard to which subsequently constructed cognitive maps could be compared. Such an application would generate consistent revised positivistic perspectives that seek to elicit more personal understanding of knowledge. The conceptual framework provides a basis or standard from which subsequent maps can be understood and compared. On the other hand, concept mapping could be used to locally construct a shared interpretation of phenomena of interest (MacDonald, Cousins, Bailetti, & Rahman, 1996; Sholl, 1987). Such applications would be consistent with more interpretivist perspectives. In these applications, knowledge acquired is dependent on the social and cognitive construction of meaning by the individuals within the group (Cousins & Simon, 1996). Constructivist applications of concept mapping involve the notion that the mind is an active creator and manipulator of symbols that support the development and understanding of knowledge (Cousins & Simon, 1996). As such, people involved in the concept mapping process brainstorm ideas about a specific domain of knowledge leading to the development of representative maps that clarify and foster understanding of the complex structures under exploration. In the constructivist paradigm, concept mapping is considered a process that supports and creates a learning environment that enhances the process of knowledge construction and increases the understanding of phenomena (MacDonald et al., 1996; Sholl, 1987).

From yet another epistemological perspective, concept mapping might also be employed as a critical theoretic tool to encourage participants to gain a deeper understanding of their circumstances thereby fostering self-determination and responsibility (Lather, 1992). Such approaches would likely be highly participatory and engaging (Fetterman, 1995). As a critical tool, participants commit to social justice principles that are inevitably value centred (Fetterman, 1995). Critical theory is best understood in the context of empowerment of individuals. As such, critical inquiries aspire to confront the injustice of a particular society or situation within

society (Lather, 1992). In these approaches, knowledge is an artifact of culture, inseparable from a person's knowledge systems and structures and highly influenced by those using it (Kincheloe & McLaren, 1994). Critical research supports political actions that can be taken to address the injustices found within the context of the research (Kincheloe & McLaren, 1994). Within these assumptions and applications, concept mapping can be used as a tool to shape knowledge in an emancipatory context.

lnterpretivist, constructivist and critical theory research paradigms are the underpinnings from which variations in concept mapping applications surface. lnterpretivist and constructivist approaches adopt concept mapping applications that support interactions amongst people in developing information about specific phenomena (Micheli, 1998). Critical theory research supports concept mapping processes that favour political examination and action on injustices within the context of the research undertaken (Micheli, 1998). Despite epistemological differences, concept mapping applications are flexible and adaptable processes. However, the concept mapping applications employed in a study are dependent on the epistemological and methodological orientation adopted by the researcher (Micheli, 1998). Specifically, the underlying paradigm that researchers bring to the inquiry process guides which concept mapping approach will be adopted. The epistemological perspective adopted in a study is critical to understanding the nature by which various concept mapping approaches are applied (Micheli, 1998). It is precisely these evolving perspectives that establish the basis from which contributions to evaluation theory can be elicited.

In summary, an understanding of the psychological, sociological and philosophical foundations from which the concept mapping process is derived, is crucial. Psychologically, concept mapping in al1 approaches manages to simplify the complex tasks of achieving, retaining, and transforming concepts through cognitive schematic work that integrates concepts into cognition. While psychological foundations emphasise cognitive structures associated with concept mapping, sociological foundations stress social interactions as integral to concept mapping evolution. Sociologically, all concept mapping approaches adopt varying degrees of social, interactive processes. Despite minimal emphasis given to social processing in

approaches that emphasise statistical analysis, social interactions of participants are still vital components of these inquiries. All concept mapping applications rely on these interactions. However, the degree to which these social processes predominate varies across applications. Philosophically, concept mapping applications are consistent with varying epistemological research paradigms. These epistemological perspectives underlie the nature of the concept mapping application employed by the researcher. As a research method however, concept mapping is free from ties to any particular orientation to ways of knowing and can provide both qualitative and quantitative data.

2.4 Construction Methods for Concept Maps

Numerous mapping systems have been developed that enable the graphical depiction of ideas and concepts such as concept maps, knowledge maps, mind maps, cognitive maps, and semantic networks. Concept maps differ from the other types of mapping systems because of their grounding in Ausubel's cognitive theory of learning, their semantic and syntactical (structural) organisation, the nature of concepts that comprise a concept map, and the unconstrained nature of linking words or phrases (Battle, Moore & Dreyer, 2003). A standard procedure for concept map construction involves defining the topic or focus question, identifying and listing the most important or general concepts that are associated with that topic, ordering the concepts from top to bottom in the mapping field, and adding and labeling linking words or phrases (Novak & Gowin, 1984) as described in Section 2.3.1. Once the preliminary concept map has been built, cross-links are identified and added, and a review of the map for completeness and correctness is performed.

2.4.1 Variations on the Standard Map Construction Method

Several alternative approaches to concept map construction exist. Some of these mapping variations are based on the use of software tools, the pre-specification of concepts and/or link labels, and individual versus collaborative mapping. Individually produced concept maps and those produced by groups can be made with the assistance of human or software-based facilitation. Many facilitation procedures

are possible in concept map construction, ranging from support provided to novices who are learning to create concept maps, to support of a group of experts who work in conjunction with a facilitator or knowledge engineer. These methods of map construction have been used to serve a variety of goals, including ease of computer implementation and ease of construction by students (Cañas et al., 2001).

Ruiz-Primo, Schultz, Li and Shavelson (2001) suggested that the degree of control or directedness in map construction differs in different mapping tasks. Map builders can be given the structure of the knowledge map and lists of concepts and linking words to use to fill in the slots in the graph (a fill-in task) (Ruiz-Primo et al., 2001). At the opposite extreme, the creator may be required to provide all concepts and linking phrases (a graph-from-scratch task) (Ruiz-Primo et al., 2001). Aside from encouraging the semi-hierarchical format, the method proposed in Novak and Gowin (1984) is a low-directedness mapping task. Ruiz-Primo et al. (2001) have suggested that graph construction tasks that are low in directedness may provide clearer insights into differences among students' knowledge structures.

Other concept mapping methods include variations designed to address specific tasks or settings. For example, concept maps can be constructed on the basis of interviews with students, experts, or other individuals (Novak, 2004; Novak & Cañas, 2006). Concept maps can be constructed by individuals or by collaborative groups, either in the same location or in remote locations, facilitated by computer networks. Concept maps can also be constructed with or without the use of a facilitator, either within a group or an individual setting (Novak, 1998). In either case, the facilitator may simply play the role of transcriptionist, or may actively promote elaboration or clarification of ideas in the concept map, and improvement of map structure. Concept mapping software has been designed to provide different types of facilitation for map construction, including online scoring and assessment of maps, or suggestions about improvements that may be made to the concept map (Cañas et al., 2001).

Although the standard method of concept mapping presumes that a concept map can be made to represent an individual's current level of knowledge and understanding, in many cases concept maps can be constructed as part of a collaborative group process. Concept mapping can facilitate the exchange of information in a group, can

make the viewpoints of individual collaborators more clear, and can encourage participation in the collaborative process (Chiu, Huang, Chang, 2000; Kinchin, De-Leij, Hay, 2005). In educational settings, collaborative concept maps have been used for group projects, and have been compared to other types of group projects such as posters (e.g., Van Boxtel, Van der Linden & Kanselaar, 1997, 2000).

Collaborative creation of concept maps may take many forms. Sessions may be conducted face-to-face or at a distance, and may be synchronous (all participants working concurrently) or asynchronous (e.g.: one collaborator completes edits and then another collaborator edits) (Chinn, O'Donnell & Jinks, 2000; Van Boxtel et al., 1997, 2000).

One method of collaborative concept map construction entails group identification of concepts and their relationships. A means of improving efficiency in such group concept map creation is by the identification of a group moderator and a recorder or 'driver' who records the concepts and builds the concept map (Roth & Roychoudhury, 1993a). Negotiation and compromise must take place in the group construction of a concept map. It should be noted that participants might have irreconcilably different opinions that are made evident by the process (Chinn et al., 2000). Such differences can cause the mapping process to stall. In such cases, it is probably best to separate out the conflicting ideas into two concept maps, and continue in separate groups. An attempt to reconcile differences can be made when both positions are clearly mapped (Roth & Roychoudhury, 1993a).

Another form of collaboration in concept map construction is allowing the user access to related maps in development by others. There are multiple ways to provide this capability, including searching for related maps on public servers and collaboration capabilities provided by a software system. Cañas, Hill, Granados, Perez and Perez (2003) describe the extensive networking provided by the concept map tools software in support of synchronous and asynchronous collaboration and sharing during concept map construction. A different form of collaboration is proposed by Cañas et al. (2001), whereby a 'knowledge soup' stored in a shared server allows students from distant schools to share claims (propositions) derived from their concept maps regarding any domain of knowledge being studied.

2.4.2 Computer-based Concept Maps

Computer-based concept mapping enhances students' abilities to effectively organise their conceptual ideas because electronic maps transcend page size, are easy to create, and are dramatically faster to revise than their paper-and-pencil counterparts (Anderson-Inman & Ditson, 1999). Therefore, when students have computer skills, they can more easily construct, modify, or maintain their visualisations than they can on paper, and skilled teachers can monitor and evaluate students' understandings effectively (Jonassen, Reeves, Hong, Harvey, & Karen, 1997; Reader & Hammond, 1994; Royer & Royer, 2004). Anderson-Inman and Horney (1996) indicated that computer-based visualisation makes the learning process more accessible to students, and helps alleviate the frustration felt by students while constructing concept maps using paper-and-pencil. Computer-based concept mapping fosters knowledge representation and construction (Anderson-Inman & Zeitz, 1993). Interacting through computer-based concept mapping enables students to take a look at the whole problem space as it is visualised by other group members (Stoyanova & Kommers, 1999, 2001, 2002). According to Lanzing (1998), the use of computer-based concept mapping supports ease of adaptation and manipulation, dynamic linking, conversion, communication, immediate analysis, and storage. The use of computer-based visualisation tools such as Inspiration™, Mind Mapper™, and Microsoft™ Visio enables learners to interrelate the ideas that they are studying in multidimensional networks of concepts, and to label and describe the relationships between those concepts (Jonassen, 2000; Jonassen, Carr, & Yueh, 1998).

The development of the Web resulted in developments and research into the use of concept maps within web-based environments (Tsai, Lin, & Yuan, 2001). The current focus of research is on the web-based use of concept maps with synchronous and asynchronous communicative facilities (e.g., Cañas et al., 2001). Collaborative concept mapping has therefore become feasible even when participants are widely distributed. The trend towards the web-based use of concept map systems provides opportunities for the application of concept mapping within electronic learning environments. This application of concept maps has a clear track record of successful demonstrations in a range of learning domains (Cañas et al., 2001). Further research

is needed to demonstrate usefulness, usability and net performance gain using concept map-based knowledge acquisition or concept map-based intelligent systems.

Electronic concept maps may be used to facilitate critical thinking through an intellectual partnership between the learner and the computer (Jonassen, 2000). In an intellectual partnership, the learner and the computer each do the work for which they are especially well-suited; the computer retrieves and stores information and the learner recognises patterns, organises information, and restructures knowledge into a meaningful representation. Through this partnership, the learner must reflectively and deeply engage the content using critical thinking to see patterns and make judgements (Jonassen, 2000).

In addition to the intellectual partnerships that may develop, there are advantages to using electronic concept map programs over paper-and-pencil versions. With the software, students can use a variety of images to illustrate their concept maps adding an element of individuality and creativity. Also, the software allows for manipulation of concepts so that revisions may be made as new learning occurs. Finally, the maps are not confined to the size of the paper and can be easily expanded (Anderson-Inman & Ditson, 1999). Inspiration™. software (Inspiration Software, Inc, 2009) enables the user to develop electronic concept maps using a variety of graphics for illustrating purposes. It also has several features that enhance the user's ability to show learning including an outline feature, a place to embed notes and graphics, and a mechanism to facilitate brainstorming activities. Many researchers have reported the positive effects of computer-supported concept mapping using Inspiration™. Anderson-Inman and Zeitz (1993) found that computer-based concept mapping using the Inspiration™ program encouraged students to revise or change their maps more when compared to their maps drawn with paper-and-pencil. McClellan, Harvel, Velmurugan, Borkar and Scheibe (2004) developed a tool called the Concept Navigation Tool (CNT) which has the ability to automatically link resources to the concepts by accessing a database. The tool was developed as a general application so that it could be used by other groups with their own content repositories. The strength and novelty of this tool lies in its ability to attach resources to the concept maps and to perform dynamic updates to those linked resources. The advantage is a growing set of resources for a specific subject, which supports student learning.

Royer and Royer (2004) investigated the difference between hand drawn and computer generated concept mapping with 9th and 10th grade Biology classes using Inspiration™ software on desktop computers. They found that the group using the computer created more complex maps than the group that used paper-and-pencil. The study revealed that students preferred using Inspiration™ to facilitate their concept mapping than paper-and-pencil. It also highlighted the idea that when used properly, concept mapping and computer tools can work together to promote meaningful learning. In summary, previous studies have shown that computer-supported concept mapping can have positive effects on conceptual learning.

2.5 Methods of Scoring Concept Maps

The traditional method of concept map scoring was proposed by Novak and Gowin (1984), and is based upon the components and structure of the concept map. Novak and Gowin's system assigns points for valid propositions (1 point each), levels of hierarchy (5 points for each level), number of branchings (1 point for each branch), cross-links (10 points for each valid cross-link), and specific examples (1 point for each example). The number of hierarchical levels addresses the degree of subsumption, the number of branchings indicates progressive differentiation, and the number of cross-links indicates the degree of integration of knowledge. This scoring technique has proven to be time-consuming, but it does give a great deal of information about the creator's knowledge structure.

Various scoring techniques have been developed as extensions or variations of Novak and Gowin's original scoring system. For example, Mintzes and colleagues (e.g., Pearsall, Skipper, & Mintzes, 1997) score the same components of the map but weigh them differently. Markham, Mintzes and Jones (1994) use a modified version of Novak and Gowin (1984) concept map scoring methods. They claimed that a student's branching ability reflects the student's breadth of knowledge, commonly known as progressive differentiation. A student's ability to establish a hierarchy of concepts and subconcepts reflects the student's depth of knowledge. Points were given for the number of concepts, relationships, branchings, hierarchies, cross-links and examples represented in each map. One point was assigned to each concept and

to each valid relationship. One point was assigned to the first branching and three points to each successive branching. Five points were given for each hierarchy in the map. Ten points were assigned to each cross-link. One point was awarded for each example presented. Mintzes and Quinn (2007) scored concept maps for structural complexity and content validity in accordance with the simplified procedure of Novak and Gowin (1984). In scoring for structural complexity, one point was given for each non-redundant concept, scientifically acceptable relationship, level of hierarchy, superordinate-to-subordinate branching, and conceptually accurate cross-link.

Some researchers argue against the quantitative scoring of concept maps (Caine & Caine, 1994; Kinchin, 2001; Kinchin, Hay, & Adams, 2000; White & Gunstone, 1992), citing the limitations of using a number or letter grade to represent the breadth of a learner's knowledge (Caine & Caine, 1994) and the potential negative effects of quantitative assessments on students' motivation to learn (White & Gunstone, 1992). Others have cited the inability of quantitative scoring systems to highlight student misconceptions (Kinchin et al., 2000).

Some researchers have chosen to score only valid propositions. This has been criticised as it may miss valuable information about students' misunderstandings and the means by which they represent their knowledge. Kinchin (2001) believes that the scoring of valid links only is "unsupportive of the learning process and at odds with the constructivist philosophy that underlies the use of concept mapping as a learning tool" (p. 1259). Given these concerns Kinchin and colleagues (2000) support a qualitative approach in which maps are evaluated primarily as a function of the thought patterns used in their creation.

Ruiz-Primo and Shavelson (1996) described methods to compare a student's map to that of an expert and score the overlap between the two maps. Expert maps may be constructed by a teacher, a domain expert or a group of teachers or domain experts. This strategy assumes that there is some ideal organisation that best reflects the structure in a domain. Different methods are used to compare the expert map and the student's map. Lomask, Baron, Greig and Harrison (1992) scaled both the count of terms and the count of links. The size of the count of terms was expressed as a

proportion of terms in an expert concept map mentioned by the student. This proportion was scaled from complete (100%), to substantial (67% to 99%), to partial (33% to 66%), to small (0% to 32%), to none (no terms mentioned or irrelevant terms mentioned). A comparison procedure must also be defined, and can range from propositional comparisons to holistic comparisons of structure. Computerised techniques can be used to simplify the comparison of maps, and this possibility has been explored by researchers at the Centre for Research on Evaluation, Standards, and Student Testing (CRESST) and other places (Chung, Herl, Klein, O'Neil & Schachter, 1997; Herl, O'Neil, Chung, Dennis & Lee, 1997; O'Neil & Klein, 1997). These automated scoring systems are typically based on propositional matching within limited sets of concepts and linking phrases. Holistic or structural comparisons are more difficult to automate, as they often require human judgment.

Some researchers have experimented with the combination of methods based on components, and methods based on comparison to a criterion (e.g., expert) map. One example of this approach is to use traditional component-based scoring combined with some comparison to a criterion map, by assigning more weight to propositions that were considered to be critical by experts. Rye and Rubba (2002) and Conlon (2004) reported such a concept map scoring system that was based on components, but which used an expert map to weigh propositions in the student maps.

2.5.1 Major Concerns Regarding Scoring Methods for Concept Maps

Two major concerns have arisen regarding scoring methods for concept maps. The first is that traditional methods, such as those based on Novak and Gowin (1984), are time-consuming and require the input of an expert, either in terms of judging the validity and importance of map components, or in the construction of a criterion map. The second issue is concerned with psychometric properties of concept maps as an assessment tool, and pertains to the reliability and validity of concept map scores. Each of these issues is described below.

Scoring of concept maps

Scoring of concept maps has been addressed in at least two ways: the development of computerised scoring methods and the development of simplified map scoring

techniques (e.g., Chung et al, 1997; Herl et al., 1997). The computerised scoring systems are typically based on propositional matching within limited sets of concepts and linking phrases. An example of a simplified concept map scoring scheme is provided by Shaka and Bitner (1996) who used Novak and Gowin's (1984) scoring scheme as a starting point, but provided a simplified analysis of important map characteristics. In their approach, several map characterises including propositions, hierarchies, branches, differentiation of concepts, cross-links, examples, and degree of conceptualisation were given a rating from 0 to 4, rather than being counted or characterised. A rating of zero indicated the characteristic was missing from the concept map. A rating of four indicated the characteristic was correctly used through the entire concept map. This kind of simplification in scoring is typical of those utilised in concept map assessments.

Another alternative that was proposed by Kinchin et al. (2000) is to analyse maps in terms of their overall structure rather than in terms of a detailed analysis of concepts, links and propositions. This approach differentiates maps in terms of their complexity, resilience in accommodating additions, the establishment of a context for the key concepts, degree of appreciation of a wider viewpoint, and relationship with an expert view. Implicit in this classification is the development of increasing integration of a conceptual framework from 'spoke' structures towards 'net' structures. The structure of the framework held by a student will have implications for the mechanism of further meaningful learning.

Reliability and Validity of Concept Maps

Issues of reliability and validity of concept maps are integrally related to the concept map task and to the scoring system used (Ruiz-Primo & Shavelson, 1996). Traditionally, reliability issues related to the measurement of learning have not been concerned with consistency of scores over time (i.e., test-retest reliability) since actual knowledge is expected to change. Rather, the focus has been on inter-rater reliability (do people scoring the maps agree), and with the internal reliability of the measure. For example, Liu and Hinchey (1996) found relatively low correlations among different component scores in Novak and Gowin's (1984) scoring system. However, the component scores for propositions, levels of hierarchy, cross-links, and examples may actually be measurements of different aspects of the structure and

organisation of knowledge. A variety of conclusions have been drawn relative to reliability measures, including that they are reasonable (Shavelson & Ruiz-Primo, 2000; West et al., 2000), better for proposition-based scores than for structural scores (Shavelson & Ruiz-Primo, 2000; Herl, O'Neil, Chung, & Schachter, 1999), and better as scorers become more experienced (West et al., 2000).

Ruiz-Primo and Shavelson (1996) defined validity as "the extent to which inferences to students' cognitive structures, on the basis of their concept map scores, can be supported logically or empirically" (p. 592). There are many different types of validity: content, face, construct and predictive validity. For most concept map studies, independent discipline experts or teachers establish content validity for concept mapping as appropriate to the respective content area. Concept maps have face validity to the extent that they directly represent Ausubel's components of meaningful learning: subsumption, progressive differentiation, and integration of knowledge (Ruiz-Primo & Shavelson, 1996).

Construct validity refers to the extent to which concept maps correlate with other measures of meaningful learning (Ruiz-Primo & Shavelson, 1996). It has often been suggested that concept maps measure different aspects of knowledge than traditional assessment techniques which do not measure meaningful learning; thus it is not surprising to find moderate or low correlations with some other types of assessments (Novak, Gowin & Johansen, 1983). Shavelson and Ruiz-Primo (2000) suggested that scores gleaned from concept maps are moderately correlated with traditional assessments (average $r = 0.50$), demonstrating that concept map assessments measure something that is related, but not identical, to traditional assessments. West et al. (2000) also suggested that the correlation of concept map scores with standardised exams for medical students is moderately high, with the highest correlation for the map component of specific examples.

A related concern is predictive validity: whether concept map scores can be used to predict performance on skills that would seem to be related. Although the degree to which concept map scores can predict other performance scores is necessarily variable, some researchers have found relatively high correlations with some skills. Rice, Ryan and Samson (1998) designed a map scoring system that was based upon

propositions that were assigned points if they contained correct propositional information that appeared on standardised state and national assessments. This type of scoring system resulted in high predictive validity for these national achievement measures.

Research by McClure et al. (1999) investigated the relationships between map scoring method and measures of reliability and validity. Several different scoring methods were evaluated, including holistic assessments, assessments based on the correctness of individual propositions, and assessments based on structural components similar to those proposed by Novak and Gowin. Inter-rater reliability varied for the scoring methods, with the best results for propositional-based methods. Validity of map scores was assessed by comparing student-constructed maps with a master or expert map, through the use of techniques assessing the neighbourhood or interconnectedness of concepts. The question addressed was whether the map score was an assessment of changes in student knowledge. In nearly all cases, concept map scoring techniques resulted in significant correlations between student maps and the master map. The best technique, both in terms of inter-rater reliability and validity, was based on propositional analysis of the concept map. Structural and holistic measurements appeared to be more problematic in terms of evaluation and matching between maps.

2.5.2 Summary

These developed scoring methods for concept maps do not seem to be as indicative of the structure of knowledge as traditional concept map scoring methods, but rather are focused on the proposition or concept level. While the developed scoring method may show greater agreement with traditional measures of achievement, basing assessment of achievement on the inclusion of simple propositions or concepts is unlikely to motivate learners to learn new information in a meaningful and structured way.

Increasing interest in the use of concept maps is likely to generate more interest in the development of computer scoring techniques leading to better assessment of the reliability and validity of concept map scoring in general. The use of large-scale

automated scoring procedures will require further elaboration and testing of map scoring techniques. While proposition-based methods are the easiest to generate and to match across maps, these methods miss some of the most important structural characteristics of concept maps and should be applied with caution.

2.6 Applications of Concept Maps in Educational Settings

Concept maps have been used in a large number of educational settings from elementary school through to adult education. Research using concept maps has been performed with elementary school students (Fellows, 1993), high school students (Cakir, Uzuntiryaki, & Geban, 2002; Tekkaya, 2003), college students (Gonzalez, 1997; Van Zele, Lenaertz, & Wierne, 2004), pre-service teachers (Kim, Germann, & Patton, 1998), and in-service teachers (Cakir & Crawford, 2001). This section presents the use of concept maps as a tool to support learning, as a tool for collaborative and cooperative learning, as a tool for the assessment of learning, as a tool to organise and present information, and as a tool for curriculum or course development.

2.6.1 Concept Maps as a Tool to Support Learning

Novak and Gowin (1984) pointed out that concept maps are a kind of schematic summary of what students know. They can be used to display students' prior knowledge about a given topic, or they can be used to summarize what has been learned. In this regard, concept mapping is often used for note taking or as a study aid. Novak and Gowin (1984) noted that mapping is a creative activity, in which the learner must exert effort to clarify meanings, by identifying important concepts, relationships and structure within a specified domain of knowledge. The activity fosters reflection on one's knowledge and understanding, providing feedback that helps students monitor their learning and, perhaps with assistance of teachers or peers, focus attention on learning needs (Novak and Gowin, 1984). As a creative activity, concept mapping can also be used as a planning tool or as an alternative to essay writing.

Schmidt and Telaro (1990) sought to test the effectiveness of concept mapping on high school biology achievement and to assess this by student academic ability level. The study was conducted in Montreal, Canada and involved students at Levels 4 and 5 of the Canadian system. The subject matter was a unit of a biology course on the nervous system. The experimental design combined treatment (using concept maps as a teaching strategy) and control (using traditional instruction) at three levels of academic ability (high, medium, and low). The results indicated that the usefulness of concept mapping increased as groups moved from high to medium to low ability. The authors concluded that concept mapping helped low ability students to a greater degree than high ability students because it required them to take an organized and deliberate approach to learning, which higher ability students were likely to do anyway.

The goal of a study by Bascones and Novak (1985) was to test the effect of concept mapping on students' problem solving in high school physics. The teaching process used in this study was based on Ausubel's (1968) theory of meaningful learning. The course was a required physics course taught throughout Venezuela. The design involved two groups. The treatment group had general-to-specific orderings of content and routine concept mapping exercises, while the control group had traditional instructional methods. The results showed large effects in favor of the treatment group on every test and at all ability levels. The results of this study clearly presented a strong statement for the benefit of instruction that is based on Ausubel's (1968) learning theory and the utilisation of concept maps. Unfortunately, the nature of this instruction was not fully described in the paper.

Concept mapping activities have been used in teacher training. To increase their awareness of the subject taught, concept maps have been used in the training of pre-service teachers (Ferry, Hedberg, & Harper, 1998) to reach a better understanding of subject content (Cicognani, 2000). Artiles, Mostert, and Tankersley (1994) assessed the link between pre-service teachers' conceptions of planning, their interactive behaviours during classroom instruction, and pupil responses to lessons. Ten secondary education pre-service teachers participated in this study. Concept maps were used to measure pre-service teachers' conceptions of planning. The findings supported a relationship between pre-service teachers' behavioural and cognitive

domains. They found that themes emphasised in concept maps by pre-service teachers during coursework were also reflected in their teaching behaviors during their internship experiences. Patterns of pupil responses appeared to vary according to the planning perspectives exhibited by pre-service teachers in their lessons.

Himanyshu, Iuli and Venn (2008) used concept maps with elementary pre-service teachers in a science course to illustrate the many advantages of this approach to teaching and learning. Concept mapping was used to model best practices in enhancing science conceptual development, the learning environment and formative assessment. As a consequence of instruction with concept mapping, 75% of the pre-service teachers were found to have an increased conceptual understanding as reflected in increased hierarchical linkages, increased number of concept linkages, increased examples, and decreased misconceptions and inaccuracies across the semester course. This was further reflected in increased teaching confidence on an individual and classroom level basis.

Ferry et al. (1998) focused on pre-service teachers' use of concept mapping to organise their curriculum content knowledge. Analysis of the concept maps constructed showed how the pre-service teachers used the concept mapping tool to construct their curriculum content knowledge in the form of more powerful integrated patterns. It was also found that the process of concept map construction enhanced pre-service teacher skills in planning instruction. The findings also suggested that the concept mapping tool made it easy for most pre-service teachers to construct and revise a concept map of their subject matter knowledge. The study suggests that because the concept mapping tool was easy to use, it quickly became transparent to the pre-service teachers. This enabled them to focus on the cognitive processes involved in the construction of their concept maps.

Jones, Carter and Rua (1999) used teachers' pre- and post-course concept maps, along with journal reflections and portfolios, to examine professional growth as a result of changes in conceptual understanding of content and pedagogical knowledge. This study was implemented as part of a constructivist-based graduate course on elementary and middle school science methods. Results of the concept map analysis showed that teachers' maps became more integrated and cohesive as seen in the

increase of cross-links, hierarchies, and relationships drawn for each science topic. The journals and portfolios showed that students' science knowledge served as discrepant events that evoked teachers' dissatisfaction with their own content knowledge and motivated them to reconsider their pedagogical practices. Students' concepts also served as change agents, resulting in changes in teachers' views of their roles and instructional behaviors.

In contrast, Lang and Olson (2000) and Winitzky and Kauchak (1995), looking at pre-service teacher knowledge and the effects of practical experience, found decreases in complexity and organisation of pre-service teacher knowledge from pre- or early course to post-course concept maps. They identified significantly more concepts from pre- to post-maps about beliefs of effective teaching with an increase in the number of relations to central concepts. This kind of differentiation is assumed to be part of a learning process without the influence of classroom practice.

Efficacy studies reveal that when concept mapping is used in a course of instruction, it is better that it be an integral, on-going feature of the learning process, not just some isolated 'add-on' at the beginning or end (Fischer, Bruhn, Grasel, & Mandl, 2002). In this regard, concept mapping appears to be particularly beneficial when it is used in an on-going way to consolidate or crystallise educational experiences in the classroom, for example, a lecture, demonstration, or laboratory experience. In this mode, learners experience an educational event and then use concept mapping in a reflective way to enhance the learning from the event. There is also indication that learning is enhanced when, in the course of concept mapping, learners adopt an active, deep and questioning approach to the subject matter. Such active, self-engaging, transformational interaction with learning material has been suggested to enhance learning in general (e.g., Feltovich, Spiro & Coulson, 1993) and this appears to carry over to learning with concept maps as a tool.

The nature of the learner's mental interaction with the subject matter to be learned during the building of the concept map is the key to the learner's achievement. The interaction must be active if learning is to occur (Cañas et al., 2001; Feltovich et al., 1993). Concept mapping is greatly enhanced when a teacher (or other facilitator working with a learner), the learner, a device (e.g., computer generated prompts), or

the nature of the interaction in a learning group promotes active inquiry and organization. This active inquiry can be in the form of asking questions, prompting explanation or justification requesting clarification, or encouraging the learner to formulate questions about the material.

Hay (2007) used concept mapping in his research to reveal patterns of student learning in research methods unit taught at the Master's level. The results of this study showed that deep, surface and non-learning are tangible measures of learning that can be observed directly as a consequence of concept mapping. Concept mapping has considerable utility for tracking change in the course of learning, and has the capacity to distinguish between changes that are meaningful, and those that are not.

Williams (1995) provided an example of a study exploring the use of concept maps to illustrate the construction of knowledge by comparing the conceptual knowledge of function held by college students in reform and traditional calculus classes at a large state university. Fourteen students from reform classes and 14 from traditional classes served as subjects. A primary task was the construction of a concept map of function. Four instructors of reform sessions and four from traditional classes also completed concept maps. Quantitative analyses of the concept maps showed that the core contents from both student groups matched poorly with their instructors' core concepts. Qualitative analysis of the student maps revealed differences between the student groups, with the reform group using terminology common in the reform text and using fewer algorithmic references than the traditional group. The traditional group's maps contained more algorithmic references to hand-graphing techniques. Maps of both groups were considerably less well-structured than the experts' maps and lacked the expert's higher level categories.

Various studies have explored the effect of concept mapping on students' achievement. Pankratius (1990) sought to test if concept mapping, and especially the amount of concept mapping, would affect achievement in physics problem solving of high school students. The instrument chosen for measuring achievement for the unit under study consisted of 30 items selected from the *Ontario Assessment Instrument Pool: Physics-Senior Division*. The main variable was the amount of concept

mapping practice/experience in which the students were engaged. One treatment group created concept maps at the beginning of a unit and continued to improve them throughout the unit. A second treatment group made concept maps once at the end of a unit. A control group did not make any concept maps. The results showed statistically significant differences in achievement means scores, with both treatments performing better than the control, and periodic concept mapping being more effective than concept mapping just at the end of the unit.

A study by Czerniak and Haney (1998) was designed to test if the addition of concept mapping to instruction in a physical science methods course would improve pre-service teachers' knowledge of physical science, reduce anxiety toward physical science, and reduce anxiety about teaching physical science at the elementary school level. The results showed that concept mapping increased knowledge of physical science, decreased anxiety for learning physical science, and decreased general (trait) anxiety. The pre-service teachers developed a better understanding of the interrelatedness of physical science concepts. Results did not indicate an increase in self-efficacy for teaching physical science.

A study by Spaulding (1989) addressed the effects of concept mapping versus 'concept defining' on learning achievement in biology and chemistry. The results showed no differences between concept mappers and definers. There was also no differential effect for chemistry versus biology. The statistical interactions indicated that lower ability students performed better with concept mapping, while higher ability students performed better defining concepts. These results are consistent with pervious research by Schmidt and Telaro (1990) who found concept mapping helped low ability students to a greater degree than high ability students.

BouJaoude and Attieh (2008) examined whether or not the construction of concept maps by students improved their achievement in chemistry. This study was conducted on 60 Grade 10 chemistry students in Lebanon. The participants were randomly assigned to an experimental or control group. The experimental group students were trained to construct concept maps as homework while the control group students covered the same chemistry content with regular exercises assigned as homework. The Chemistry Achievement Test was used to measure achievement as a

pre- and post-test. The mean score of the chemistry achievement post-test for the experimental group exceeded that of the control group. The results of this study support using concept mapping as homework to engage students in constructing their own knowledge.

Concept mapping is well-supported in longitudinal education studies (Ault, 1985; Novak & Gowin, 1984; Okebukola & Jegede, 1989). Morine-Dershimer (1993) used concept maps to measure changes in 65 pre-service teachers' conceptions about teacher planning associated with a year-long general methods course, which was accompanied by a practicum experience in a field setting. She found significant differences in responses on pre- and post-concept maps and discovered that certification level (i.e., elementary versus secondary), time of map construction, and differences in instructors affected post-concept map scores. Horton et al. (1993) found that both student achievement and student attitudes were positively affected by the use of concept maps in higher education. The greatest effect was found when students created the maps and provided the terms rather than the teacher. Concept maps were also found to motivate learning, identify misconceptions, and focus tutoring within higher education students (Mahler, Hoz, Fischl, Tov-Ly & Lernau, 1991).

2.6.2 Concept Maps as a Tool for Collaborative and Cooperative Learning

One of the most promising uses of concept maps is its integration into co-operative learning activities. In this situation the members of a group collaboratively construct group maps. Computers and ICT have been used to support collaborative concept maps since the mid-1990s (e.g. Cañas et al., 2001) and some moves to create web-based tools with collaborative facilities have taken place (e.g., Luckie, Batzli, Harrison & Ebert-May, 2003). Gaines and Shaw (1995) carried out one of the first attempts to use concept maps for collaboration on the Web. However, their work focused more on the technical aspects of the collaborative concept map and was not concerned with the learning and teaching situation. Cañas et al. (2001) used a knowledge soup as a collaborative software system. This was a store of students' concepts and links they had used for their concept maps. All users could see them without seeing the whole of other students' concept maps. The research showed that

with collaborative effort students could elaborate, refine, and improve their own knowledge structures. The authors believed more research was needed to improve the methods for using collaborative concept mapping as a tool for representing knowledge (Cañas et al., 2001).

The benefits of collaboration in concept mapping have been noted in a number of studies. For example, Esiobu and Soyibo (1995) compared groups using both concept mapping and V-diagramming, individually or in small groups, as a summarization or study strategy at the end of regular classroom instruction, with a control group that used neither tool. The study took place in Nigeria and involved 808 tenth-grade students (said to be equivalent to tenth grade high school students in the United States). Both treatment groups did better than the control group as measured by multiple-choice-question achievement tests, and showed some advantage for cooperative group learning.

Other researchers have found that collaboration does not appear to benefit students. For example, Chung, O'Neil, and Herl (1999) examined team processes that occurred as ninth grade high school students jointly constructed concept maps over a computer network. They found the quality of constructed maps was not related to teamwork processes. In another study looking at collaborative map construction, Herl et al. (1999) found no benefit in collaboration. In this study, researchers looked at two conditions for knowledge mapping. In one group, students collaborated over a network to construct group maps. In the other group, students worked individually to construct maps using information from web-searches. Students in the individual mapping condition showed significant improvement in mapping scores over the course of a year, whereas the students in the collaboration condition showed no change.

The nature of the interaction among participants appears to have an influence on whether or not effects of collaboration are positive. Collaborative concept mapping has been found to promote more debate and reasoning in the interaction among students (Chinn et al., 2000; Van Boxtel et al., 1997, 2000). Other research (Mereer, 2000; Okeukola & Jegede, 1989; Roth & Roychoudhury, 1994) has found that collaborative concept mapping leads to effective discussion concerning

interrelationships among concepts because this task enables students to use language for thinking and reasoning together, and thus enhances meaningful learning.

Concept maps help students communicate with each other about what they know or think they know as tools for negotiating meaning (Anderson-Inman & Ditson, 1999). Therefore, concept maps are useful tools for provoking students' interaction and collaboration. Among other benefits of concept mapping, Baroody and Bartels (2000) and Baroody and Coslick (1998) also noted that when used collaboratively, concept mapping promotes questioning, discussion and debate. Interestingly, Stoyanova and Kommers (2002) found that synchronous collaboration with concept mapping "provoked a more intense collaboration" (p. 113), and resulted in "a more dense conceptual representation" (p. 113) than did mapping in distributed or mediated groups. Cañas et al. (2001) described a computer-based collaboration environment, part of the CmapTools (Cañas, Hill, Carff & Suri, 2003) software, designed to promote meaningful learning by means of a unique collaboration tool. The software allowed students from distant schools to share claims (propositions) derived from their concept maps regarding any domain of knowledge being studied. Sharing takes place through the 'knowledge soup', a repository of propositions submitted by the students stored in a server. Propositions in the soup that are found to be similar to those submitted by the student are displayed on the student's screen. Student can then use these propositions to enhance their concept map. In addition, students can question or criticize propositions submitted by other students, leading to a peer-review type of environment, where students themselves are responsible for the validity of the propositions in the soup.

Although some research suggests that collaborative concept mapping is an effective tool that can lead to in-depth discussions concerning concepts and thus enhance meaningful learning (e.g., Fischer et al., 2002), others have shown that collaborative concept mapping is not effective (e.g., Chung et al., 1999). This inconsistency in results has led to an increased focus on the process of collaboration in the production of collaborative concept maps. For example, Chiu et al. (2000) investigated the interaction of the communication patterns among participants as they completed a synchronous web-based concept map task. They found that group concept mapping

performance was significantly correlated to the quantity of group interaction, particularly high-level cooperation.

Both concept maps and collaborative learning, individually and synergistically, have been shown to have educational benefits. The concurrent use of these two techniques can lead to students having more active involvement in their learning. The benefits of collaborative concept mapping are more accessible today due to improved technology and software and the capability of remote collaboration.

2.6.3 Concept Maps as a Tool for the Assessment of Learning

One of the original uses of concept mapping in education was for the assessment of learning. If constructed as ongoing evaluation of knowledge within a course, or across an instruction in a discipline, concept maps can demonstrate the changes that occur in a student's knowledge structure and the increasing complexity of knowledge structure that develops as students integrate new knowledge with existing knowledge. Of particular interest in this discussion is Goldsmith and Johnson's (1990) description of an ideal assessment as one that meets four criteria: it is objective, reliable, limits the impact of context on responses, and taps into the structural nature of the respondent's knowledge. Arguably, traditional assessments (e.g., multiple choice, short answer, and essay) often only meet a few of these criteria (Goldsmith and Johnson, 1990). Multiple-choice assessments may be objective and reliable, but the context of the items may affect respondents' answers. Additionally, this type of assessment does not assess knowledge structures. Essay questions can be relatively context independent and assess student knowledge structures, but often raise reliability concerns with regard to scoring. McClure et al. (1999) contend that concept maps offer a balance by providing assessors with an objective tool that is context independent and sensitive to the structure of students' knowledge.

White and Gunstone (1992) described uses of concept maps in education that are primarily based on assessment of change in learner's understanding. These uses might include assessment of understanding of a limited aspect of a topic, assessment of whether learners can make links among concepts and the changes that occur in these links, assessment of whether learners understand goals of instruction,

identification of which concepts are perceived as key concepts by learners, and promotion of collaboration among learners.

Concept maps have helped educators assess complex conceptual change in students' thinking (e.g., McClure et al., 1999; Roth & Roychoudhury, 1993b; Stuart, 1985; Trent, Pernell Jr, Mungai & Chimedza, 1998). Wallace and Mintzes (1990) described the use of concept maps as a means to demonstrate conceptual change in biology for students enrolled in an elementary science methods course. Students were assigned to either an experimental group or a control group. All participants in both groups were required to draw a pre-concept map based on marine life zones. The experimental group subsequently received 45 minutes of computer-assisted instruction on marine life zones, while the control group received an equivalent exposure to an unrelated topic. At the end of semester, all participants in both groups were required to draw a post-concept map based on marine life zones. Results indicated that substantial and potentially important changes in both complexity and propositional structure of the knowledge base were revealed in the concept maps in the experimental group. The authors concluded that concept mapping offers a valid and useful mechanism for looking at changes in cognitive structure.

Concept maps have been used to assess student performance on class-related tests (Beissner, 1992; Bolte, 1999a; De Simone, Oka & Tischer, 1999; Heinze-Fry & Novak, 1990; Markow & Lonning, 1998; Okebukola, 1990). These researchers used classroom achievement measures to assess the effects of concept mapping on performance with varying results. In a study involving biology majors, Okebukola (1990) found a significant improvement in post-test scores for both genetics and ecology in students constructing concept maps. The dependent measure was a test constructed to assess knowledge at the comprehension level and beyond. The researcher concluded that concept maps may be a way to have students see that "concepts do not exist in isolation" (Okebukola, 1990, p. 501). Beissner (1992) found that athletic training students who constructed concept maps scored significantly better on treatment-planning problem-solving questions than students who did not use concept maps. Heinze-Fry and Novak (1990) investigated the use of concept mapping as an enhancement tool to promote meaningful learning in college autotutorial biology students. The students received handouts on concept mapping as

a learning strategy, characteristics of concept maps, examples of good and bad maps, and directions on how to construct a concept map. The experimental group employed the strategy for the biological units of nutrition, gas exchange and transport. Only comparisons between the experimental and control groups were made for the third unit of study. Although Heinze-Fry and Novak (1990) reported no statistically significant differences between the two groups, according to two error analyses and student interview results, mapping enhanced clarity of learning, integration and retention of knowledge, and the transferability of knowledge to new situations.

Concept maps have been used to demonstrate conceptual change in college students (Graham, 1994; Trowbridge & Wandersee, 1994; Wallace & Mintzes, 1990) which has shed some light on the validity of concept mapping as an assessment tool. Trowbridge and Wandersee (1994) used concept maps to identify critical junctures in a course on evolution. After finding that students were unable to agree on the superordinate concept for two particular lectures, the researchers conferred with the course instructor who confirmed that those concepts were traditionally difficult for students to understand. The validity of concept maps was further assessed in a study of conceptual change in biology (Heinze-Fry and Novak, 1990; Wallace & Mintzes, 1990). There was an underlying assumption that those students with more knowledge would construct better quality concept maps than those with less knowledge. The concept maps were able to detect changes in learning and structuring of new information.

Bolte (1999b) explored the use of student concept maps in conjunction with written interpretive essay as an additional method of assessment in three undergraduate mathematics courses. The study findings suggest that concept maps, used in conjunction with interpretive essays, are a viable addition to traditional assessment in mathematics courses. Analysis of the number and type of connections illustrated on the concept maps and described in the accompanying essay indicated that the combined use of these instruments can provide substantial insight into the degree of connectedness of students' knowledge with respect to the given topics.

Iuli and Himanyshu (2006) used concept maps to assess changes in students' conceptual understanding of undergraduate science. An environmental problem-

solving model for science education was used that integrated classroom instruction, field and laboratory techniques, and cooperative learning. Student concept maps were compared to faculty expert maps at the beginning and end of the semester to assess the changes in student conceptual understanding compared to expert organisation of knowledge. Concept maps were analysed for the attainment of main ideas, presence or absence of misconceptions, tendency to make connections between concepts, and level of conceptual organisation. As measured by the concept maps, the majority of students were found to have gains in the number of concepts and depth of understanding, thus demonstrating increase in conceptual understanding over the semester.

Kaya's study (2008) explored the feasibility and validity of pre-service science teachers' concept maps as authentic assessment tools in a student-centred approach to describe the changes in the conceptual understanding of the pre-service teachers in general chemistry laboratory investigations. This study showed the use of pre- and post-laboratory concept maps as authentic assessment tools was a valid and reliable means for describing the conceptual understanding of the science.

Although the potential use of a concept map to assess students' knowledge structures has been recognized (e.g., Jonassen et al., 1993; White & Gunstone, 1992), concept maps are far more frequently used as instructional tools (Pankratius, 1990; Schmidt & Telaro, 1990). Concept maps, as tools of assessment, tend to be characterised in terms of a task that invites a student to provide evidence based on his or her knowledge structure, a style that displays how and what a student learns, and a scoring system by which the student's conceptual knowledge can be accurately and consistently evaluated.

2.6.4 Concept Maps as a Tool to Organise and Present Information

This section reviews the uses of concept maps and related representations as 'advance organisers'. Ausubel introduced the idea of advance organisers as a way to "bridge the gap between what the learner already knows and what he needs to know before he can successfully learn the task at hand" (Ausubel, 1968, p. 148) by showing the underlying structure of a body of knowledge. Concept maps have been

touted as possible tools to help facilitate the discernment and selection of central concepts that "constitute the 'big picture' or pervasive principles at the core of scientific disciplines" (Trowbridge & Wandersee, 1998, p. 116).

In theory, advance organisers are most effective if they make explicit the relationships among concepts that learners already know, thus providing a structure into which the new concepts can be integrated. When used as an advance organiser, concept maps can be presented at the beginning of a textbook chapter or other instructional unit, used as a guide for a lecture, or used to present an overview of multimedia with links to instructional materials associated with different topics.

In his dissertation, Cliburn (1985) compared junior college student performance in two classes of human anatomy and physiology. One class was structured with concept maps as advance organisers and the other class was structured in the traditional way by textbooks. Based on scores from a multiple-choice post-test, he found a marginal facilitating effect on learning in the group with concept mapping. There was a statistically significant effect on retention in the advance organiser group suggesting that expository organizers, such as concept maps, may have a delayed effect on learning by helping to establish structure for students when the content is new (Cliburn, 1985). Instructing students with new content while using a device that shows how the new content fits in with the big picture improved the students' ability to retain information.

Advance organisers address the issue of learning transfer on a relatively large scale. However, the ability to transfer learning may be largely dependent on personal characteristics such as metacognition. Metacognition may be developed through careful application of study strategies that help the student to reflect on the process of learning and not just the content of learning.

2.6.5 Concept Maps as a Tool for Curriculum or Course Development

Concept mapping can be a tool for planning a curriculum in an educational environment. A concept map can outline which concepts or knowledge is central to the course, and the relationships between general and specific knowledge. This is very useful in strategic learning planning because a concept map can be a road map that helps students to choose correctly which courses and subjects are to be learned first (Novak & Gowin, 1984).

Novak and Cañas (2006) suggest that using concept maps in planning curriculum or instruction on a specific topic helps to make the instruction 'conceptually transparent' to students. When concept maps are developed at the course or curriculum level, it is often desirable to organise them. This involves creating a global 'macro map' which shows the main topics and their interrelationships, and more detailed 'micro maps', which show more specific details for a particular portion of the instructional material. Concept maps arranged in this way avoid some of the difficulties that are associated with processing large expert maps, or maps that attempt to cover too many focus questions or topics.

Cristea and Okamoto (2001) described a concept mapping environment that was designed to support collaborative course authoring, through the development of an adaptive web-authoring system. This authoring environment is part of a system for English upgrading, called 'My English Teacher'. The courseware structure is aimed mainly at representing a field in which, with the help of texts, videos and audio presentations, the whole material can be presented. Rather than using concept mapping during the learning process, this system used concept mapping during the course authoring process. It also presented both automatic and manual concept mapping options adjusted for the system.

The semi-hierarchical organisation of maps may be useful in terms of determining sequencing of materials, with meaningful learning more likely to occur if higher level, more inclusive concepts are presented early in instruction. Edmondson (1994; 1995) reported on the use of concept maps to describe the structure of courses in an interdisciplinary curriculum of College of Veterinary Medicine at Cornell University.

Concept maps were used at several levels, including curriculum, foundation courses, lectures, laboratoriess and individual case studies. The curriculum rework required faculty to reconceptualise the subject matter in a way that avoided redundancy across various fields. Concept mapping was used as a way of developing representations of the entire veterinary curriculum, the planned courses within the curriculum, and case-based exercises within the courses. The process of developing the curriculum involved a collaboration of faculty and students. The faculty found concept maps to be effective tools for mapping the content in a way that allowed faculty from various disciplines to reach a consensus on how to design interdisciplinary courses. The use of concept maps helped faculty to create integrated, interdisciplinary courses; communicate with each other; visually explain the conceptual relationships that serve as the educational objectives for any course or unit; and facilitate the faculty's efforts to reconceptualise their subject matter (Edmondson, 1995).

Educational applications of concept mapping have been used in a variety of ways including their use as: a learning/study strategy, a collaborative and cooperative learning tool to assess learning for organising and presenting information, and for curriculum or course development (Bartels, 1995; Beyerbach, 1988; Novak, 1991). Angelo and Cross (1993) stated that concept maps "stimulate students to create, and allow faculty to assess, original intellectual products that result from a synthesis of the course content and the students' intelligence, judgment, knowledge, and skills" (p, 1).

2.6.6 Advantages and Limitations of Using Concept Maps in Education

The concept mapping approach can serve as a key plan for the teacher in determining the best way to teach a topic. It can train students to build up relationships among concepts to clarify differences between related concepts, and motivate students to think more deeply. It can also assist students to clarify what they have learned and what they do not understand, while retaining a mind map of the information they are studying.

Concept maps offer a user-friendly way of evaluating learning and are valuable alternatives to multiple-choice tests (Quinn et al., 2003). The concept map is a useful

science education tool, used for both increasing students' learning abilities and assessing their understanding of subject matter (Good, Novak, & Wandersee, 1990; Rye & Rubba, 1998; 2002). Generating concept maps composed of nodes, links, and labels on the links, integrates verbal and visual coding and externalises both cognitive and affective processes which stimulates self-appraisal and self-reflection and supports mental imagery (Stoyanov & Kommers, 1999). Also, concept mapping can enhance students' motivation (Novak et al., 1983) and creativity (Lanzing, 1998).

Quinn et al. (2003) summarised several advantages of concept mapping in science education as follows:

a) Concept maps offer a global picture of students' conceptual understandings rather than a piecemeal depiction of isolated facts;
b) Concept maps are useful in emphasising the importance of quality of knowledge rather than just its quantity in conceptual learning;
c) Concept maps encourage students to become meaningful learners, and can be used in studying for formal assessment; and
d) Students benefit from sharing ideas with instructors and other students.

According to Jonassen (2000), concept mapping engages learners as follows: (a) reorganisation of knowledge; (b) explicit description of concepts and their interrelationships; (c) deep processing of knowledge, which promotes better remembering and retrieval and the ability to apply knowledge in new situations; (d) relating new concepts to existing concepts and ideas, which improves understanding; [and] (e) spatial learning through spatial representation of concepts in an area of study (p.60).

The inclusion of concept mapping in a lesson can increase students' cognitive and discovery learning, enhance retention, and produce higher order logical thinking, analysis, and application. In the process of mapping concepts, students' concepts and ideas are revealed and, thus, instructors may trace and correct students' misconceptions (Snead & Snead, 2004). When instructors examine student-generated concept maps, they access a student's understanding and are enabled to provide

feedback and clarification during instruction. Concept maps help to increase the total quantity of formal content knowledge because they facilitate learners' abilities to use the skill of relating patterns and relationships (Jonassen, 2000).

One of the most obvious disadvantages of concept mapping is the messiness. A large messy concept map is not usable in practice (Holley & Dansereau, 1984). It is very hard to see a concept map or diagram when the map becomes too 'crowded'. People can only easily understand a diagram that has less than nine blocks of information (Satzinger, Jackson & Burd, 2000). Moreover, a messy concept map can be a danger for readers because they can forget some important propositions that are not seen readily. Furthermore, creating a concept map (even with the support of concept map software) can consume large amounts of time and effort because the concept mappers have to create many links to logically connect all of the concepts together (McKeachie, 1984).

A further disadvantage of concept mapping is the insufficient time to train students in this technique. In most reported studies, the teacher/researcher spends 60 to 90 minutes training students on how to construct concept maps. This short time frame only allows students an initial understanding of the process and limited development of mapping skills. Training over several weeks would allow the teacher/researcher to reflect upon the progress being made by the student, and adjust instructions accordingly as required (Rice, Ryan & Samson, 1998).

As current concept mapping software uses the drag-and-drop graphical components, a large concept map can make the concept mapping software run very slowly. Further, there is no current standard for drawing a concept map. The formula for drawing a concept map is rather arbitrary and relies on the creativities of the concept mappers. For example, the linking word can be a noun, a verb, or a whole sentence. This arbitrary nature in developing concept maps can make it difficult for some readers to understand a concept map (Novak & Gowin, 1984).

Like any tool, the effectiveness of concept mapping depends on how it is used and the conditions in which it is used. There is no doubt that concept mapping can

enhance learning, with the great majority of studies reviewed showing differing degrees of positive effects associated with the use concept mapping.

2.7 Summary of Chapter

This chapter presented a discussion of the defining characteristics of constructivism, the constructivist view of learning, the teacher's role in a constructivist classroom, implementing constructivism in the classroom, obstacles in the take-up of constructivism, and applied constructivist views to teaching and learning in social studies. The second section of this chapter dealt with concept maps, the definition of concept map, goals of using concept maps and the foundations of concept mapping. This section presented various approaches to concept map construction. It also described the types of scoring systems that have been used for concept maps including traditional component-based measures, methods based on comparison to a criterion or an expert map, and methods which combine component based and criterion-based assessment. Issues of reliability and validity of concept maps were also addressed.

A large body of literature was reviewed on the use of concept maps in educational settings. This included using concept maps as a tool to support learning, to assist in collaboration and cooperative learning, in the assessment of learning, to organise and present information, and in curriculum or course development. Finally, this section described the advantages and limitation of concept maps. The following chapter is a continuation of the literature review, and focuses on the instruments that have been used to measure the learning environment, attitudes and confidence within the study framework.

CHAPTER 3

REVIEW OF THE LITERATURE - MEASURING LEARING ENVIRONMENT, ATTITUDES AND CONFIDENCE

3.1 Introduction

The previous chapter provided a description of the current research on constructivism and concept maps. This chapter presents detailed information on the instruments that have been used to measure learning environment, attitudes towards social studies and confidence towards teaching social studies. This chapter is divided into three sections based upon these instruments. Each section introduces the instrument used, the development and validation of the instrument, and then presents a review of the literature for the use of the instrument. Learning environment was measured with a modified *Constructivist Learning Environment Survey* (CLES), attitudes towards social studies were measured with a modified *Test of Science Related Attitudes* (TOSRA), and confidence was measured with a modified *Science Teacher Efficacy Belief Instrument* (STEBI-B). Modifications made to each instrument for the social studies context used in this study are presented in the next chapter.

3.2 The Learning Environment

The field of learning environments encompasses the study of students' perceptions of the activities and interactions that occur within their classroom (Fraser, 1998a). The scope of learning environment research is large, ranging from a small-group session in a classroom to the whole school level. Studying the learning environment is important as students make judgments about their perceptions of their classrooms and its influence on their learning (Fraser, 1986). The following information presents a history of learning environments, classroom learning environment instruments, the development and validation of the learning environment instrument that was

modified in this study, CLES, and an overview of studies in which CLES has been used.

3.2.1 History of Learning Environments

Although research related to the field of learning environments is still somewhat new, remarkable progress has been made in the past three decades (Fraser, 1998a; Fraser & Walberg, 1991). The earliest pioneers of this field are considered to be Lewin (1936) and Murray (1938) who developed theoretical, conceptual and measurement foundations (Fraser, 1991). Lewin's contribution focused on recognising that both the environment and its interaction with personal characteristics of the individual are potent determinants of human behaviour. Murray (1938) continued Lewin's approach by creating a needs-press model, which allowed the analogous representation of a person and his/her environment in common terms. Murray introduced the term 'alpha press' to describe the environment as assessed by an unbiased observer, as well as the term 'beta press' to describe the environment perceived by milieu inhabitants. Although Murray's needs-press model is more applicable to the study of personalities rather than during a teaching-learning process, researchers have found ways to identify situational variables transferable to the field of education. This needs-press theory was popularised and encouraged by Pace and Stern (1958). Getzels and Thelen (1960) supported research in the field of learning environments by developing a model of a class as a social system. Personality needs, role expectations and classroom climate interact to predict group behavior including learning outcomes (Fraser, 1986). In 1970, Stern formulated a theory of Person-Environment Congruence in which the congruence between personal needs and the environmental press enhanced student outcomes (Stern, 1970).

In some of the earliest work on human environments, Moos (1973) stated that interest in the physical and social aspects of planning human environmental systems such as towns, workplaces or public institutions, was increasing. Moos eventually saw this growing concern as being responsive to the technological changes which were (and are) effecting large-scale change in society. He suggested that this created a need for a model to conceptualise and assess these environments.

Building on Lewin and Murray's foundations, two research programs focused on developing instruments to assess the learning environment. These research programs focused on the independent work of Herbert Walberg and Rudolph Moos. They made significant contributions to the field of learning environments. Walberg's independent research led to development of an early version of the widely-used *Learning Environment Inventory* (LEI) (Anderson & Walberg, 1974). Moos conducted research and developed social climate scales used in a wide variety of human environments (Moos, 1968; Moos & Houts, 1968). This work led to the development of the *Classroom Environment Scale* (CES) (Moos & Trickett, 1987; Trickett & Moos, 1973).

In the 1980s, research focusing on the nature and quality of interpersonal relationships between teachers and students originated in The Netherlands. Wubbels, Certon and Hooymayers (1985) developed a model to map interpersonal behavior using an adaptation of the work of Leary (1957). Drawing upon a theoretical model of proximity (cooperation-opposition) and influence (dominance-submission), the *Questionnaire on Teacher Interaction* (QTI) was developed to assess student perceptions of eight behavior aspects (Leadership, Helpful/Friendly, Understanding, Student Responsibility and Freedom, Uncertain, Dissatisfied, Admonishing and Strict) (Wubbels & Levy, 1993). Studies conducted by Wubbels and Berkelemans (1998) and Wubbels and Levy (1993) used the QTI to further expand the field of learning environments. These international research efforts involving the investigation of interactions between teachers and their students have assisted in establishing learning environments as a noteworthy field of research.

3.2.2 Classroom Learning Environment Instruments

The progression of the field of learning environments has seen the development of a plethora of instruments that can be used to assess classroom environments. Many of these classroom environment instruments have been modelled after Moos' (1974) three basic types of dimensions for classifying human environments: Relationship, Personal, and System Change. The Relationship dimension identifies the nature and intensity of personal relationships within the environment and assesses the extent to which people are involved in the environment and support and help each other. The

Personal dimension assesses the directions along which personal growth and self-enhancement tend to occur. The System Change dimension refers to the extent to which the environment is orderly, clear in expectations, maintains control and is responsive to change.

To date, nine classroom learning environment instruments that follow Moos's three basic types of dimensions have been developed: *Learning Environment Inventory* (LEI), *Classroom Environment Scales* (CES), *Individualized Classroom Environment Questionnaire* (ICEQ), *My Class Inventory* (MCI), *College and University Classroom Environment Inventory* (CUCEI), *Questionnaire on Teacher Interaction* (QTI), *Science Laboratory Environment Inventory* (SLEI), *Constructivist Learning Environment Survey* (CLES), and *What Is Happening In this Class*? (WIHIC). A brief overview of these nine widely applicable classroom learning environment instruments is presented in Table 3.1.

Along with the development of various instruments to measure classroom learning environment, there have been many different forms of scales developed: actual and preferred, and personal and class forms (Fraser, 1994). Many classroom environment instruments have been designed to address either student or teacher perception of the actual or preferred classroom environment. Actual forms measure the participants' actual perception of their classroom learning environment, whereas the preferred form measures the perceptions of the classroom learning environment preferred by the participants. Class and personal forms of classroom environment instruments have also been developed. Personal forms take into account that a student can have their own perceptions about the classroom that can vary for different students in the same classroom (Fraser, 1994).

As interest in the study of classroom learning environments has grown, the need for translations of popular questionnaires from the English language to other languages also expanded. Various questionnaires have been translated into numerous languages including Indonesian, Taiwan, and Chinese and have shown high reliability (Ismail & Saleh, 2001; Margiani, 2001; Thair, 1999). For instance, WIHIC, has been translated into the Arabic language and showed high reliability, ranging from 0.75 to 0.88 for the actual version and from 0.82 to 0.90 for the preferred version. Such high

values indicate that this questionnaire is highly reliable even when translated into the Arabic language (MacLeod & Fraser, 2009).

Table 3.1: Overview of Scales Contained in Nine Classroom Environment Instruments (LEI, CES, ICEQ, MCI, CUCEI, QTI, SLEI, CLES and WIHIC)

Instrument	Level	Items per Scale	Classified According to Moos's Scheme		
			Relationship Dimensions	Personal Development Dimensions	System Maintenance and Change Dimensions
Learning Environment Inventory (LEI)	Secondary	7	Cohesiveness Friction Favouritism Cliqueness Satisfaction Apathy	Speed Difficulty Competitiveness	Diversity Formality Material environment Goal direction Disorganisation Democracy
Classroom Environment Scale (CES)	Secondary	10	Involvement Affiliation Teacher support	Task orientation Competition	Order and organisation Rule clarity Teacher control Innovation
Individualised Classroom Environment Questionnaire (ICEQ)	Secondary	10	Personalisation Participation	Independence Investigation	Differentiation
My Class Inventory (MCI)	Elementary	6–9	Cohesiveness Friction Satisfaction	Difficulty Competitiveness	
College and University Classroom Environment Inventory (CUCEI)	Higher Education	7	Personalisation Involvement Student cohesiveness Satisfaction	Task orientation	Innovation Individualisation
Questionnaire on Teacher Interaction (QTI)	Secondary/ Primary	8–10	Helpful/friendly Understanding Dissatisfied Admonishing		Leadership Student responsibility and freedom Uncertain Strict
Science Laboratory Environment Inventory (SLEI)	Upper Secondary/ Higher Education	7	Student cohesiveness	Open-Endedness Integration	Rule clarity Material environment
Constructivist Learning Environment Survey (CLES)	Secondary	7	Personal relevance Uncertainty	Critical voice Shared control	Student negotiation
What Is Happening In This Classroom (WIHIC)	Secondary	8	Student cohesiveness Teacher support Involvement	Investigation Task orientation Cooperation	Equity

3.2.3 Development and Validation of CLES

While the previous section concentrated on general classroom learning environments, this section presents detailed information on the *Constructivist Learning Environment Survey* (CLES) as the current study modified this instrument. CLES focuses on student-centred settings and was developed to assist teachers and researchers to assess the degree to which a particular classroom's environment is consistent with a constructivist epistemology, and to assist teachers to reflect on their epistemological assumptions and reshape their teaching practice (Taylor, Fraser & Fisher, 1997).

The CLES was originally created by Taylor and Fraser (1991) based on a constructivist psychosocial view that emphasises students as co-constructors of knowledge. The first small-scale study was conducted in the area of mathematics at a public high school located in a middle-class neighbourhood in Perth, Australia. The eighth grade students who were involved were taught a 5 week mathematics activity. The activity challenged the students to be creative by engaging in open-ended problem solving and negotiating their methods and results while working with their peers in small groups (Taylor and Fraser, 1991). The results found CLES to have satisfactory reliability where the Cronbach alpha values ranged from 0.61 to 0.85. The second small-scale study was conducted in the area of science at a private all-girls school located in an upper-class neighbourhood in Perth, Australia. The Grade 10 students who were involved were taught in a student-centred environment that enabled them to discuss and assess their established ethical beliefs by engaging in reflective thinking (Taylor et al., 1997). The results found CLES to have satisfactory reliability where the Cronbach alpha values ranged from 0.64 to 0.80.

Through an extensive and rigorous process, CLES was found to be valid and reliable for use within classroom situations. However, Taylor et al. (1997) concluded that this version did not include some important points. Therefore, they elaborated and revised the CLES by adding the notions of radical constructivism and critical theory. This new version was thought to be useable with a wide range of samples, including different subjects and year levels. The CLES contains 30 items altogether, with six items in each of five scales. These scales are Personal Relevance, Uncertainty,

Critical Voice, Shared Control, and Student Negotiation. A description of these scales can be found in Table 3.2. Each item in the survey is responded to on a five-point Likert scale with the alternatives of 'Almost Never', 'Seldom', 'Sometimes', 'Often', and 'Very Often', which are scored 1, 2, 3, 4, and 5 respectively.

Two forms of the CLES have been developed to gather students' perceptions of science classrooms: the student actual and student preferred forms (Taylor et al., 1997). Although item wording is almost identical in the actual and preferred forms, words such as 'I wish' are included in the preferred form to remind students that they are rating their preferred, or ideal classroom, rather than the actual classroom environment. For example, the statement, 'In this class, I learn about the world outside of school' from the actual form of the CLES is changed in the preferred form to, 'In this class, I wish that I learned about the world outside of school'.

Table 3.2: Descriptive Information for the CLES Scales

Scale name	Moos Category	Description	Personal Form
Personal Relevance	Relationship Domain	Extent to which school science is relevant to student' everyday out-of-school experiences	What I learn has nothing to do with my out-of- school life
Uncertainty	Relationship Domain	Extent to which opportunities are provided for students to experience that science knowledge is evolving and culturally and socially determined	I learn that science has changed over time
Critical Voice	Personal Domain	The extent to which students feel that it is legitimate and beneficial to question the teacher' pedagogical plans and methods	It's OK for me to express my opinion
Shared Control	Personal Domain	Extent to which students share with the teacher control for the design and management of learning activities, assessment criteria, and social norms of the classroom	I help the teacher to decide which activities I do
Student Negotiation	System Maintenance and System Change Dimension	The extent to which students have opportunities to explain and justify their ideas, and to test the viability of their own and other students' ideas	I get the chance to talk to other students

Note: From Taylor, Fraser and Fisher (1997). Items are scored 1, 2, 3, 4 and 5, respectively, for the responses Almost Never, Seldom, Sometimes, Often and Almost Always. Omitted or invalid responses are scored 3.

3.2.4 Major Research Using CLES

Previous research studies have led to the CLES being validated and used in variety of research settings in many countries around the world, including the USA, Australia, Taiwan, Korea, South Africa, and Thailand (Aldridge, Fraser, Taylor & Chen, 2000; Fraser, Dryden & Taylor, 1998; Kim, Fisher & Fraser, 1999; Lee & Fraser, 2000; Puacharearn & Fisher, 2004; Sebela, 2003; Taylor, Dawson & Fraser, 1995).

Churach and Fisher (1998) considered the learning environment of a sample of 431 students in five high schools using the Web in secondary science classes. They used CLES in combination with a number of other quantitative and qualitative methods to investigate whether the use of Web technologies impacted on the classroom environment in a positive way. The CLES includes the five scales of Personal Relevance, Uncertainty, Critical Voice, Shared Control and Student Negotiation. The results revealed that CLES has satisfactory reliability where the Cronbach alpha values ranged from 0.64 to 0.92. The study found that student attitudes, as well as individual feelings of self-control and personal relevance, seem to be enhanced by the use of the Internet in these classrooms.

Fraser, Dryden and Taylor (1998) evaluated the success of an Urban System Initiative (USI) in terms of students' perceptions of the CLES in 1994 and 1997 and obtained qualitative data from external classroom observations. The study administrated actual and preferred forms of CLES to 440 high school students. The results found CLES to have satisfactory reliability where the Cronbach alpha values ranged from 0.61 to 0.89. The findings indicated that moderate levels of the CLES dimensions of Personal Relevance, Critical Voice, Uncertainty of Science, and Student Negotiation were perceived by students in 1994, and that these levels did not increase during the three years of the USI. Low levels of Shared Control were found, with a negligible shift in this dimension between 1994 and 1997.

Kim, Fisher and Fraser (1999) used the CLES in a study designed to assess the new curriculum in Korea. They translated the CLES into the Korean language and investigated Korean students' perceptions of their science classroom learning environment. The CLES was administered to 1083 students and 24 science teachers

in 12 different schools. With the individual student as the unit of analysis, the alpha reliability ranged from 0.64 to 0.87 for the actual form and from 0.79 to 0.91 for the preferred form. This suggests that all scales of the Korean version of the CLES possess satisfactory internal consistency. The results of this research indicated that Grade 10 students who studied in the new curriculum perceived a more constructivist learning environment than Grade 11 students who were studying the old curriculum.

Administration of the CLES to 1081 high school science students in Australia and 1,879 high school science students in Taiwan provided support for its internal consistency reliability and factor structure (Aldridge, Fraser, Taylor & Chen, 2000). The CLES was translated into Mandarin. Principal components factor analysis followed by varimax rotation confirmed the *a priori* structure of the instrument. All items had a loading of at least 0.4 on their *a priori* scale and no other scale in both the Australian and Taiwanese questionnaires. Based on the student actual form and using the class mean as the unit of analysis, scale reliability estimates ranged from 0.87 to 0.97 in Australia and from 0.79 to 0.98 in Taiwan. This cross-national study of science classroom environments in Taiwan and Australia supported the reliability and validity of both an English and Mandarin version of CLES.

The CLES has been used in South Africa by Sebela (2003). This research further validated the CLES, with the results of the study being used to improve mathematics teaching and learning practice through action research. The participants were 1864 learners from 34 intermediate and senior schools. For the actual version of the CLES, scale reliability estimates ranged from 0.60 to 0.63 using the individual as the unit of analysis and from 0.88 to 0.90 using the class mean as the unit of analysis. For the preferred version of the CLES, scale reliability estimates ranged from 0.56 to 0.75 using the individual as the unit of analysis and from 0.83 to 0.97 for the class mean as the unit of analysis. These results suggest that the CLES had potential for monitoring the development of social constructivist classroom learning environments in South Africa.

Wanpen and Fisher (2004) used the CLES at an undergraduate level in a university in North-eastern Thailand. This action research project aimed to create a collaborative learning environment in a computer classroom where the CLES was

administered to 710 undergraduate students in 33 computer classes. The actual and preferred forms were translated into Thai language to determine the reliability of the CLES for use in Thailand. With the individual student as the unit of analysis, the alpha reliability ranged from 0.76 to 0.91 for the actual form and from 0.82 to 0.93 for the preferred form. When the class means were used as the unit of analysis, the alpha reliability ranged from 0.77 to 0.96 for the actual form and from 0.88 to 0.94 for preferred form. This suggests that all scales of the Thai version of the CLES possess satisfactory internal consistency in both the actual and preferred forms.

Spinner and Fraser (2005) used CLES to assess the effectiveness of the Class Banking System (CBS), which enables teachers to use constructivist ideas and approaches in combination with a number of other quantitative and qualitative methods. CLES was administered to two groups of fifth grade students as a pre-test and a post-test over an academic year. Cronbach alpha values for the five scales of CLES ranged from 0.53 to 0.86 for pre-test and from 0.76 to 0.87 for post-test. Over the year, students experienced more favourable changes in classroom environment on all scales of CLES. The quantitative and qualitative data supported the effectiveness of the CBS in providing elementary mathematics students with constructivistic classroom learning environment.

The CLES has been found to be both a reliable and valid instrument for meeting the needs of science educators who desire to reshape their teaching practice to be more consistent with a constructivist epistemology (Taylor, Dawson, & Fraser, 1995; Taylor & Fraser, 1991). Even with modifications through word changes and translation, and use in different settings, CLES continues to produce results with high reliability and validity (Kim, Fisher, & Fraser, 1999; Wanpen & Fisher, 2004).

3.3 Measuring Attitudes

Assessing attitudes has been extensively investigated in educational research. Students' attitudes toward different subjects have been measured using a wide range of instruments. For the purpose of this study the *Test of Science-Related Attitudes* (TOSRA) was modified and used. The following information presents the

development and validation of the TOSRA and an overview of studies in which TOSRA has been used.

3.3.1 Development and Validation of TOSRA

Fraser (1981) developed the *Test of Science-Related Attitudes* (TOSRA) to measure students' attitudes towards their science classes. The scales of TOSRA are based on Klopfer's taxonomy of the affective domain related to science education. TOSRA was originally designed to measure seven distinct science-related attitudes among secondary students: Social Implications of Science, Normality of Scientists, Attitude to Scientific Inquiry, Adoption of Scientific Attitudes, Enjoyment of Science Lessons, Leisure Interest in Science and Career Interest in Science. Each of the seven scales contain 10 items. Each item is responded to on a five-point Likert scale with the alternatives of 'Almost Never', 'Seldom', 'Sometimes', 'Often', and 'Very Often', which are scored 1, 2, 3, 4, and 5 respectively. A description of these scales can be found in Table 3.3.

Table 3.3: Klopfer's (1971) Classification for the TOSRA Scales

Scale Name	Klopfer's (1971) Classification	Sample Item
Social Implications of Science	Manifestation of favourable attitudes towards science	Scientific discoveries are doing more harm than good. (-)
Normality of Scientists	Manifestation of favourable attitudes towards scientists	Scientifics usually like to go to their laboratories when they have a day off. (-)
Attitude to scientific Inquiry	Acceptance of scientific inquiry as a way of thought	I would prefer to find out why something happens by doing an experiment than by being told. (+)
Adoption of Scientific Attitudes	Adoption of 'science attitudes'	I enjoy reading about things which disagree with my previous ideas. (+)
Enjoyment of Science Lessons	Enjoyment of science learning experiences	Science lessons are fun. (+)
Leisure Interest in Science	Development of interest in science and science-related activities	I dislike reading newspaper articles about science. (-)
Career Interest in Science	Development of interest in pursuing a career in social studies	A career in science would be dull and boring. (-)

Note: Adapted from Fraser (1981). Items designated (+) are scored 1, 2, 3, 4 and 5, respectively, for the responses Almost Never, Seldom, Sometimes, Often and Almost Always. Items designated (-) are scored in reverse manner. Omitted or invalid responses are scored 3.

Fraser (1981) supports the validity and reliability of TOSRA in studies conducted around the world since 1977. In a cross-national study Fraser (1981) validated the TOSRA using 2593 junior and senior high school students from Australia and 546 ninth grade students from the United States. Average reliability and validity values across the Australian sample were 0.80 and 0.35, respectively. Corresponding values for the United States sample were 0.79 and 0.34. Such results indicate that TOSRA has high reliability and validity.

Schibeci and MacGaw (1980) conducted their study among 1,049 Grade 8-10 students from 11 schools in Perth, Australia. Alpha internal consistency values ranged from 0.64 in the scale Adoption of Scientific Attitudes to 0.72 in Enjoyment of Science Lessons. For the purpose of curriculum evaluation, these values indicate that each scale of TOSRA displays an acceptable degree of internal consistency, especially for a scale consisting only of 10 items.

3.3.2 Major Research Using TOSRA

TOSRA has been found to be useful in studies around the world that investigate associations between learning environment and students' attitudes to science. In studies conducted by Farenga and Joyce (1998) and Joyce and Farenga (1999), associations between science-related attitudes and course section were investigated using the TOSRA for 111 high-ability students between the ages of nine and 13. The Cronbach alpha reliability values for the seven scales ranged from 0.61 to 0.90. The results revealed a relationship between early life experience, affective factors, and future interest in science. The finding also revealed significant correlations between early career interest in science and future participation in science.

In an investigation by Margianti (2001), an attitude scale derived from the TOSRA was used along with the WIHIC questionnaire to study associations between the learning environment and attitudes of Indonesian university students. The questionnaire was translated into the Indonesian language and administered to 2500 students enrolled in the third semester of their computing course. The TOSRA scale proved to be highly reliable in this study: the internal consistency reliability was 0.77 with the individual as the unit of analysis, and 0.85 with the class as the unit of

analysis. Significant positive correlations were found between students' attitudes towards their mathematics classes and all seven learning environment scales.

In a cross-national study conducted in Indonesia and Australia by Adolphe, Fraser and Aldridge (2003), TOSRA was used in an investigation into the associations between students' attitudes and the classroom environment for 594 students from Indonesia and 567 students from Australia. The version of the TOSRA administered to the former group had been translated into Indonesian. Data analyses showed the factorial validity and reliability of both the English and Indonesian versions of all seven scales of the TOSRA were acceptable.

These results prompted a follow-up study in which the Science Experience Survey and TOSRA were employed together with a learning environment questionnaire in several studies conducted at different school levels designed to gauge students' attitudes toward science classes. For example, Helding, (2006) investigated the effectiveness of the National Board of Professional Teaching Standards (NBPTS) in the United States in promoting positive classroom environments and student attitudes. The WIHIC questionnaire and Enjoyment of Science Lesson scale from the TOSRA was administered to 927 science students in Grades 8 and 10. The TOSRA scale proved to be highly reliable in this study where the internal consistency reliability was 0.81 with the individual student as the unit of analysis and 0.93 for the as a unit of analysis. This result suggests reasonable reliability for the attitude scale. The results of this study revealed a positive and significant correlation between all learning environment scales and students' attitudes.

Two TOSRA scales (Enjoyment of Science Lessons and Adoption of Scientific Attitudes) were used in conjunction with the CLES in a study of the attitudes of 739 students in Grade K-3 science classes toward their classroom learning environments (Peiro & Fraser, 2005). These two questionnaires were translated into the Spanish language and modified based on the needs of the kindergarten students. These modifications included adding pictures, excluding negatively-phrased items, changing the number of response alternatives from five to three, and using individual scales. The alpha reliability for the CLES ranged from 0.87 to 0.95 with the individual student as the unit of analysis, and from 0.79 to 0.96 with the class mean

as the unit of analysis. The alpha reliability for the TOSRA was 0.89 (individual student) and 0.95 (class mean) for the Enjoyment of Science Lessons scale, and 0.94 (individual student) and 0.97 (class mean) for the Adoption of Scientific Attitudes. These high alpha coefficients in both questionnaires suggest that CLES and TOSRA are reliable when translated into Spanish. The results of the study found a positive and significant relationship between students' perceptions of their science classroom environment and their attitudes towards science.

Telli, Cakiroglu and Brok (2006) examined Turkish high school students' perceptions of their classroom environment in biology and investigated the relationships between these perceptions and students' attitudes towards biology. The translated version of the WIHIC questionnaire and four scales from TOSRA (Attitudes to Scientific Inquiry, Enjoyment of Science Lessons, Leisure Interest in Science, and Career Interest in Science) were administrated to 1983 Grade 10 students from 57 biology classes in two major cities. The internal consistency reliability of TOSRA scales ranged from 0.71 to 0.89. This result suggests that all TOSRA scales were sufficiently reliable. Correlation and regression analysis revealed that students' perceptions of their learning environment in biology were significantly associated with their attitudes.

This short review of the literature has found TOSRA to be both a reliable and valid instrument for measuring students' attitudes towards science (Aldridge & Fraser, 2000). Modification through word changes, the use of a varying number of scales, and translation has led to the development of specialised attitude instruments that have produced high reliability (Fraser, 1981; Telli, Cakiroglu & Brok, 2006; Wong & Fraser, 1996).

3.4 Self Efficacy

Bandura (1981, 1982) proposed the construct of 'self-efficacy' as a belief in one's ability to perform effectively. Self-efficacy is concerned with a person's beliefs that he or she can "organise and execute courses of action required to deal with prospective situations that contain many ambiguous, unpredictable and often

stressful, elements" (Bandura, 1981, p. 201). There are two dimensions of self-efficacy: efficacy expectation and response-outcome expectancy. Efficacy expectation is the belief that one can successfully perform the action, whereas response-outcome expectancy is the belief that the action will be effective in achieving the desired outcome (Palmer, 2006). Self-efficacy is situation specific, so an individual may have a high self-efficacy for one task but a low self-efficacy for another. Research has shown that self-efficacy is positively correlated with effort and performance. People with high self-efficacy for a task will persist in their efforts until the task is completed successfully, whereas those with low self-efficacy will tend to give up easily or even avoid the activity (Palmer, 2006).

Bandura (1997) described four factors that can improve self-efficacy: mastery experiences, vicarious experiences, verbal persuasion, and the physiological/affective state. The most powerful of these are *mastery experiences*, which are authentic previous successes in dealing with a particular challenge. In the classroom, teachers should keep learning tasks at a challenging but achievable level of difficulty so students experience successes in learning. The more often students experience success, the more powerful their self-efficacy will become. Palmer (2001) found that providing students with a clear goal or purpose for each science lesson enabled them to set short term, proximal sub-goals. Further, student success in understanding science was facilitated by clear teacher explanations, giving students the opportunity to ask questions to clarify their understandings, and the use of hands-on activities that demonstrated each concept.

Vicarious experiences are those in which a person sees a behaviour modelled by another person, so they feel they could also perform that behaviour. Pajares (2002) argued that teachers provide more effective models if they freely admit when they have made a mistake, as this allows students to see that errors are inevitable and that they can be overcome. However, higher self-efficacy is achieved when people treat anxiety and fear as normal responses that even highly competent individuals may experience in certain situations. To reduce this problem, teachers should create supportive and pleasant classroom atmospheres, for example by "smiling, empathetic listening, voice moderation, frequent use of student's name, appropriate and

reassuring facial gestures, affirmative head nodding, and general attentiveness" (McCabe, 2003, p. 18).

Verbal persuasion refers to situations in which individuals are given positive feedback from others. If a person is told that he/she does possess the capabilities to succeed in the task, then that person will be encouraged to try hard to succeed (Palmer, 2006). *Physiological and affective states* refer to individuals' responses to their own stress. Fear and anxiety moderate levels of stress and can energise high achievers, but can debilitate low achievers (Palmer, 2006).

Self-efficacy provides an effective means of describing people's beliefs in their own ability to produce desired effects through their actions (Bandura, 1997). In many studies the terms 'confidence' and 'self-efficacy' are used interchangeably (Appleton & Kindt, 2002; Rice & Roychoudhury, 2003; Watters & Ginns, 2000). The same approach will be adopted in this study.

3.4.1 Development and Validation of STEBI-B

The *Science Teacher Efficacy Belief Instrument* (STEBI-B) was originally designed by Riggs and Enochs (1990) as a means of measuring pre-service primary teachers' sense of science teaching efficacy. The STEBI-B consists of two scales: Personal Science Teaching Efficacy (PSTE) and Science Teaching Outcome Expectancy (STOE). Personal teaching efficacy is defined as the belief in one's ability to teach effectively (Huinker & Madison, 1997), and is equivalent to Bandura's efficacy expectation. Teaching outcome expectancy is the belief that effective teaching will have a positive effect on student learning (Huinker & Madison, 1997), and is equivalent to Bandura's response-outcome expectation.

The STEBI-B consists of 23 items. The PSTE scale contains 13 items, five worded in the positive and eight in the negative. Possible scores on the PSTE range from 13 to 65. High scores from PSTE indicate a strong personal belief in one's efficacy as a science teacher (Ginns, Watters, Tulip & Lucas, 1995). The STOE scale contains 10 items, eight worded in the positive and two in the negative. Possible scores on the STOE range from 10 to 50. High scores from STOE indicate high expectations of the

outcomes of science teaching (Ginns et al., 1995). The items for the two scales are scattered randomly through the instrument. Each item in the survey is responded to on a five-point Likert scale with the alternatives of 'Almost Never', 'Seldom', 'Sometimes', 'Often', and 'Very Often', which are scored 1, 2, 3, 4, and 5 respectively. A description of these scales can be found in Table 3.4.

Table 3.4: Descriptive Information for the STEBI-B Scales

Scale Name	Description	Sample Item
Personal Science Teaching Efficacy (PSTE)	Self-efficacy	I know the steps necessary to teach science concepts effectively. (+)
Science Teaching Outcome Expectancy (STOE)	Outcome expectancy	Increased effort in science teaching produces little change in some students' science achievement. (-)

Note: From Enochs and Riggs (1990). Items designated (+) are scored 1, 2, 3, 4 and 5, respectively, for the responses Almost Never, Seldom, Sometimes, Often and Almost Always. Items designated (-) are scored in reverse manner. Omitted or invalid responses are scored 3.

STEBI-B has been both a reliable and valid instrument (Enochs & Riggs, 1990; Ginns et al., 1995). In their original development of STEBI-B with 212 pre-service primary teachers, Enochs and Riggs (1990) used factor analysis and reported a Cronbach alpha coefficient of 0.90 for the PSTE scale and 0.76 for the STOE scale. These high values indicate that the items within each scale are measuring the same efficacy. Validating the STEBI-B in an Australian context, Ginns et al. (1995) surveyed 72 pre-service teachers and obtained a Cronbach alpha coefficient of 0.73 for the PSTE scale and 0.68 for the STOE scale. Discriminant validity, the mean correlation of a scale with other scales, was found to be very low (-0.13) indicating that the two scales are measuring different efficacies.

3.4.2 Major Research Using STEBI-B

Various studies have used STEBI-B as a means of measuring the change in confidence of pre-service teachers. Watters and Ginns (1994) investigated the relationship between self-efficacy (as measured by STEBI-B) and three psychometric tests: attitudes towards science (TOSRA), interest in science teaching (*Subject Preference Inventory*, SPI), and learning environment (*Constructivist Learning*

Environment Survey, CLES). The sample included 149 first year pre-service primary teachers enrolled in an introductory science content course. Multiple regression was used to identify the strongest predictors of self-efficacy from the data. Using PSTE (post-test) as the dependent variable, and SPI, TOSRA and CLES as the independent variables, Watters and Ginns (1994) found that 33% of the variability in PSTE was accounted for by Social Implications of Science (TOSRA) and Personal Relevance of Science (CLES). Similarly, only 22% of the variability in STOE (post-test) was accounted for by any of the variables, with significant contributions from Personal Relevance of Science (CLES) and Social Implications of Science (TOSRA). The results showed that the PSTE values of some pre-service teachers had changed by more than one standard deviation over the semester along with relatively low measures of variability accounted for in the regressions. This indicated that the psychometric tests on their own did not provide an adequate prediction of PSTE or STOE.

Huinker and Madison (1997) investigated how a science methods course influenced the confidence of pre-service teachers. The research was conducted with two separate cohorts that completed a science methods course over two different semesters. Significant changes were found in both PSTE and STOE for both cohorts. The mean scores for cohort one increased from 46.2 on the pre-test to 52.2 on the post-test. The mean score for cohort two increased from a pre-test of 48.0 to a post-test value of 52.4. Most pre-service teachers believed that they were better able to teach science effectively at the conclusion of their science methods course. The positive increases in both PSTE and STOE were attributed to the pre-service teachers being allowed to explore science as learners in the science methods course, and explore science as teachers in their experiences during school placement.

Palmer (2006) reported on the changes in self-efficacy and the importance of various sources of efficacy information during a third-year science methods course for pre-service teachers. The methods course had an emphasis on hands-on activities, investigations, relevance to primary school, and tutor modelling. One assessment task required the pre-service teachers to teach and evaluate a hands-on science lesson taught to a single primary student. Significant increases in both PSTE scores (mean pre-test score of 42 increased to 53 in the post-test) and STOE scores (means pre-test

score of 34 increased to 38 in the post-test) were obtained over the semester. Pre-service teachers' self-efficacy was primarily affected through success in understanding science teaching methods and self-modelling (Palmer, 2006).

Howitt (2007) investigated how pre-service primary teachers perceived a holistic science methods course that aimed to increase their confidence and attitudes towards science and science teaching. The sample consisted of 73 pre-service primary teachers enrolled in a second year science education unit at an Australian university. The Cronbach alpha coefficient was consistently high for both scales of the STEBI-B questionnaire: 0.91 for PSTE and 0.76 for STOE. The pre-service teachers had a significant increase in their confidence towards science across the science methods course, as measured by both PSTE and STOE.

STEBI-B has been a reliable and valid instrument for measuring the science teaching efficacy of pre-service teachers. Increases in pre-service teachers' self-efficacy have been achieved through the use of a variety of teaching strategies that address student-centred learning, motivation and authentic experiences (Huinker & Madison, 1997; Howitt, 2007; Palmer, 2006; Watters & Ginns, 1994).

3.5 Summary of Chapter

This chapter has presented detailed information on the three instruments used to measure learning environment, attitudes towards science, and self-efficacy. Each instrument has been described in terms of its development, validation and use in major research. The CLES, TOSRA and STEBI-B have all been reliable and valid instruments within educational research.

The selection of the appropriate instrument to measure learning environment, attitudes towards social studies, and confidence was based on the characteristics, adaptability and availability of each instrument. As CLES was developed to assist teachers and researchers to assess the degree to which a particular classroom's environment is consistent with a constructivist epistemology, and to assist teachers to reflect on their epistemological assumptions and reshape their teaching practice, it

was considered the most appropriate instrument for measuring learning environment. The TOSRA was selected to measure attitudes. This instrument can be used in a variety of contexts and settings, and has been found to produce high reliability and validity even with modifications to the instrument and translations. As the STEBI-B was developed specifically for measuring pre-service teachers' efficacy towards science, it was considered the most appropriate instrument for measuring confidence. How each of these instruments was modified for the social studies context of this study is discussed in detail in the following chapter on methodology.

CHAPTER 4

RESEARCH METHODOLOGY

4.1 Introduction

This chapter describes and explains the methodology and research methods used by the researcher in answering the four research questions stated in Chapter 1. This chapter is divided into 16 main sections, each describing a different component of the methodology used in this research. An overview of the methodological structure of this research is presented in Table 4.1. Section 4.2 presents the critical theory paradigm which underpins this study. Section 4.3 justifies the use of an action research methodology. The multiple methods of data collection are presented in section 4.4. Section 4.5 describes the participating pre-service teachers involved in the study, while section 4.6 presents the research setting. The Social Studies Teaching Methods course is described in Section 4.7. Section 4.8 describes the stages of data collection. The entire pilot trial is presented in section 4.9. A description of the data collection and analysis for the concept maps, *Constructivist Learning Environment Survey*, *Test of Social Studies-Related Attitudes* and *Social Studies Efficacy Belief Instrument* are presented in Sections 4.10 to 4.13. The development of the case studies and reflections are presented in sections 4.14 and 4.15. The quality criteria of the study are presented in section 4.16 while the ethical issues associated with the study are explained in Section 4.17. Finally, the chapter ends with a summary in Section 4.18.

4.2 Critical Theory Paradigm

Critical theory is explicitly prescriptive and normative, viewing what behaviour in a social democracy should entail. Habermas (1970) described critical theory as “a way to develop knowledge that is free and undistorted” (p. 11). Critical theory tries to understand why the social world is the way it is (Huckle, 1993). Thomas (1995) believed that the goal of critical theory was to unfreeze law like structures. The purpose of critical theory is not merely to understand situations and phenomena but

to change them. Cohen, Manion, and Morrison (2005) explained that critical theory is about redressing inequality and promoting individual freedom.

Table 4.1: Aspects and Approaches of the Research Process

Aspect of the Research Process	Approach Taken in this Study
Research Paradigm	Critical Theory
Theoretical Framework	Constructivism, Concept Maps
Methodology	Action Research
Data Collection	Individual Concept Maps Group Concept Maps Closed Questionnaires • Modified *CLES* • Modified *TOSRA* • Modified S*TEBI-B* Semi-structured Interviews Journals Class Reflections Researcher Reflection
Data Analysis/Interpretation	Content Analysis Development of case studies Statistical Summaries Paired *t*-test Multivariate Analysis of Variance
Trustworthiness	Credibility Transferability Dependability Confirmability
Ethical Issues	Informed Consent Consideration Anonymity and Confidentiality Acknowledgment

Habermas (1972) emphasises the emancipatory aspect as one of cognitive interest. This involves an interest in self-knowledge; that is, the knowledge of self-reflection, including interest in roles and social expectations. Insights gained through critical self-awareness can be considered emancipatory in the sense that reasons for particular problems can be identified.

Critical theory was the chosen paradigm in this thesis as change was being implemented into the Social Studies Teaching Methods course. This change was to replace the traditional teaching style used in the Saudi classroom with constructivist

teaching and learning strategies. The purpose of such change was to encourage student-centred approaches to learning based upon positive learning environments, which would ultimately lead to students performing complex activities such as decision making, critical analysis and innovative thinking.

4.3 Action Research Methodology

An action research methodology was used in this research. Action research has been one of the most practical and efficient methods of conducting research by educators for over 30 years (Greenwood & Levin, 1998). The term action research was first used in modern texts by Kurt Lewin (1946), a social psychologist working to improve social, economic, and industrial conditions. Lewin conceptualised social change as a three-stage process: unfreezing former structures, changing those structures, and freezing them back into an improved structure (Greenwood & Levin, 1998). However, action research is now envisaged not as a short-term intervention driven by a single researcher but as a "continuous and participative learning process to create sustainable learning capacities and give participants the option of increasing control over their own situation" (Greenwood & Levin 1998, p. 18). Kemmis and McTaggart (1988) regarded action research as a form of 'self-reflective inquiry' undertaken by the participant in order to improve understanding of their practices in context with a view to maximising social justice.

A primary purpose of action research is to produce practical knowledge that is useful to people in the everyday conduct of their lives (Reason & Bradbury, 2001). A wider purpose of action research is to contribute, through this practical knowledge, to the increased economic, political, psychological, or spiritual wellbeing of persons and communities to develop more equitable and sustainable relationship (Reason & Bradbury, 2001). On a more practical teaching level, McMillan (1992) stated that the purpose of action research in education was to solve a specific classroom problem or make a decision at a local site in order to improve practice immediately within one or more classrooms.

Carr and Kemmis (1983) distinguish between three kinds of action research that are differentiated by the research focus and purpose and the role of the researcher: technical, practical, and emancipatory. Technical action research aims to improve practitioner effectiveness and skills, where the researcher coopts, facilitates, and manages the group. Practical action research aims to build group understanding and professional development, and the researcher asks critical questions to probe for understanding. Emancipatory action research is similar to practical action research but aims at a critical response to organisational constraints, with the researcher acting as moderator to provide the conditions for emancipation (Zuber-Skerritt, 1992). The emancipatory researcher not only treats the group as equals but also leaves the group enabled to continue with the research without expert help. There is a continuum in these approaches, and one action research project or thesis can begin as technical and progress to emancipatory.

An important characteristic of action research is that it is usually cyclical in nature, reflecting the fact that people usually work towards solutions to their problems in cyclical ways. Kemmis and McTaggart (2000) described the action research process as a spiral involving three steps: Plan, Act and Observe, and Reflect. In the Plan step a problem or issue is identified and a plan of action is developed in order to bring about improvements in specific areas of the research context. This step is prospective to action, forward looking and critically informed in terms of the recognition of real constraints, and the potential for more effective action. In the Act and Observe step the plan is put into action over an agreed period of time and the effects of the action are observed and data are collected. In the Reflect step the effects of the action are evaluated and become the basis for further cycles of research. Action research is evaluative and descriptive, in that it makes sense of the processes, problems, issues and constraints of action and develops perspectives and comprehension of the issues and circumstances in which it arises.

Action research was the chosen methodology in this thesis for the following reasons. The action research process provided the researcher with an opportunity to plan, adapt and evaluate concept maps as a new teaching and learning approach in Saudi Arabia. Such an approach encouraged the use of different teaching strategies to support constructivist student-centred learning strategies within a positive learning

environment. Action research involved both the researcher and pre-service teachers as participants in the educational process, allowing both to have a voice in the evaluation. Furthermore, action research allowed the researcher to conduct research in her own classroom and on her own practices.

4.4 Multiple Methods of Data Collection

This study incorporated multiple methods to collect, describe and interpret the data. The use of multiple methods in a single study enhances the validity of research findings (Mathison, 1988) as it provides rigour, breadth and depth to understanding the phenomenon in question (Denzin & Lincoln, 2000). Multiple methods also allow for triangulation, in the classic sense of seeking convergence of results (Creswell, 2005). Both of these purposes for using multiple methods are relevant to this study.

A summary of the research methods employed to answer each of the research questions, the data collection strategies, the instruments used to collect the data, the sample size, and the methods of analysis is presented in Table 4.2. Detailed quantitative and qualitative data have been used throughout this study. Individual and group concept maps provided highly detailed information about pre-service teachers' knowledge of teaching social studies. Three different questionnaires provided information on the pre-service teachers' perceptions of their learning environment, attitudes towards social studies, and confidence to teach social studies. Case studies provided detailed information on how three pre-service teachers perceived the use of concept maps as both a learning and teaching tool. Weekly class reflections provided general information on how the pre-service teachers perceived their weekly social studies learning experiences. Finally, reflections from the researcher as the teacher educator provided detailed information on perceived significant events in each lesson and how these informed future teaching.

Multiple data sources have been incorporated into this research by including information from the entire class, detailed case studies of three pre-service teachers over the semester, and detailed reflections from the researcher as the teacher educator. The data that is collected from these different approaches is

complementary and helps to present a coherent picture of how pre-service teachers' knowledge of teaching social studies, perceptions of their learning environment, attitudes towards social studies, and confidence towards teaching social studies changed as a consequence of using concept maps as a teaching strategy in the Social Studies Teaching Methods course.

Table 4.2: Overview of Research Methods with Data Collection and Analysis Strategies

Research Questions	Method	Data Collection Strategy	Instrument Used	Sample Size	Data Analysis Strategy
1. How does the use of concept maps in a Social Studies Teaching Methods course change Saudi pre-service teachers' knowledge of teaching social studies?	Concept Map	Individual Concept map	Individual Concept map	30	Statistical summaries
		Group Concept map	Group Concept map	6	Paired t-test
					Multivariate analysis of variance
	Case Studies	Semi-structured Interviews &	Interview Protocol	3	Content analysis
		Journals	Journal Protocol	3	Content analysis
	Reflection	Weekly Class	Reflection Protocol	30	Identification of common themes
	Self-Reflection	Weekly Journal Entries	Significant Points	1	Identification and interpretation of significant events
2. How does the use of concept maps in a Social Studies Teaching Methods course change Saudi pre-service teachers' perception of their social studies learning environments?	Questionnaire	Closed Questionnaire	CLES Closed Form	30	Statistical summaries
					Paired t-test
	Case Studies	Semi-structured Interviews &	Interview Protocol	3	Content analysis
		Journals	Journal Protocol	3	Content analysis
3. How does the use of concept maps in a Social Studies Teaching Methods course change Saudi pre-service teachers' attitudes towards social studies?	Questionnaire	Closed Questionnaire	TOSSRA Closed Form	30	Statistical summaries
					Paired t-test
	Case Studies	Semi-structured Interviews &	Interview Protocol	3	Content analysis
		Journals	Journal Protocol	3	Content analysis
4. How does the use of concept maps in a Social Studies Teaching Methods course change Saudi pre-service teachers' confidence to teach social studies?	Questionnaire	Closed Questionnaire	SSTEBI-B Closed Form	30	Statistical summaries
					Paired t-test
	Case Studies	Semi-structured Interviews &	Interview Protocol	3	Content analysis
		Journals	Journal Protocol	3	Content analysis

4.5 The Participants

The participants in this study consisted of 30 female pre-service teachers. The mean age (± standard deviation) of the pre-service teachers was 22.8 (± 0.9) years, with a range from 22 to 25 years. All the pre-service teachers were studying at Umm Al-Qura University in Saudi Arabia in the fourth (final) year of their Bachelor of Geography or Bachelor of History major. Thirteen of these pre-service teachers were completing a major in Geography, with the remainder completing a major in History. The students in this Bachelor degree studied educational preparation programmes in their third and fourth years, synchronous with studying for their major. In the first two years of their degree the students studied only units relating to their major of Geography or History. During their third year the students studied six major units and three educational units each semester. In the fourth year they studied six major units and four educational units each semester. A summary of the units offered in the Geography and History degrees across the four years is presented in Appendix A and B, respectively. The Social Studies Teaching Methods course is a compulsory unit taught in the second semester of the fourth year of the major.

During the same semester as the Social Studies Teaching Methods course, the pre-service teachers were required to complete a practicum at a secondary school. The pre-service teachers attended and taught at the school two days per week.

The participants of this research came from various socio-economic backgrounds, but the majority were from families with a middle-upper income. Parents' were commonly public servants such as teachers and lecturers, or businessmen and other skilled white-collar workers.

4.6 Research Setting

This study was conducted in the Education College of the Umm Al-Qura University in Saudi Arabia in Semester 2, 2007. Umm Al-Qura University was established in 1981. It is a government university that provides free education for citizens at all

higher education levels. Umm Al-Qura University ranks as one of the three biggest universities in Saudi Arabia, providing undergraduate courses across 25 faculties.

The Social Studies Teaching Methods course is studied within the Education Faculty, in the Curriculum and Teaching Methods Department. The Education Faculty was established in 1970 and is one of the oldest Saudi educational faculties. It awards degrees of Bachelor, Higher Diploma, Masters, and Doctor of Philosophy in many specialist areas. The Education Faculty consists of eight departments: Islamic Education, Curriculum and Teaching Methods, Psychology, Art Education, Physical Education, Kindergarten, Centre of Training Courses, and Educational Management and Planning. Most of the college staff are Saudi citizens who have obtained their doctoral degrees from Western countries (Umm Al-Qura University, 2008).

The Curriculum and Teaching Methods Department was established in 1975. This department is one of the biggest in Saudi Arabia in terms of the number of staff, the number of programs presented, and the number of award degrees. The Curriculum and Teaching Methods department has a staff of 56, with only one non-Saudi staff member. There are 40 male staff and 16 female staff. Forty of the staff have doctoral degrees, and there are nine professors on staff (Umm Al-Qura University, 2008).

The goals of the Curriculum and Teaching Methods Department are to

1. teach the subjects of curriculum, teaching methods, educational supervision, and educational means across a range of educational preparation programs;
2. provide practical training in teaching contexts through the practicum program;
3. provide programs for postgraduate students in curriculum and educational supervision;
4. conduct research in curriculum and teaching methods, educational supervision, and practical educational means across all educational levels; and
5. provide educational advice to government departments (Umm Al-Qura University, 2008).

4.7 Social Studies Teaching Methods Course

This research was conducted over a 12 week Social Studies Teaching Methods course. The following section presents the objectives, curriculum, teaching and learning styles, and the assessment associated with the Social Studies Teaching Methods course.

4.7.1 Social Studies Teaching Methods Course Objectives

The main aim of the Social Studies Teaching Methods course is to prepare pre-service teachers to become social studies teachers in secondary schools by providing them with knowledge of teaching social studies. The aim of the curriculum is "to improve the learning outcomes of all pre-service teachers and to enable the Education College to develop learning and teaching programs which meet the needs of secondary schools" (Umm Al-Qura University, 1993, p. 3). Also, the curriculum outcomes aim to progress from the concrete to abstract, and from personal to objective experiences, with an increase in problem solving ability and increasing ability to think scientifically. Moreover, the aims of the course are to increase the pre-service teacher's cognitive and processing ability to teach social studies.

In general, the Curriculum and Teaching Methods Department lists many aims for the Social Studies Teaching Methods curriculum: designing instruction and assessment to promote pre-service teachers' learning; creating a positive, productive classroom environment; implementing effective, responsive instruction and assessment; fulfilling professional roles and responsibilities; and providing the pre-service teachers with an adequate knowledge and pedagogy of social studies to help them in their future teaching career (Umm Al-Qura University, 1993). The Department recommends pedagogic strategies for teaching, suggesting that lecturers should use a variety of teaching methods (e.g. lecturing, discussion, demonstration, inquiry method) to achieve the curriculum objectives (Umm Al-Qura University, 1993).

Curriculum of the Social Studies Teaching Methods Course

The Social Studies Teaching Methods curriculum consisted of four main themes that covered ten topics, being delivered over a 12-week semester. Table 4.3 presents the themes and topics in the Social Studies Teaching Methods curriculum. The themes were taken from three Arabic books that investigated the issues relating to social studies teaching: *Curriculum of Social Studies* (Saadah, 1984), *Social Studies Between Theorization and Implementation* (Alkalza & Muktar, 1987), and *Studies in Social Studies and Civics Teaching Approaches* (Abo Sarhan, 2000). Each of the four themes from the Social Studies Teaching Methods curriculum is described below.

Table 4.3: Themes and Topics in the Curriculum of the Social Studies Teaching Methods Course

Theme No.	Title of Theme	Topic No.	Title of Topic
1	Teaching perspective of social studies	1	Instructional objectives of social studies
		2	Social studies teaching methods
		3	Educational means in social studies teaching
2	Content knowledge of the social studies curriculum	4	Facts, Values, and Attitudes
		5	Concepts, Generalization and Skills
		6	Principles, Laws and Theories
3	Contemporary international trends in social studies teaching	7	Using correlation, fusion and integration in social studies teaching
		8	Using local environment, events and contemporary issues in social studies teaching
		9	Textbook and Suggested Readings
4	Evaluation of social studies	10	Evaluation of social studies

Theme 1: Teaching Perspective of Social Studies

Theme 1 consists of three main topics, namely, instructional objectives of social studies, social studies teaching methods, and educational means in social studies

teaching. The first main topic defines the instructional objectives, the rationale for using instructional objectives in social studies, the advantages of social studies instructional objectives, characteristics of good social studies instructional objectives, how to write social studies instructional objectives, and description of Bloom's taxonomy and its application in social studies. The second topic, social studies teaching methods, briefly describes the different types of social studies teaching methods such as problem solving, group discussion, cooperative learning, lectures, and instructional packages. The final topic in this theme is educational means in social studies teaching. The term 'educational means' refers to "all material or equipment used by the teacher either inside or outside the classroom to assist teaching and learning" (Umm Al-Qura University, 2001, p. 141). The final topic clarifies the educational means concept, the importance of using educational means in teaching social studies, the characteristics of good educational means in teaching social studies, roles using educational means in teaching social studies, the sources of educational means in teaching social studies, and types of educational means in the social studies classroom.

Theme 2: Content Knowledge of the Social Studies Curriculum

Theme 2 relates to the content knowledge of the social studies curriculum. It clarifies the problems facing the selection and organisation of content, criteria for the selection of content, and the organisation of social studies content. This theme also describes details of social studies content including facts, values, skills, attitude, concepts, generalisations, and principles or theories. Each of these seven aspects is covered by a definition, types, characteristics, resources, and teaching methods. This theme aims to make the pre-service teachers aware of the issues facing the selection and organisation of social studies content, and criteria that must be considered when selecting social studies curriculum content. Moreover, this theme strongly aims to provide pre-service teachers with a wide range of strategies to teach different content.

Theme 3: Contemporary International Trends in Social Studies Teaching

This theme explains the contemporary international trends in social studies teaching. It consists of three topics. The first topic discusses three new trends in teaching social studies, namely correlation, fusion, and integration. Each of these trends is presented

in terms of their status in the modern curriculum of social studies, and their concept, characteristics and the methods applied in teaching social studies. These new trends encourage the utilisation of the local environment, current events and contemporary issues in teaching social studies, as a mechanism to motivate students and relate social studies to real life.

The second topic in this theme describes how to use the local environment (such as natural resources, artificial resources, and human resources) and how to utilise current events and contemporary issues in social studies teaching. Local environment, current events and contemporary issues are discussed in terms of their concepts, creators, sources, and benefits in the teaching of social studies.

The final topic in this theme discusses the textbook and suggested readings. It focuses on the complementary relationship between the textbook and suggested readings. This topic identifies the criteria of a good textbook, and its importance to teachers and students. In addition, it describes the ways and phases of utilising the textbook in social studies teaching. This theme also elaborates on the sources of suggested readings, types of readings, the criteria for selection, and ways of utilising the suggested readings in social studies teaching.

The objective of this theme is to avoid the disadvantages of the old social studies curriculum that separated the objectives of each social studies subject and concentrated only on information and facts. The information and facts were not related to the students' environment, and were disconnected from current events and contemporary issues. This old curriculum has been replaced by the modern social studies curriculum that encourages correlation, fusion, and integration between social studies subjects. This modern curriculum also uses the local environment, current events and contemporary issues as sources for social studies teaching. Furthermore, this theme aims to use the textbook and suggested readings in a more effective manner.

Theme 4: Evaluation of Social Studies

The final theme relates to the evaluation process. This theme describes the definition of evaluation, the importance of evaluation, evaluation purposes and functions, the

components of evaluation, characteristics of an effective evaluation program, types of evaluation, external factors influencing the evaluation process, and evaluation techniques. Definition of tests, advantages of tests, planning or construction of a test, criteria to be considered in constructing tests, characteristics of a good test, and types of tests are elaborated briefly in this theme in relation to social studies.

The aims of this theme are to train the pre-service teachers to ask questions and obtain feedback from the students, an important requirement if they are to develop reflective practitioners. This theme also aims to familiarise pre-service teachers with constructing both essay type and objective type tests in the social studies field.

4.7.2 Teaching and Learning Style

The researcher was the lecturer of the Social Studies Teaching Methods course. The lectures were delivered using concept maps as a social constructivist referent for teaching and learning. Each weekly lecture lasted two hours. During lectures the researcher encouraged small group work, brainstorming and class discussion, thus encouraging pre-service teachers to share, negotiate, and explain their ideas within their groups and class.

In the second week of lectures pre-service teachers were given an introductory lecture on concept mapping. In this lecture students participated in an interactive whiteboard exercise in order to become acquainted with the concept mapping technique. This activity utilised the university structure (e.g., academic departments) and students' experiences with the university to create personalised 'Self-as-University Student' concept maps (Novak, 1995). This group activity was used to teach the basic tenants of Novak's (1995) concept mapping process, including the meaning and use of concepts, propositions, hierarchical structuring and cross-links.

Ten minutes at the beginning of the each lecture was dedicated to process commentary. This process commentary was implemented from the second lecture to the twelfth lecture. The purpose of the process commentary was to remind the pre-service teachers of the main ideas discussed in the last lesson and thus assist with making connections in the current lecture. The aim of this process was to assist the

pre-service teachers to build an integrated conceptual understanding between the course topics. As the pre-service teachers had to individually comment it also provided them with an opportunity to talk to a class.

Concept maps were incorporated into all lectures as both a teaching strategy and mechanism for assisting pre-service teachers to increase their knowledge of teaching social studies. The general approach is described here. At the beginning of the first five lectures, the pre-service teachers were provided with a list of terms relating to the studied topic to assist them in constructing their maps. In the remaining lectures the pre-service teachers were allowed to read the related chapters from their text to construct their concept maps. In groups they were required to read the terms as an initial introduction to the topic and then develop concept maps based around these terms. In this process, the pre-service teachers were encouraged to explore both hierarchical and web-like relationships, and develop links between terms. During this process, the pre-service teachers were encouraged to share ideas within their groups. As there was no single correct map, some pre-service teachers omitted terms from their maps, while others included additional terms. Once all groups were satisfied with their maps there was a whole class discussion. Here, one member from each group explained their group's concept map. Positive feedback from the class was encouraged. This approach took approximately 60 minutes.

A formal 30-40 minute lecture on the specific content was then delivered using a PowerPoint presentation. Within this lecture any difficult concepts noted from the development or discussion of the concept maps were clarified.

The last 15 minutes of each lecture was dedicated to reflection, where the pre-service teachers were encouraged to discuss what they learnt during the lecture, what had happened in the lecture to encourage that learning, and how this information could be applied when they were teaching.

4.7.3 Assessment

There were four assessment items in the Social Studies Teaching Methods course: attendance, assignment, mid-semester test, and final exam. Table 4.4 summarises the

list of assessments, allocated marks, and the purpose of each assessment. The mid-semester and final exams were a mix of objective questions and essay questions that covered the Social Studies Teaching Methods curriculum content.

The assignment was on preparing a lesson from the secondary school social studies curriculum where concept maps would be used in the class. This assignment required the pre-service teacher to describe in detail how they would use concept maps as a teaching strategy in the classroom. The assignment also assessed the pre-service teachers' ability to develop a lesson. Four criteria were used to assess the assignment: lesson objectives, educational means used, lesson procedure where the pre-service teachers described how they would use concept maps as a teaching strategy, and evaluation.

Table 4.4: Assessment of the Social Studies Teaching Methods Course

Assessment Producer	Allocated Marks (%)	Purpose
Attendance and Participation	10	Encourages attendance and participation
Assignment	10	Demonstrate understanding of how to use concept maps as a teaching strategy in the classroom
Mid-semester Test	20	Assessing achievement in the middle of the semester
Final Examinations	60	Assessing academic achievement of the course content

4.8 Stages of Data Collection

There were four stages in the data collection. An overview of these stages in relation to data collection and the weekly lecture timetable is presented in Table 4.5. This illustrates the specific data that was collected each week. While the semester was only 12 weeks long, data was collected over a 15 week time frame (see Table 4.5). The last three weeks coincided with 'study weeks' leading up to exams. The pre-service teachers used this time to revise for exams and ask questions in class. For the purpose of this study, Weeks 1 to 15 will be used to describe the data collection. A

detailed description of the data collection and analysis used in this study is provided in Sections 4.9-4.15.

The initial stage (or pilot trial), related to validation of the Arabic versions of the three instruments used in this study, namely, *Constructivist Learning Environment Survey* (CLES), *Test of Social Studies-Related Attitudes* (TOSSRA), and *Social Studies Teacher Efficacy Belief Instrument* (SSTEBI-B). This stage was conducted during the modification of the instruments before the implementation of the action research. The processes adopted in this stage enabled the establishment of the reliability and validity of the modified forms of CLES, TOSRA, and STEBI-B and identified any modifications required before these questionnaires were used in the second stage. The entire pilot trial along with results is described in Section 4.9 to provide the reader with the required information to ensure the validity of the research instruments.

The second stage of data collection related to the pre-assessment of the pre-service teachers' perceptions of their Social Studies Teaching Methods learning environment, their attitudes towards social studies and confidence toward teaching social studies (Table 4.5). This stage was conducted in Weeks 1-3. Four main methods of data collection were used during this stage: individual concept maps, and the Arabic versions of the CLES, TOSSRA and SSTEBI-B. Information relating to data collection and analysis for this stage is presented in Sections 4.10 - 4.13.

Table 4.5: Summary of Data Collection

Stage	Week+	Date	Whole Class	Case Study	Researcher
1		02/09/2007	Pilot trial		
2	1	08/09/2007	CLES, TOSSRA (Pre-test)		Informing pre-service teachers of the research. Informed consent Reflection
2	2	15/09/2007	SSTEBI-B (Pre-test) Pre-journal		Call for volunteers for the case studies. Reflection
2 & 3	3	22/09/2007	Pre-concept map individual		Reflection
3	4	29/09/2007	Class reflection	Interview & journal	Reflection
3	5	06/10/2007*	Group concept map Class reflection		Reflection
3	6	20/10/2007	Class reflection		Reflection
3	7	27/10/2007	Class reflection		Reflection
3	8	02/11/2007	Class reflection	Interview & journal	Reflection
3	9	10/11/2007	Group concept map Class reflection		Reflection
3	10	17/11/2007	Class reflection		Reflection
3	11	24/11/2007	Group concept map Class reflection		Reflection
3	12	01/12/2007	Class reflection	Interview & journal	Reflection
4	13	08/12/2007**	CLES, TOSSRA (Post-test)		Reflection
4	14	29/12/2009	SSTEBI-B (Post-test)		Reflection
4	15	05/01/2008	Post-concept map individual		Reflection

+ Formal teaching occurred from Week 1 to Week 12
* The period from 07/10/2007 until 19/10/2007 is holiday of end of Ramadan and Lesser bairam.
** The period from 09/12/2007 until 28/12/2007 is Hajj holiday

The third stage related to implementing concept maps as a teaching strategy. This stage coincided with the formal instruction of Weeks 3 to 12, and was conducted from October to December, 2007. During this stage group concept maps were collected. Journals and interviews were collected from three pre-service teachers to develop case studies. The researcher wrote personal weekly reflections on using concept maps in the classroom. Weekly class reflections were also obtained. The information gained from this wide range of data was used to confirm and support the findings from the concept maps and questionnaires. Information relating to data

collection and analysis for this stage is presented in Sections 4.10 to 4.14, and section 4.15.

The fourth and final stage of data collection was evaluation and occurred in Weeks 13 to 15. The purpose of this stage was to obtain an understanding of whether the pre-service teachers were able to respond to using concept maps as a tool for improving their knowledge of teaching social studies and perception of teaching social studies. Data were collected from post-concept maps as well as post-test CLES, TOSSRA, and SSTEBI-B. Researcher reflections were ongoing in order to support the findings from the concept maps and questionnaires. Information relating to data collection and analysis for this stage is presented in Sections 4.10 - 4.13 and 4.15.

4.9 Pilot Trial

The pilot trial involved modifying the CLES, TOSRA and STEBI-B questionnaires, translating them into Arabic and trialling them on a small group of pre-service teachers. The purpose of the pilot trial was to validate the modified Arabic versions of these three questionnaires. The implementation and results of the pilot trial are presented in their entirety within this section, to provide the reader with all of the required information before progressing on to methods associated with the full research.

4.9.1 Implementation of the Pilot Trial

To determine the reliability, validity and practicality of the modified Arabic versions of the three instruments, they were piloted on 30 female pre-service English Language teachers in the final year of their Bachelor of English Language major, at Umm Al-Qura University. The pilot was conducted on a small cohort of English Language pre-service teachers for three reasons. First, the English Language class was most responsive to doing this pilot trail as they saw this as an opportunity to practice their English. Second, the English Language pre-service teachers can read and speak English, thus providing an ideal opportunity to discuss if any Arabic

statements were not clear. Third, both English Language and Social Studies fall under the Humanities, making administration of the trial easier.

Modifications made to CLES before translation were to change the word “science” to “English language” and change the word “school” to “university”. The modifications made to the TOSRA before translation were to change the word “science” to “English language”, the word “school” to “university”, and the word “scientist” to “English language professor”. The modifications made to the STEBI-B before translation were to change the word “science” to “English language”, the word “primary” to “secondary”, and the word “child” to “student”.

The following changes were made to STEBI-B. Of the 23 items in the survey 13 are designed to address pre-service teachers’ level of belief that they can teach science (Personal Science Teaching Efficacy or PSTE). Five of the questions are worded positively and eight are worded negatively. The remaining 10 items assess the respondents’ belief that their teaching will have a positive effect on the students they are teaching (Science Teaching Outcome Expectancy or STOE). Eight of these questions are worded positively and two are worded negatively. Due to this large imbalance in the number of positive and negative questions within each scale, some were reworded to reverse the polarity of the question. This resulted in six positive and seven negative questions in the PSTE scale, and five positive and five negative in the STOE. Other than that, the original order of the questions was changed around so that all the PSTE questions were first in the questionnaire, followed by all the STOE questions. This was done to allow the pre-service teachers a logical order to the questions they were to answer, and to make analysing the data easier.

Because the original CLES, TOSRA, and STEBI-B were designed for Western students, with all statements in English, careful translations and back translations, as suggested by Brislin (1970, 1980), were carried out. The three questionnaires were translated into the Arabic language by the researcher, then back translated by an English speaking instructor not involved in the original translation. The modified, Arabic, and back-translated versions of CLES can be found in Appendices C, D, and E, respectively. The modified, Arabic, and back-translated versions of TOSRA can be found in Appendices F, G, and H, respectively. The modified, Arabic, and back-

translated versions of STEBI-B can be found in Appendices I, J, and K, respectively. By comparing the original questionnaires with back-translated versions, it was possible to ensure that both versions conveyed the same meaning. The only exception was one statement within the CLES. The statement "I learn that science is about creating theories" was removed from this questionnaire as no suitable statement could be developed for the social studies context of this study.

The pilot trial was conducted by the researcher on September 2, 2007 (see Table 4.5). During the first ten minutes, the researcher explained the purpose of the trial, read instructions, and encouraged the pre-service teachers to identify or question any unclear statements. The pre-service teachers then completed all three questionnaires within 45 minutes.

The pilot trial assisted in checking the time required to complete each questionnaire, as well as to gain feedback on the layout and ease of reading the questionnaires. The researcher found no difficulties in the administration of the questionnaires to the class. The pre-service teachers had no problems in understanding the meaning of the Arabic statements on the questionnaires. They considered all the statements were clearly written.

4.9.2 Internal Consistency Reliability and Discriminant Validity of Instruments

Reliability analysis explores the properties of measurement scales and the items in a questionnaire. Cronbach's alpha coefficient was used as an index of internal consistency reliability for each of scales in all three instruments. To assess the extent to which a scale is unique in the dimension that it covers and is not included in another scale in the same instrument, the mean correlation of a scale with other scales was used as a convenient index of discriminant validity.

Constructivist Learning Environment Survey (CLES)

Table 4.6 shows the alpha coefficients and mean correlation of the five scales of the Arabic version of the modified CLES. The Cronbach's alpha coefficient ranged from 0.57 to 0.78, with the individual as the unit of analysis. The mean correlation of a

scale with other scales varied between 0.22 and 0.43. These results suggest that each scale assesses a unique dimension and that, while there is some overlap between raw scores on scales, they are relatively independent of each other. According to Trochim (2000), theoretically similar measures should yield high correlations between each other while theoretically dissimilar measures should yield low correlations.

Table 4.6: Internal Consistency (Cronbach Alpha Coefficient) and Mean Correlation Coefficient of the Scales of the Modified Arabic CLES from the Pilot Trial (N=30)

Scale	Alpha Reliability	Mean Correlation
Personal Relevance	0.57	0.35
Uncertainty	0.61	0.22
Critical Voice	0.65	0.43
Shared Control	0.78	0.43
Student Negotiation	0.78	0.47

Modified Test of Science-Related Attitudes (TOSRA)

Table 4.7 shows that the Cronbach alpha coefficient of the Arabic version of the modified TOSRA was 0.93 for Adoption of English Language Attitude, 0.77 for Enjoyment of English Language Lessons and 0.91 for Career Interest in English Language. As shown in Table 4.7 the mean correlation for the three scales ranged from 0.06 to 0.26, indicating that the three scales are reasonably distinct from each other.

Table 4.7: Internal Consistency (Cronbach Alpha Coefficient) and Mean Correlation Coefficient of the Scales of the Modified Arabic TOSRA from the Pilot Trial (N=30)

Scale	Alpha Reliability	Mean Correlation
Adoption of English Language Attitudes	0.93	0.06
Enjoyment of English Language Lessons	0.77	0.26
Career Interest in English Language	0.91	0.13

Modified Science Teacher Efficacy Belief Instrument (STEBI-B)

Table 4.8 shows the values of Cronbach alpha coefficient and mean correlation of the two scales of the Arabic version of the modified STEBI-B. The Cronbach alpha coefficient for English Language Teaching Outcome Expectancy was 0.90, and 0.78

for the Personal English Language Teaching Efficacy scale. The mean correlation between these two scales was 0.26.

Table 4.8: Internal Consistency (Cronbach Alpha Coefficient) and Mean Correlation Coefficient of the Scales of the Modified Arabic STEBI-B from the Pilot Trial (N=30)

Scale	Alpha Reliability	Mean Correlation
English Language Teaching Outcome Expectancy	0.90	0.26
Personal English Language Teaching Efficacy	0.78	0.26

4.9.3 Summary of the Pilot Trial

The results of this pilot trial show that the reliability, validity and usability of the modified Arabic versions of CLES, TOSRA and STEBI-B are acceptable. This pilot trial validates the use of these questionnaires with Saudi pre-service teachers.

4.10 Concept Maps

4.10.1 Data Collection

Both individual and group concept maps were used as forms of data. In Week 3, the first week of formal teaching with concept maps (see Table 4.5), the pre-service teachers were asked to draw individual concept maps on the social studies teaching process. No list of concepts was given. Each pre-service teachers drew a concept map based on their understanding and prior knowledge of the social studies teaching process. These individual concept maps were drawn in the first 15 minutes of the lecture. In Week 15 the pre-service teachers were asked to draw individual post-concept maps on the same topic. One hour was allocated for the pre-service teachers to draw their individual post-concept maps.

Group concept maps were also collected over the semester to provide an indication of concept development over time. These group concept maps provided additional information about the pre-service teachers' developing knowledge of teaching social

studies. During Weeks 5, 9 and 11 (see Table 4.5) the pre-service teachers worked in the same group of five to produce a group concept map. The last half hour of the lecture was allocated to the production of these maps. No list of concepts was given.

4.10.2 Data Analysis

The concept maps were coded and scored using the procedures described by Novak and Gowin (1984). Points were given for the numbers of relationships, hierarchies, examples and cross-links represented in each concept map. One point was assigned to each valid relationship, five points for each hierarchy, one point for each example presented, and 10 points were assigned to each cross-link. A modified scoring system for branching was used where points were assigned according to the type of branching. Thus, one point was assigned for a single branching, two points for a double branching, three points for a triple branching, and so on. This scoring system was developed to show the extent and complexity of branching over time, as opposed to just the overall number of branches (which is the same as the number of relationships) (Alansari & Howitt, 2009). The researcher scored all concept maps first. This was then validated by a second independent scorer. Any discrepancies were discussed and resolved, so that a final score could be allocated to each concept map. A total score was obtained by adding together the scores of the relationships, hierarchies, examples and cross-links.

Descriptive statistical information in the form of mean, range and standard deviation was obtained for the number of relationships, hierarchies, examples, cross-links, and the total score. Paired t-tests (Jackson, 2006) were used to compare individual pre- and post-concept maps for these five categories. Multivariate analysis of variance (Jackson, 2006) was used to examine differences in the group concept maps over time for each of the five categories.

For individual and group concept maps, major concepts were summarised in tables. This table included the occurrence of the major concept, sub-concepts and examples that were provided in the concept maps.

Branching distribution of the individual and group concept maps were also analysed to determine the extent and complexity of branching. A summary table showing the frequency of branchings for each pre-service teacher was developed. This table provided a mechanism for summarising the distribution of branching. It also highlighted the frequency of different branching types and range of branching across the concept maps. The pre- and post-distrubitions were then compared graphically. The same procedure was used with the group concept maps.

4.11 Constructivist Learning Environment Survey (CLES)

4.11.1 Data Collection

In this research a modified *Constructivist Learning Environment Survey* (CLES) was utilised. The CLES was chosen for this study because it was the most suitable instrument for assessing the extent to which the participating classrooms reflected constructivism. This instrument allowed the researcher to monitor the development of constructivist approaches to teaching social studies.

In this study, the student actual form of the CLES was used to investigate pre-service teachers' perceptions of their learning environment from a constructivist perspective. The item scoring in each scale of the CLES employed a five-point Likert response scale where each item is responded to with the alternatives of Almost Never, Seldom, Sometimes, Often and Almost Always. The same questionnaire as that used in the pilot trial was used in the actual trial, with the word "English language" changed to "Social studies". The CLES had 29 items, 6 in each scale of Personal Relevance, Critical Voice, Shared Control, and Student Negotiation and 5 in Uncertainty. One item was dropped based on the results of the pilot trial. The five scales of CLES and an example of an item in each scale are given in Table 4.9. The complete instrument can be found in Appendix L.

Table 4.9: Scale Description and Sample Items of the Constructivist Learning Environment Survey (CLES)

Scale Name	Description	Sample item
Personal Relevance	Extent to which university social studies is relevant to pre-service teachers' everyday out-of-university experience	What I learn has nothing to do with my out-of-university life (-)
Uncertainty	Extent to which opportunities are provided for pre-service teachers to experience that social studies knowledge is evolving and culturally and socially determined	I learn that modern social studies is different from that of long ago (+).
Critical Voice	The extent to which pre-service teachers feel that it is legitimate and beneficial to question the lecturer's pedagogical plans and methods	It's OK for me to express my opinion (+)
Shared Control	Extent to which pre-service teachers share with the lecturer control for the design and management of learning activities, assessment criteria, and social norms of the classroom	I help the lecturer to plan what I'm going to learn (+)
Student Negotiation	The extent to which pre-service teachers have opportunities to explain and justify their ideas, and to test the viability of their own and other pre-service teachers' ideas	I get the chance to talk to other students (+)

Note. From Taylor, Fraser and Fisher (1997). Items are scored 1, 2, 3, 4 and 5, respectively, for the responses Almost Never, Seldom, Sometimes, Often and Almost Always. Items designated (-) are scored in reverse manner. Omitted or invalid responses are scored 3.

The pre-service teachers completed the modified CLES in Week 1 as a pre-test and again in Week 13 as a post-test. Pre-service teachers' names were placed on the questionnaires so that the pre-test and post-test answers could be matched. However, only class results are reported. To further ensure confidentiality, the researcher assigned each pre-service teacher a 'security monitor' to seal and sign each envelope containing the completed questionnaire. The pre-service teachers took approximately 20 minutes to complete the modified CLES questionnaire.

4.11.2 Data Analysis

Throughout the quantitative data analysis the individual has been used as the unit of analysis. This decision was guided by the small sample size used in this research. Reliability coefficients are a measure of the consistency of a test (Wiersma, 1986). In interpreting reliability coefficients, McMillan and Schumacher (1993) indicate

that an acceptable range for most instruments is 0.70 to 0.90 and 0.5 is acceptable in exploratory research. However, these authors suggest that as reliability is essentially a function of the nature of the trait being examined, measures of achievement should generally have high reliabilities. Further, high reliabilities are required if results are used to make decisions about individuals whereas studies of groups can tolerate a lower reliability. In the development of a questionnaire, it is necessary to establish that each item in a scale assesses a common construct. If this is the case, then the scale is referred to as being homogenous or having internal consistency. The internal consistency of each scale in the modified CLES was established using Cronbach's (1970) alpha coefficient. Cronbach alpha is based on the average correlation of items within a scale when the items are standardised. Values range from zero to one, with high values indicating that items on the same scale are measuring the same thing. The results for the Cronbach alpha reliability coefficient of the scales of the modified CLES are described in Chapter 6.

Validity refers to the extent to which what we measure accurately reflects what we expected to measure (Anderson & Arsenault, 2004). Discriminant validity assesses the extent to which a scale is unique in the dimension that it covers (i.e., the concept is not included in another scale of the instrument) (Munro, 2005). As a convenient index of the discriminant validity of raw scale scores, the mean magnitude of the correlation of one scale with other scales in the modified CLES was calculated. Values for discriminant validity range from zero to one, with low values indicating that the scale can be differentiated from other scales. The results for the discriminant validity of the scales of the modified CLES are described in Chapter 6.

All modified CLES forms were individually scored by the researcher. This data was then entered into SPSS (Version 14) to generate the required statistics. Average item means were obtained for each scale. Average item means were calculated in preference to total scale scores in order to allow for the different number of items contained in different scales when comparing scale means. Descriptive statistics in the form of means and standard deviations were obtained for the pre- and post-test data. Paired t-tests (Jackson, 2006) were used to compare pre-service teachers' perception of their learning environment as a consequence of using concept maps.

Effect sizes were calculated as a measure of the magnitude of the educational significance of the modified CLES pre- and post- differences.

4.12 Test of Social Studies-Related Attitudes (TOSSRA)

4.12.1 Data Collection

A modified TOSRA was used to develop the *Test of Social Studies-Related Attitudes* (TOSSRA). The TOSSRA was used to investigate pre-service teachers' attitudes towards social studies. Only three of the original scales of TOSRA were used in this research: Adoption of Scientific Attitudes, Enjoyment of Science Lessons, and Career Interest in Science. For use in the TOSSRA, these scales names were changed to Adoption of Social Studies Attitudes, Enjoyment of Social Studies Lessons, and Career Interest in Social Studies. The TOSSRA contained 30 items altogether, with ten items in each of the three scales. The same questionnaire as that used in the pilot trial was used in the actual trial, with the word "English Language" changed to "Social Studies" and word "English language professor" changed to "Social studies professor". The item scoring in each scale of the TOSSRA employed a five-point Likert response scale where each item is responded to with alternatives of Almost Never, Seldom, Sometimes, Often and Almost Always. The three scales of TOSSRA and examples of an item in each scale are given in Table 4.10. The complete instrument can be found in Appendix M.

Table 4.10: Scale Description and Sample Items of the Test of Social Studies-Related Attitudes (TOSSRA)

Scale Name	Klopfer's (1971) Classification	Sample item
Adoption of Social Studies Attitudes	Adoption of 'social studies attitudes'	I dislike listening to other people's opinions (-)
Enjoyment of Social Studies Lessons	Enjoyment of social studies learning experiences	Social studies lessons are fun (+)
Career Interest in Social Studies	Development of interest in pursuing a career in social studies	A job as a social studies professor would be boring (-)

Note. Adapted from Fraser (1981). Items designated (+) are scored 1, 2, 3, 4 and 5, respectively, for the responses Almost Never, Seldom, Sometimes, Often and Almost Always. Items designated (-) are scored in reverse manner. Omitted or invalid responses are scored 3.

The pre-service teachers completed the TOSSRA in Week 1 as a pre-test and again in Week 13 as a post-test (see Table 4.5). Pre-service teachers' names were placed on the questionnaires, so that the pre-test and post-test answers could be matched. However, only class results are reported. To further ensure confidentiality, the researcher assigned each pre-service teacher a 'security monitor' to seal and sign each envelop containing the completed questionnaire. The pre-service teachers took approximately 20 minutes to complete the TOSSRA questionnaire.

4.12.2 Data Analysis

The internal consistency of each scale in the TOSSRA was established using Cronbach's (1970) alpha coefficient. The discriminant validity of raw scale scores was calculated using the mean magnitude of the correlation of one scale with other scales in the TOSSRA. The results for the Cronbach alpha reliability and the discriminant validity of the scales of the TOSSRA are presented in Chapter 6.

All TOSSRA forms were individually scored by the researcher. This data was then entered into SPSS (Version 14) to generate the required statistics. Average item means were obtained for each scale. Descriptive statistics in the form of means and standard deviations were obtained for the pre- and post-test data. Paired t-tests (Jackson, 2006) were used to compare pre-service teachers' attitudes towards social studies as a consequence of using concept maps. Effect sizes were also calculated as a measure of the magnitude of the educational significance of the TOSSRA pre-post differences.

4.13 Social Studies Teacher Efficacy Belief Instrument (SSTEBI-B)

4.13.1 Data Collection

A modified STEBI-B was used to develop the *Social Studies Teacher Efficacy Belief Instrument* (SSTEBI-B). The SSTEBI-B was used to examine pre-service teachers' efficacy or confidence towards teaching social studies. The two scales Personal Science Teaching Efficacy (PSTE) and Science Teaching Outcome Expectancy

(STOE) were changed to Personal Social Studies Teaching Efficacy (PSSTE) and Social Studies Teaching Outcome Expectancy (SSTOE). The same questionnaire as that used in the pilot trial was used in the actual trial, with the word "English Language" changed to "Social Studies". A description of the two scales for SSTEBI-B and an example of an item in each scale is given below in Table 4.11. The complete instrument can be found in Appendix N.

Table 4.11: Scale Description and Sample Items of the Social Studies Teaching Efficacy Belief Instrument (SSTEBI-B)

Scale Name	Description	Question(s) No.
Personal Social Studies Teaching Efficacy (PSSTE)	Outcome expectancy	Increased effort in social studies teaching produces little change in some students' social studies achievement (-)
Social Studies Teaching Outcome Expectancy (SSTOE)	Self-efficacy	I know the steps necessary to teach social studies concepts effectively (+)

Note. From Enochs and Riggs (1990). Items designated (+) are scored 1, 2, 3, 4 and 5, respectively, for the responses Almost Never, Seldom, Sometimes, Often and Almost Always. Items designated (-) are scored in reverse manner. Omitted or invalid responses are scored 3.

The pre-service teachers completed the SSTEBI-B in Week 2 as a pre-test and again in Week 14 as a post-test (see Table 4.5). Pre-service teachers' names were placed on the questionnaires, so that the pre-test and post-test answers could be matched. However, only class results are reported. To further ensure confidentiality, the researcher assigned each pre-service teacher a 'security monitor' to seal and sign each envelope containing the completed questionnaire. The pre-service teacher took approximately 15 minutes to complete the SSTEBI-B questionnaire.

4.13.2 Data Analysis

The internal consistency of each scale in the SSTEBI-B was established using Cronbach's (1970) alpha coefficient. The discriminant validity of raw scale scores was calculated using the mean magnitude of the correlation of one scale with other scales in the modified SSTEBI-B. The results for the Cronbach alpha reliability and the discriminant validity of the scales of the SSTEBI-B are described in Chapter 6.

All SSTEBI-B forms were individually scored by the researcher. This data was then entered into SPSS (version 14) to generate the required statistics. Average item means were obtained for each scale. Descriptive statistics in the form of means and standard deviations were obtained for the pre- and post-test data. Paired t-tests (Jackson, 2006) were used to compare pre-service teachers' confidence to teach social studies as a consequence of using concept maps. Effect sizes were also calculated as a measure of the magnitude of the educational significance of the SSTEBI-B pre-post differences.

4.14 Case Studies

4.14.1 Participants in the Case Studies

Three individual case studies were compiled for the pre-service teachers, Omniah, Eba, and Jury (all pseudonyms). All three volunteered in Week 2 after receiving information about the study in the first week. Omniah was a 22 year old geography student in the final year of her Bachelor degree. Eba was a history student in the final year of her Bachelor degree. She was also 22 years old. Jury was a 25 year old geography student in the final year of her Bachelor degree. Jury was married and had two daughters. Data to develop the case studies was collected from pre-service teachers' semi-structured interviews and journals. The method of data collection for each of these is presented below.

4.14.2 Semi-Structured Interviews Data Collection

Interviews are important tools to discover participants' feelings and to probe further ideas or statements that are vague (Merriam, 1998). In conducting the interviews, the format suggested by Fontana and Frey (2000) was followed. Semi-structured interviews were maintained so that there was a casual atmosphere and the interviewees were engaged in real conversations. Semi-structured interviews were conducted with the three case study pre-service teachers during Weeks 4, 8, and 12 (see Table 4.5). Each of the pre-service teachers was interviewed individually in a meeting room of the Education Faculty at a time convenient to them (see Ethics

sections at the end of this chapter). The interview transcript was written in the Arabic language, then translated into the English language by the researcher. An English speaking instructor checked the translation from Arabic to English. Each interview lasted from 20 to 40 minutes, depending on how much the participant wished to discuss. The following questions were asked during the interviews.

1. Reflect on the strengths and weaknesses of using concept maps as a method of learning?
2. What are the issues that concern you in relation to your learning in this unit?
3. Can you describe your feelings as a learner using concept maps?
4. After experiencing the unit, do you think that the concept map is a valuable means of learning?
5. As a learner, what advantages did you experience, or can you expect, in learning with concept maps?
6. What difficulties did you experience using concept maps as a mode of learning?
7. What aspects have been most significant for you in this unit?

4.14.3 Journal Data Collection

Journals are considered a powerful tool to collect qualitative data (Cooper, 1991). The journals elicited the pre-service teachers' attitudes, beliefs and views of the phenomenon under study.

The three case study pre-service teachers were asked to keep a journal of events occurring in their secondary school classes while on practicum. To guide these pre-service teachers in writing their journals, the researcher provided a list of journal questions. The pre-service teachers were asked to make entries into their journals in Weeks 4, 8 and 12.

The guiding journal questions are presented below.

1. What prompted you to use concept maps in your practicum this week?
2. What was involved in the preparation for this week?

a. skills
b. materials
c. expertise
3. What is your impression of the students' appreciation of the lessons?
4. How did the students perform this week in relation to using concept maps?
5. What is your impression of how you performed as a teacher using concept mapping?
6. What were some of the challenges you faced this week when using concept maps?

The researcher translated these journals from the Arabic language to the English language, with an English speaking instructor checking this translation.

4.14.4 Construction of Case Study

The three interviews and the three journals of each pre-service teacher were combined to construct the individual case studies. In constructing the three individual case studies, the researcher became immersed in the data in order to gain a better understanding of the pre-service teachers' experiences (Merriam, 1990). Emergent points were then identified which became the basis of the case studies. In writing up the case studies, these points were described in detail and supported with appropriate quotes from the pre-service teachers' interviews and journals. This process provided a detailed description of the experiences of the pre-service teachers using concept maps as a teaching and learning strategy.

4.14.5 Cross Case Analysis

The cross case analysis was performed by content analysis (Cohen et al., 2005). The researcher read the pre-service teachers' stories. Common themes across the three cases were identified and described in detail. Similarly, differences across the cases were also identified and described. This process illustrated both the benefits and the challenges facing the pre-service teachers in using concept maps as a teaching and learning strategy.

4.15 Reflection

Reflection is the strategy that encourages teachers to think about their own teaching and learning. It requires the teacher to develop an understanding of themselves, by reflecting on and articulating their own learning experiences and process (Hardy & Kirkwood, 1994). The reflection orientation is characterised by asking pre-service teachers to describe their ideas, beliefs and values about teaching and learning and then providing experiences that help them clarify, confront and possibly change such personal theories (Howitt, 2007).

4.15.1 Data Collection

Weekly data was collected in the form of class reflections and researcher reflections. Each of these is described below.

Class Reflections

Weekly class reflections were used as a means to determine how the pre-service teachers perceived their weekly social studies learning experiences. The last 15 minutes of each lecture was dedicated to reflection. During this time a class brainstorming session was used to answer three questions:

1. What did you learn in this lecture?
2. What happened during the lecture to help you learn?
3. How and why could you use this in your future teaching?

These specific questions were asked to provide the pre-service teachers with an opportunity to make explicit what they had learnt during the lecture, and to make explicit connections between the lectures and the secondary classroom. During these brainstorming sessions the researcher purposefully took a minimal participation role. Each week a different pre-service teacher became the facilitator, and directed the discussion while writing responses on the whiteboard. All pre-service teachers were encouraged to contribute. All responses from the whiteboard were written down at the end of the lecture.

Researcher Reflections

Researcher reflections were recorded through journaling after each lesson during the semester. These reflections sought to provide information on classroom events involving concept map approaches, how the concept maps were implemented in the classroom, and pre-service teachers' participation in creating the concept maps. The researcher also observed pre-service teachers participation and cooperation while developing the concept maps.

4.15.2 Data Analysis

Responses from the weekly class reflections was analysed by rereading all comments carefully, producing summary tables of each question, and then categorising these summaries based on common themes. Researcher reflections were analysed by re-reading reflections carefully, followed by content analysis (Cohen et al., 2005) to summarize the important events reflected in the classroom over the semester.

4.15.3 Data Coding

Data coding helps researchers to define categories and organise them into some form of order and structure (Cohen et al., 2005). Accordingly, qualitative data obtained from class reflections were coded and classified to help the researcher in interpreting the phenomenon. This interpretation allowed the researcher to create a coherent explanation or description of aspects that contributed to the social studies teaching methods course (Merriam, 1988). In this study, the researcher used a simple format of data coding with a combination of numbers and characters. For example *(CR.1.22.09.07)* reads as class reflection (CR) number 1, on 22 September 2007.

4.16 The Quality Criteria of the Study

Analysis that is meticulously done based on clearly articulated theories and which is responsive to research questions must also yield results that are meaningful to the people for whom they are intended and described in a language they understand (Denzin & Lincoln, 1998). It has been argued by Denzin and Lincoln (1998) that there is no single interpretive truth and that criteria that are used for evaluation purposes should stress the "situated, relational, and textural structures of the

ethnographic experience" (p. 30). Traditional and positivist or post-positivist research paradigms requiring validity and reliability checks are not relevant for research based around constructivism (Denzin & Lincoln, 1998). Where positivism concerns itself with validity, reliability and objectivity, the constructivist paradigm replaces these issues with credibility, dependability, confirmability and authenticity, respectively (Denzin & Lincoln, 1998). Thus, in order to satisfy questions of rigour in this research, the following review describes the criteria for judging the soundness of the qualitative data.

4.16.1 Credibility as Validity

Ascertaining validity of qualitative data involves issues of truth and correctness of a statement (Kvale, 1996) and accurate measurement as intended. Guba and Lincoln (1989) prefer to use the term 'credibility' to internal validity. For research to be credible, Cohen et al. (2005) contend that the findings must accurately describe the phenomena being researched. Merriam (1990) suggested five basic strategies to ensure internal validity: triangulation which includes using multiple data sources or multiple methods to confirm emerging findings; member checking data and interpretations with the participants; long-term observation at the research site or repeated observation of the same phenomena; peer examination where colleagues comment on the findings as they emerge; and participatory modes of research where participants are part of all phases of the study.

In this research, credibility was addressed in a way consistent with Merriam's (1990) strategies. In terms of triangulation, this study used a number of data sources and research methods, including concept maps, questionnaires, journals and interviews, class reflection, and researcher reflection. Peer examination took place through discussion with the thesis supervisor and associate supervisor, as well as with fellow doctoral students on a regular basis. This study included member checks through continued interaction with pre-service teachers that resulted in the participation of those involved in this research.

4.16.2 Transferability as External Validity

External validity is concerned with the extent to which the findings of the study can be applied to other situations (Merriam, 1998). Cohen et al. (2005) referred to external validity as the degree to which the results can be generalized to a wider population, cases or situation. Guba and Lincoln (1989) prefer to use the term transferability in preference to generalisability, as transferability requires that sufficient descriptive information is made available by the original investigator so that a person can make similar judgements in deciding to apply or transfer the findings to a new context. Strategies for improving transferability in this research include thorough descriptions of the setting, the pre-service teachers, the Social Studies Teaching Methods course, and the inclusion of extensive details of the time, place and context of the study.

4.16.3 Dependability as Reliability

Reliability is concerned with the stability of the data over time or the extent to which findings may be replicated (Guba & Lincoln, 1989; Merriam, 1998). Quantitative research assumes the possibility of replication. With the emergent nature of qualitative research or case study, the traditional meaning of reliability becomes somewhat strained when using a constructivist approach. To ensure dependable results, Merriam (1998) suggests triangulating data and method, and providing an audit trail. The use of triangulation was discussed under credibility. An audit trail, according to Guba and Lincoln (1989), is a process that is established, trackable and documentable so that the analysis of the collected data can be confirmed. This study's audit trail has been described in detail under Section 4.8 such that the data collection procedures can be followed by other researchers to carry out a similar study.

4.16.4 Confirmability as Objectivity

Guba and Lincoln (1989) proposed the concept of confirmability as a parallel notion for objectivity, which is concerned with "assuring that the data, interpretations and outcomes of inquiries are rooted in contexts and persons apart from the evaluator" (p. 243). To confirm the way in which the data were collected, this study has

developed an audit trail that traces the conversion of data into findings and demonstrates that the findings are not simply part of the researcher's imagination. Consequently, this chapter on research methodology establishes the confirmability and dependability audit so the process of data collection is clear, explicit and provides a level of detail that would enable other researchers to carry out a similar study.

4.17 Ethical Issues

This research was reviewed and given approval by Curtin University of Technology Human Research Ethics Committee (Approval Number SMEC20070044). The ethical issues of informed consent, consideration, anonymity and confidentiality, and acknowledgement were addressed in this research.

4.17.1 Informed Consent

In the first week of the semester all pre-service teachers were provided with information about the nature and methods of the research, its purpose, any risks and benefits to the participants, possible outcomes of the research, and the exercise of a voluntary choice to participate. Specifically, they were made aware that they were free to withdraw from the research at any time, without prejudice or negative consequences. No aspect of this research was used in determining their final grade for study in the Social Studies Teaching Methods course. All pre-service teachers were provided with an Information Sheet and Consent Form containing this information. A copy of these can be found in Appendix O, P and Q.

4.17.2 Consideration

During data collection, pre-service teachers had minimum disruption to their normal teaching and learning program. The use of questionnaires was spread across the semester, and each took approximately 20 minutes of their lecture time. Semi-structured interviews were performed after lectures, at a suitably negotiated time, in the meeting room of the Education Faculty.

4.17.3 Anonymity and Confidentiality

All pre-service teachers were guaranteed confidentiality and anonymity. While individual questionnaires were completed both before and after the course, only class results were used in the thesis, ensuring anonymity. Further, anonymity was guaranteed to student names, as they were de-identified through coding with number values, or the use of pseudonyms for the case studies. Thus, identifying features from the data during preparation and entry were completely removed. Access to data gathered was limited to the researcher and her supervisor.

4.17.4 Acknowledgement

All participants were personally acknowledged at the end of the Social Studies Teaching Methods course for their cooperation and contribution. The researcher informed all participants about what would happen to the data. Again all participants were acknowledged in the Acknowledgement section of this research compilation.

4.18 Summary of Chapter

This chapter dealt with the methodologies employed in this study. Critical theory and action research were adopted because the research method emphasised exploration, explanation, description and evaluation of the participants' actions. A range of data collection procedures was employed, including concept map construction, questionnaires, case studies developed through semi-structured interviews and journal keeping, class reflection, and researcher reflection. The quality criteria and ethical issues related to the study were also presented. The following two chapters present the findings of this study. Chapter 5 presents the findings from the concept maps. Chapter 6 presents the findings relating to the pre-service teachers' learning environment, attitudes, confidence, case studies and reflections.

CHAPTER 5

CONCEPT MAPS RESULTS

5.1 Introduction

In its simplest form, concept mapping is a schematic representation of meaningful relationships between concepts in the form of propositions. It allows pre-service teachers to understand how they learn and how new knowledge is constructed. This chapter presents the results of the concept maps compilation exercises. Results from the individual concept maps are presented in the first section, while the second section presents the results from the group concept maps.

5.2 Individual Concept Maps

This section provides the details of the individual pre-service teachers' pre- and post-concept maps. Overall quantitative results are presented first. These are then described in terms of the pre- and post-concept maps, being supported with qualitative results. A comparison between the pre- and post-concept maps is then made.

5.2.1 Overall Results

Pre-service teachers' pre- and post-conceptions about the social studies teaching process are summarised in Table 5.1. This table presents a statistical summary of the pre- and post-concept map means and standard deviations, along with differences between means as measured by the paired *t*-test, for all four categories: relationships, hierarchies, examples and cross-links. As shown in Table 5.1, post-concept map means were significantly higher ($p < 0.001$) than the pre-concept map means for all four categories, as well as the total score.

Table 5.1: Descriptive and Inferential Statistics of Pre-service Teachers Pre- and Post-concept Maps (N=30)

Category [a]	Pre-map			Post-map			Differences [b]
	Mean	Range	Standard Deviation	Mean	Range	Standard Deviation	t-value
Relationships	12.03	3-20	4.40	56.07	20-88	19.28	14.91***
Hierarchies	11.13	1-4	3.41	20.33	2-6	4.90	11.50***
Examples	6.47	0-14	3.65	20.70	8-34	7.60	12.94***
Cross Links	0.00	0-0	0.00	0.67	0-1	2.54	1.44***
Total Scores	**29.63**	**0-20**	**10.66**	**79.77**	**0-88**	**28.65**	**17.51*** **

Note: [a] Scoring system based upon Novak and Gowin (1984) where each relationship scores 1, hierarchy scores 5, example scores 1, and cross-link scores 10.
[b] $***p < 0.001$

These results are similar to earlier investigations of concept mapping for Wallace and Mintzes (1990), Markow and Lonning (1998), and Kaya (2008). Wallace and Mintzes (1990) examined the validity of concept maps for documenting and exploring pre-service teachers' conceptual change in biology. They used the same scoring categories used in this study, namely, relationship, levels of hierarchy, cross-links, and examples. Their results revealed significant increases in all four scoring categories as a consequence of instruction. Markow and Lonning (1998) used pre-lab and post-lab concept maps to help students understand the concepts involved in the experiments they performed in a first-year university chemistry course. Post-lab concept maps showed more valid relationships (between concepts) and examples, a more intricate hierarchical structure with more branching, and occasional cross-links between different branches of the hierarchy than pre-lab concept maps. Kaya (2008) focused on concept mapping as an authentic assessment tool in a student-centered approach to assessing and promoting pre-service science teachers' conceptual understanding. Results from this study indicated that post concept maps had more concepts, propositions, cross-links, and examples, providing greater integration and cohesiveness of knowledge, compared to the pre-concept maps.

Each concept map category used in this study is described below in detail, firstly in relation to pre-concept maps and then post-concept maps. This description is supported with various examples of pre-service teacher concept maps to highlight certain aspects.

5.2.2 Pre-concept Maps

Pre-service teachers started their Social Studies Teaching Methods unit with broad but limited superficial knowledge of concepts. This is reflected in the mean number of relationships of 12.03 (Table 5.1). The mean number of hierarchies on the pre-concept maps was 11.13, which equates to approximately 2 levels of hierarchy. Three of the pre-service teachers drew pre-concept maps with only one level of hierarchy, 19 drew pre-concept maps with two levels of hierarchy, seven drew pre-concept maps with three levels, and one pre-service teacher drew a pre-concept map with four levels of hierarchy. The mean number of examples in the pre-concept maps was 6.47 (Table 5.1) and ranged from a minimum of no examples to a maximum of 14 examples. Typical examples presented in the concept maps related to maps (political, economical, typographical or physical, climate) and types of test (oral, writing, essay, objectives, open book, or performance). There were no cross links in any pre-concept maps.

Eight major concepts and nine sub-concepts emerged in the pre-service teachers' pre-concept maps. Major concepts are general concepts at the top of a map and the sub-concepts are progressively less inclusive and more specifically ranked below the major concepts. Table 5.2 summarises these eight major concepts and their description along with seven additional major concepts that were identified in the post-concept maps. Table 5.3 summarises the occurrence of these eight major concepts along with sub-concepts and examples in the 30 pre-service teacher concept maps. The eight major concepts were Educational Means, Objectives, Teaching Methods, Evaluation, Curriculum, Textbook, Activities and Teacher. Education Means occurred in 97% of the pre-concept maps, reflecting that many pre-service teachers were aware of different equipment an approaches that could be used to teach social studies. Objectives occurred in 93% of the pre-concept maps, reflecting that many pre-service teachers were aware of the role of objectives as a key element in the teaching process. Sub-concepts of Objectives included General, Specific, Instructional, Cognitive, Affective and Psychomotor. Eighty three percent of the pre-service teachers included Teaching Methods as a major heading in their pre-concept map. Sub-concepts of Teaching Methods included Deductive and Inductive. Only 43% of the pre-service teachers identified Evaluation as a major concept in their pre-

concept map. The only sub-concept of Evaluation was Test. Curriculum, Textbook, Activities and Teacher were also identified as a major concepts, occurring in 36%, 30%, 10% and 7% of the pre-concept maps, respectively.

Table 5.2: Major Concepts that Emerged from the Pre-service Teachers' Concept Maps and their Descriptions

Major Concept	Description
Educational Means	All material, equipment or objects that are used inside the classroom
Objectives	Aims of teaching lesson
Teaching Methods	The principles and methods of instruction
Evaluation	The act of judging or assessing a student
Curriculum	The content knowledge of the social studies subject
Textbook	A book used in schools for the formal study of a subject
Activities	An educational process or procedure intended to stimulate learning through actual experience
Teacher	One who teaches, especially one hired to teach
Resources	Person, asset, material, or capital which can be used to accomplish a goal
Local Environment	The place and local surroundings where people live
Current Events	Contemporary happenings of significance
Correlations	Reveal the correlations among different social studies branches and use these correlations to help students to understand the topic
Suggested readings	Additional readings
Fusion	Social studies branches such as geography, history, and civic education is fusion in one discipline called social studies field
Integration	The knowledge is complementary unit.

Note: The first eight major concepts were identified in both pre- and post-concept maps, while the remaining seven major concepts were identified in the post-concept maps.

Table 5.3: Major Concepts and Occurrences that Emerged from the Pre-Concept Maps, along with Sub-Concepts and Examples

Major Concept	Occurrence[a]	Sub-concepts	Examples	
Educational Means	29		·TV ·Photos ·Computers ·PowerPoint ·Board ·O/H Projector ·Globes	·Graphs ·Samples ·Radio ·Maps -Political -Economical -Physical
Objectives	28	·General ·Specific ·Instructional ·Cognitive ·Affective ·Psychomotor		
Teaching Methods	25	·Deductive ·Inductive	·Lecture ·Discussion ·Problem solving ·Story	
Evaluation	13	·Test	·Oral test ·Writing test ·Objective test ·True-Flues test ·Matching test ·Essay test ·Multiple Choices test	
Curriculum	11			
Textbook	9			
Activities	3			
Teacher	2			

Note: [a] Maximum of 30 concept maps

A summary of the branching for each pre-concept map is presented in Table 5.4. This table provides a mechanism for summarizing the distribution of branching, and highlights the frequency of different branching and range of branching for each pre-concept map. It also presents the mean frequency of branching across all 30 pre-concept maps. The mean frequency presented at the bottom of Table 5.4 illustrates that there were, on average, very few single-branching (0.2), approximately one double-branching (1.2), approximately one triple-branching (0.8), approximately one quadruple-branching (0.9), approximately one five-branching (0.6), and very few six-branching (0.1) patterns for every pre-concept map.

Table 5.4: Branching Scores of Pre-Service Teachers' Pre-Concept Maps as Measured by the Scoring System Developed by the Researcher

Pre-service Teachers	Branchings (frequency)						Relationship
	1	2	3	4	5	6	
1	0	1	1	0	0	0	5
2	1	1	1	1	0	0	10
3	0	1	2	0	0	0	8
4	0	0	1	0	0	0	3
5	1	3	0	0	1	0	12
6	1	2	1	1	0	0	12
7	1	1	1	1	0	0	10
8	0	0	1	0	0	0	3
9	0	0	2	2	0	0	14
10	1	2	1	1	0	0	12
11	0	2	0	1	1	0	13
12	0	3	1	0	1	1	20
13	0	1	1	1	1	0	14
14	0	0	0	0	1	0	5
15	0	2	1	2	0	0	15
16	0	1	2	0	1	0	13
17	0	1	0	1	1	0	11
18	0	0	2	1	1	0	15
19	0	1	0	1	1	0	11
20	0	1	0	2	0	0	10
21	0	1	1	1	1	0	14
22	0	1	2	0	1	0	13
23	0	1	1	1	1	0	14
24	0	1	0	0	2	0	12
25	0	1	2	0	2	0	18
26	0	0	0	2	0	0	8
27	0	3	0	2	0	1	20
28	0	2	0	1	1	0	13
29	0	2	1	3	0	0	19
30	0	0	0	2	0	1	14
Total	5	35	25	27	17	3	361
Mean Frequency	0.2	1.2	0.8	0.9	0.6	0.1	12.03
Range	0-1	0-3	0-2	0-2	0-2	0-1	3-20

Figures 5.1 and 5.2 provide two examples of two pre-service teachers' pre-concept maps. Figure 5.1 was chosen as it represented the least number of concepts presented from all of the pre-service teachers' responses. Figure 5.2 was chosen as it represented a typical example of a pre-concept map from this study. As shown in Figure 5.1, only three relationships and three major concepts (Objectives, Curriculum and Teaching Methods) were drawn. There were no examples or cross-links. There is one hierarchy level and one triple-branching in this pre-concept map.

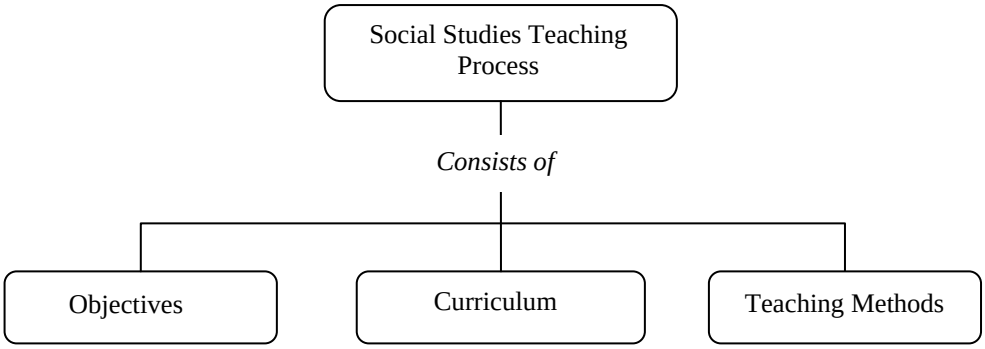


Figure 5.1 Pre-concept Map of Pre-service Teacher ID 4

In contrast, Figure 5.2 presents a pre-concept map with 13 relationships, using three major concepts (Objectives, Educational Means and Teaching Methods). This pre-concept map included two levels of hierarchy, seven examples, one double-branching, two triple-branching, and one five-branching.

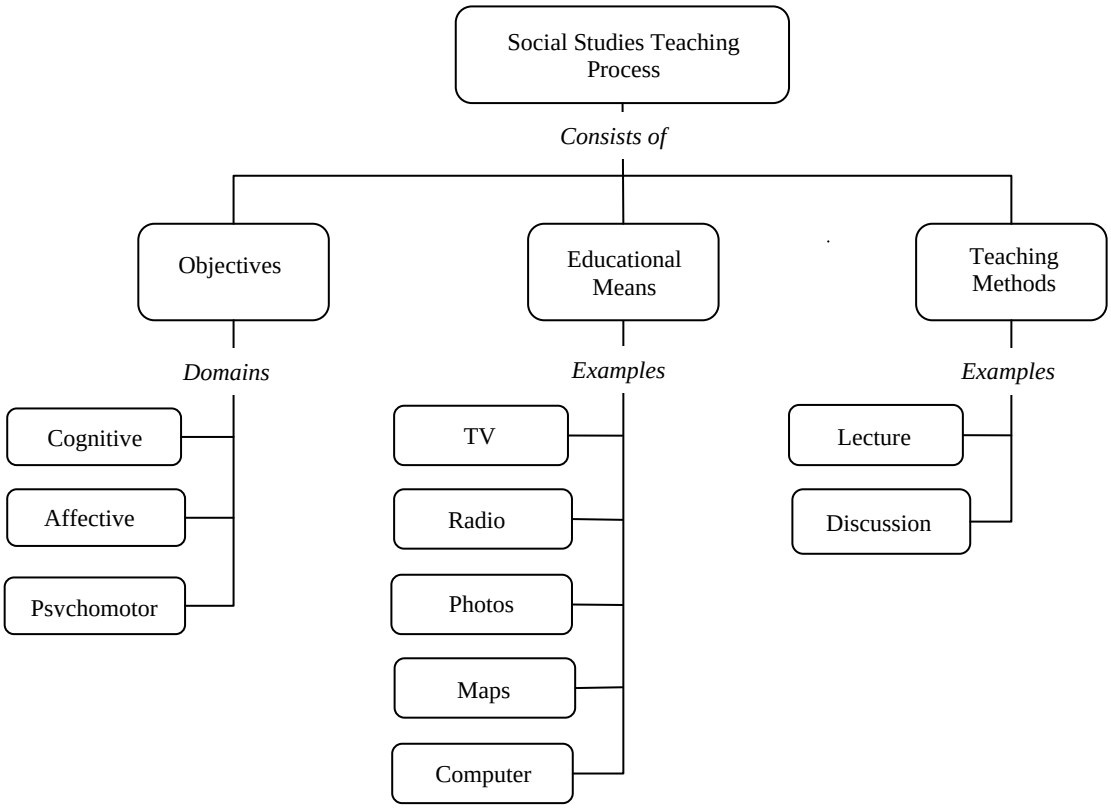


Figure 5.2 Pre-concept Map of Pre-service Teacher ID 22

5.2.3 Post-concept Maps

The post-concept maps of the pre-service teachers showed significant change on all four categories. The mean number of relationships more than tripled (from 12.03 to 56.07) as a result of instruction (Table 5.1). These findings imply a significant shift in the degree of concept differentiation and an increase in the total number of propositions. The increase in the levels of hierarchy present further evidence of progressive change in the pre-service teachers' knowledge structures. The mean number of hierarchies was 20.33, which equates to approximately four levels of hierarchy. This represents a doubling in the number of hierarchies as a result of instruction. One pre-service teacher drew 9 post-concept maps with only two levels of hierarchy, eight pre-service teachers drew post-concept maps with three levels of hierarchy, ten drew post-concept maps with four levels, eight drew post-concept maps with five levels and three pre-service teachers drew post-concept maps with six levels. The mean number of examples in the post-concept maps was 20.70 (see Table 5.1) and ranged from a minimum of eight examples to a maximum of 34 examples. The specific examples were often terminal in a line of concepts, reflecting that the post-concept maps tended to flow from general to more specific concepts. Only one cross-link was drawn in the post-concept maps.

As can be seen from Table 5.5, in addition to the eight major concepts that emerged in the pre-service teachers' pre-concept maps, another seven major concepts and 177 new sub-concepts were identified in the post-concept maps. The new major concepts were Resources, Local Environment, Current Events, Correlations, Suggested Readings, Fusion, and Integration (see Table 5.2 for a description of these concepts). Educational Means occurred in 97% of the post-concept maps. Sub-concepts of Educational Means included Audit, Visual, and Audit-visual. Objectives occurred in 90% of the post-concept maps. Nine sub-concepts of Objectives were identified: General, Specific, Instructional, Cognitive, Affective, Psychomotor, Aims, Goals, and Behavior. Likewise, 90% of the pre-service teachers included Evaluation as a major heading in their post-concept map. Sub-concepts of Evaluation included Observation, Interview, Journal, and Tests. The Curriculum occurred in 80% of the post-concept maps. Sub-concepts of Curriculum included Facts, Concepts, Values, Attitudes, Generalization, Principles, and Skills. Teaching Methods occurred in 77%

of the post-concept maps. Sub-concepts of Teaching Methods included Deductive, Inductive, and Inference. Other major concepts identified in the post-concept maps were Resources (20%), Local environment (20%), Current Events (17%), Correlation (13%), Suggested Readings (13%), Fusion (10%), Integration (7%), Activities (7%), Teacher (7%), and Textbook (7%). Sub-concepts and examples from the post-concept maps can be found in Table 5.5.

Table 5.5: Major Concepts, Description and Occurrence that Emerged from the Post-concept Maps, along with Sub-Concepts and Examples

Major Concept	Occurrence[a]	Sub-Concepts		Examples	
Educational Means	29	·Audio ·Visual ·Audio-visual		·TV ·Computers ·PowerPoint ·Concept Maps ·O/H Projector ·Maps -Political -Climate -Physical -Historical -Geological -Economical ·Representation	·Samples ·CD ·Cinema ·Board ·Atlas ·Globes ·Graphs ·Photos ·Internet ·Trips -Museums -Factories
Objectives	27	·General ·Specific ·Instructional ·Cognitive ·Affective ·Psychomotor ·Aims ·Goals ·Behaviour ·Knowledge ·Comprehension ·Application ·Analysis ·Synthesis	·Evaluation ·Receiving ·Responding ·Valuing ·Organization ·Characterized by Value ·Perception ·Set ·Guided Response ·Mechanism ·Adoption ·Origination		
Evaluation	27	·Test ·Observation ·Interview ·Journal		·Oral test ·Writing test ·Objective test ·True-Flues ·Completion ·Standardized test ·Achievement test ·Performance test ·Final test	·Ability test ·Essay test ·Matching ·Multiple Choices ·Pretest ·Posttest

Table 5.5 continued…

Curriculum	24	·Facts ·Concepts ·Values ·Attitudes ·Generalisation ·Principles ·Skills		
Teaching Methods	23	·Deductive ·Inductive ·Inference	·Instructional package ·Cooperative learning ·Dramatization ·Brainstorming ·Micro-teaching	·Lecture ·Discussion ·Problem solving ·Story
Resources	6	·Current events ·Local environment ·Suggested readings ·Textbooks		
Local Environment	6	·Natural environment ·Artificial environment ·Human environment	·Rivers ·Deserts ·Plants ·Seas ·Farmers ·University ·Policemen	·Judge ·Mayor ·Airports ·Farms ·Factories ·Banks ·Peninsula
Current Events	5	·Newspapers ·TV ·Radio ·Internet ·Magazines ·Interviews	·Effect ·Suitability ·Validity ·Newness ·Significance	
Correlation	4	·Parallel ·Successive ·Systematic correlation ·Incidental correlation		
Suggested Readings	4		·Books ·Stories ·Atlas	·Documents ·Brochures ·Articles
Fusion	3	·Fusion closed groups ·Fusion unclosed groups		
Integration	2	·Motivation		
Activities	2	·Direct ·Indirect ·Initiatory activities ·Discussion activities ·Concluding activities ·Arts & Craft activities		
Teacher	2			
Textbook	2			

Note: [a] Maximum of 30 concept maps

Table 5.6 presents a summary of the branching for each post-concept map. This table provides a mechanism for summarising the distribution of branching, and highlights

the frequency of different branching and range of branching for each pre-concept map. It also presents the mean frequency of branching across all 30 pre-concept maps. The mean frequency presented at the bottom of Table 5.6 illustrates that there were, on average, very few single-branching (0.2), approximately four-double-branchings (4.1), approximately three triple-branchings (3.5), approximately two quadruple-branchings (2.2), approximately two five-branchings (2.1), approximately one six-branching (1.4), and very few seven-branching (0.4), eight-branching (0.4), nine-branching (0.2), ten-branching (0.1), and eleven branching (0.0) patterns for each post-concept map.

Table 5.6: Descriptive of Branching Scores of Pre-service Teachers' Post-Concept Map as Measured by the Scoring System Developed by the Researcher

	Branchings (Frequency)											
Pre-service Teachers	1	2	3	4	5	6	7	8	9	10	11	Relationship
1	1	1	2	0	2	1	0	1	0	0	0	33
2	0	1	4	1	2	2	0	0	0	0	0	40
3	0	1	5	0	4	1	0	0	0	0	0	43
4	0	0	2	1	2	0	0	0	0	0	0	20
5	0	3	3	3	1	0	0	0	0	0	0	32
6	2	2	2	3	1	0	0	0	0	0	0	29
7	0	6	4	1	2	1	0	0	0	0	0	44
8	0	1	1	4	0	0	0	0	0	0	0	21
9	0	7	4	5	2	1	0	1	0	0	0	70
10	0	3	7	1	0	1	0	0	1	0	0	46
11	0	8	6	3	1	1	1	0	0	0	0	64
12	0	8	6	2	3	4	0	0	0	0	0	81
13	0	4	3	4	4	2	0	1	0	0	0	73
14	0	2	2	1	1	2	1	0	0	0	0	38
15	0	6	3	4	3	3	0	0	2	0	0	88
16	0	6	1	2	3	1	1	0	0	1	0	61
17	1	9	3	3	1	1	1	2	0	0	0	74
18	0	0	4	3	3	2	2	2	0	0	0	81
19	0	5	5	1	5	2	0	1	0	0	0	74
20	0	11	4	1	1	0	2	0	0	0	0	57
21	0	10	4	2	2	4	0	0	0	0	0	74
22	1	6	5	2	3	2	0	0	0	0	0	63
23	0	3	2	2	1	1	1	1	0	0	0	46
24	0	4	1	3	3	0	1	1	0	0	0	53
25	0	7	4	2	2	2	1	0	1	0	0	72
26	0	3	2	2	1	1	0	1	0	0	0	39
27	0	8	3	2	4	2	1	0	0	0	0	72
28	0	4	5	3	2	2	1	0	1	0	0	73
29	0	4	4	4	3	2	0	0	0	1	0	73
30	0	2	5	0	2	1	0	0	0	0	1	46
Total	5	124	106	65	64	42	13	11	5	2	1	1680
Mean frequency	0.2	4.1	3.5	2.2	2.1	1.4	0.4	0.4	0.2	0.1	0.0	56
Range	0-2	1-11	1-7	0-5	0-5	0-4	0-2	0-2	0-2	0-1	0-1	20-88

Figure 5.3 presents the post-concept map of the same pre-service teacher in Figure 5.1. This figure shows an increase in the major concepts, relationships, hierarchies, and examples compared to the pre-concept map. The post-concept map had five major concepts; in addition to Objectives, Teaching Methods and Curriculum, there was also Textbook and Educational Means. The number of relationships increased to 20. There were two hierarchy levels and eight examples. The post-concept map showed two triple-branchings, one quadruple-branching, and two five-branchings. There were no cross-links.

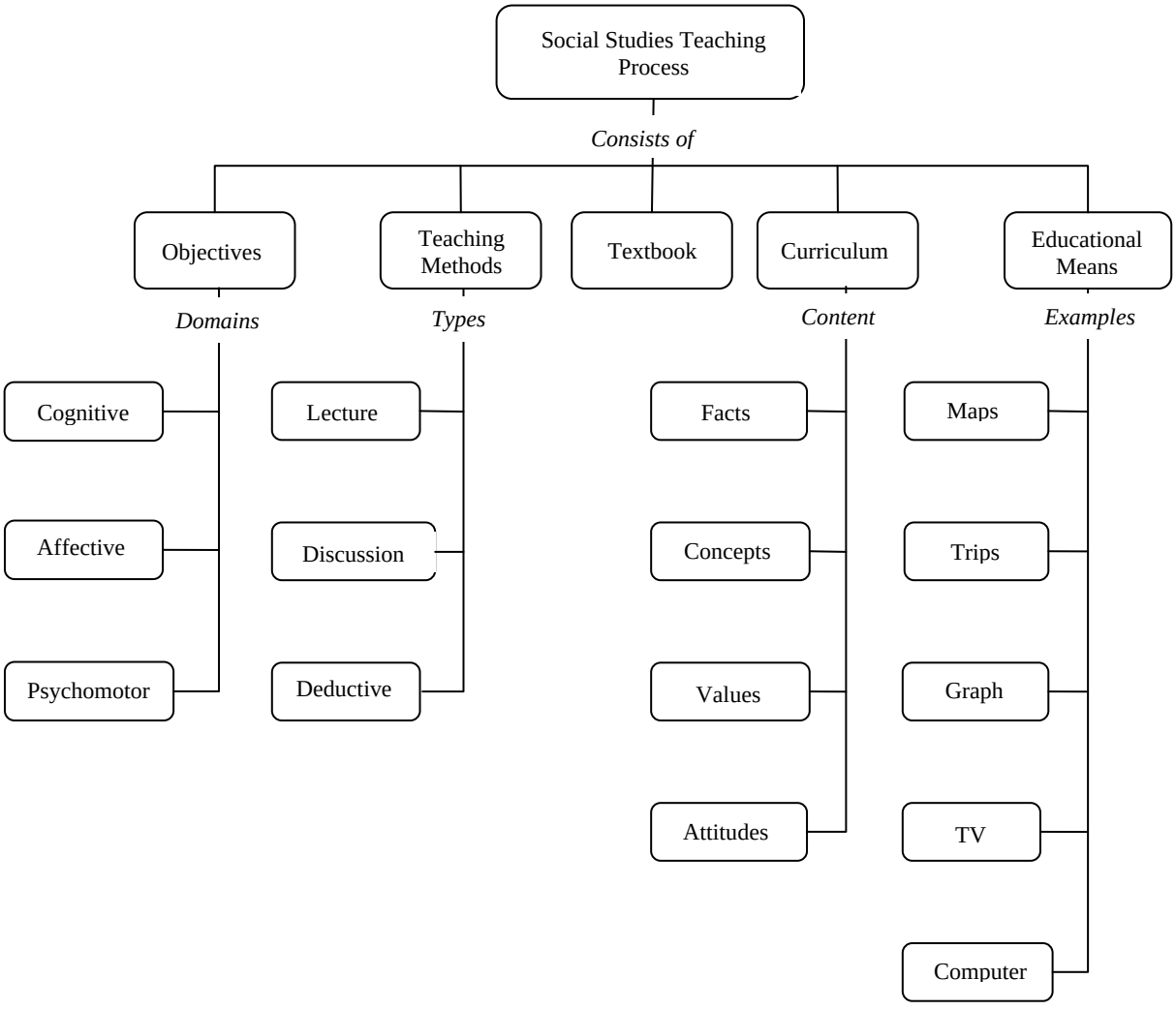


Figure 5.3: Post-Concept Map of Pre-service Teacher ID 4

Figure 5.4 shows the post-concept map of the same pre-service teacher in Figure 5.2. Pre-service teacher 22 demonstrated a large change from pre to post-concept map. This post-concept map was drawn with five major concepts; Objectives, Educational Means, Resources, Teaching Methods, and Evaluation. There were 63 relationships, five levels of hierarchies, and 24 examples. The post-concept map had one single-branching, six double-branching, five triple-branching, two quadruple-branching, three five-branching, and two six-branching. There were no cross-links.

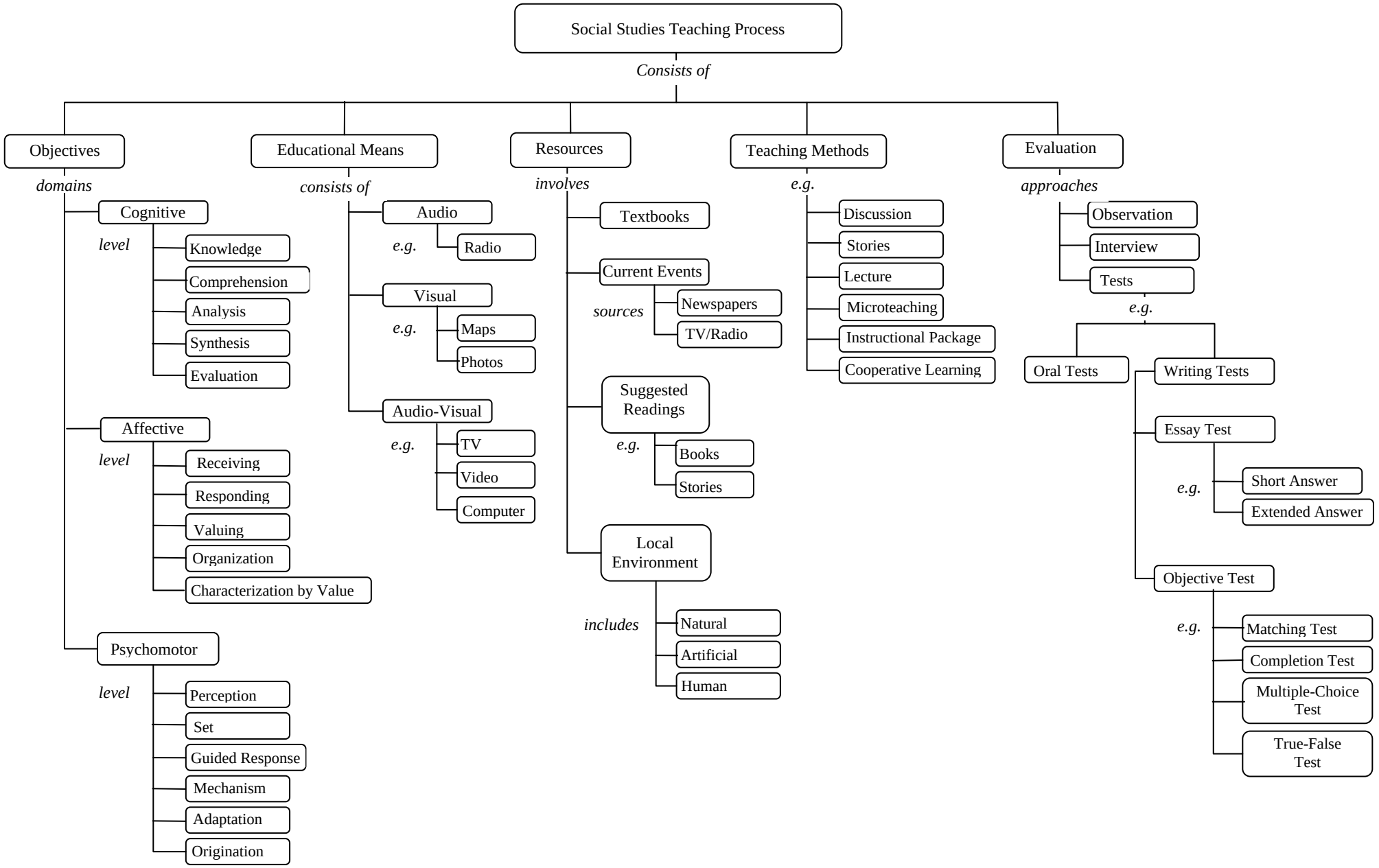
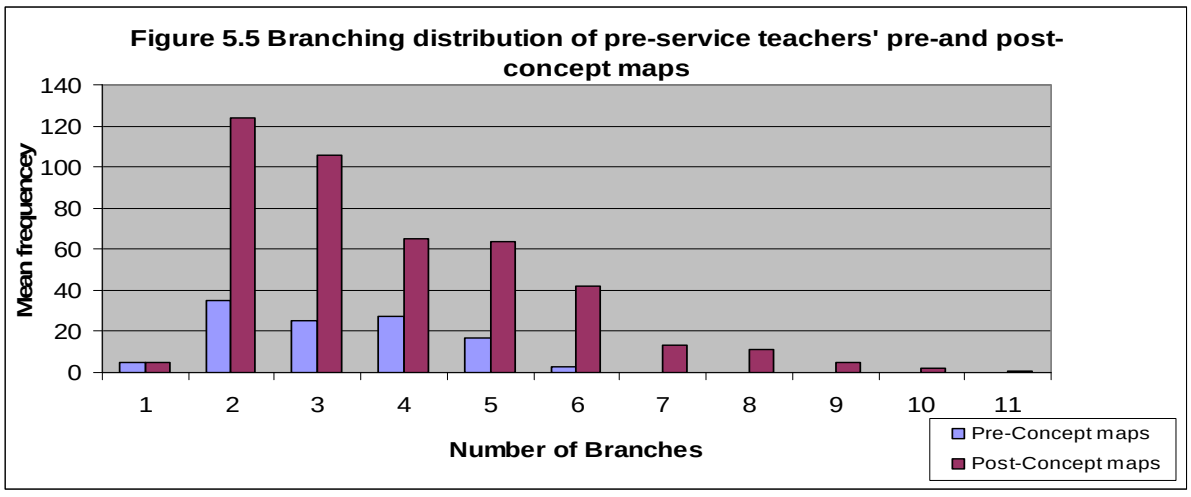


Figure 5.4: Post-Concept Map of the Pre-service Teachers ID 22

5.2.4 Comparison Between Pre and Post-concept Maps

From pre- to post-concept maps, pre-service teachers identified significantly more concepts, significantly increased the depth of their concept maps, and were able to integrate and synthesize the course content in relevant and valid ways. The post-concept maps were found to be more extensive and complex than the pre-concept maps. Post-concept maps had more concepts and relationships relating to the knowledge domain than the pre-concept maps. The total number of relationships depicted in pre-service teachers' pre-concept maps was 361, increasing to 1680 in the post-concept maps.

Large differences in the complexity of branching were found between pre- and post-concept maps. Figure 5.5 presents the branching distributions of the pre- and post-concept maps. The branching distribution for the pre-concept maps was centered around double- through to five-branchings with a small occurrence of single- and six-branchings. In contrast, the branching distribution for the post-concept maps had an increase in both mean frequency of branchings and the number of branchings (see Figure 5.5). The post-concept maps branching distribution was skewed to the right. The most frequent branches were double- through to six-, however occurrences of seven- to eleven-branchings were also present. These differences between the pre- and post-concept maps in the frequency and the number of branchings reflected the large change that had occurred in the pre-service teachers' knowledge structures. Not only had the pre-service teachers obtained more knowledge, but this knowledge was more detailed.



All pre-service teachers moved from more general pre-concept maps to post-concept maps that incorporated more information, with more hierarchical organisation and more narrative detail. Ninety percent (27 out of 30) of the pre-service teachers constructed post-concept maps that incorporated more categories than were identified on their pre-concept maps. From pre- to post- concept maps, pre-service teachers moved from general concepts about the teaching process to more specific concepts, sub-concepts and examples. This was most apparent within the major concepts of Objectives and Evaluation. Within the pre-concept maps presented in Tables 5.3, the sub-concepts of Objectives included General Objectives, Specific Objectives, Instructional Objectives, and the Cognitive, Affective, and Psychomotor domains. However, in the post-concept maps presented in Table 5.5 the pre-service teachers highlighted their new knowledge about types of objectives and the levels of their domains: Aims, Goals, Behavior, Knowledge, Comprehension, Application, Analysis, Synthesis, Evaluation, Receiving, Responding, Valuing, Organization, Characterized by Value, Perception, Set, Guided Response, Mechanism, Adoption, and Origination.

For the major concept of Evaluation, pre-concept maps had only one sub-concept map (Tests) and seven examples (Table 5.3). However, the post-concept maps demonstrated four sub-concepts (Test, Observation, Interview and Journal) along with 15 examples (Table 5.5). This increase in understanding of Evaluation is illustrated in Figure 5.6 and Figure 5.7 for the pre- and post-concept map of pre-service teacher ID 12. This pre-service teacher was chosen as they represented a typical example of increased understanding from pre- to post-concept map.

The pre-concept map in Figure 5.6 shows no sub-concepts and only four examples. The post-concept map shown in Figure 5.7 shows four sub-concepts and provides 12 examples of tests. This pre-service teacher had obtained more information and hierarchical organization of Evaluation over the semester. These results are consistent with the findings of Hay (2007). Hay's study used concept mapping to reveal patterns of student learning (or non-learning) in a Master course on research methods. The case study findings showed that the students' first map was a trivial exposition of the topic, presenting only a tenuous description of the interview

method. After instruction the students' second concept-map was much more explanatory with greater content of knowledge and better structure (Hay, 2007).

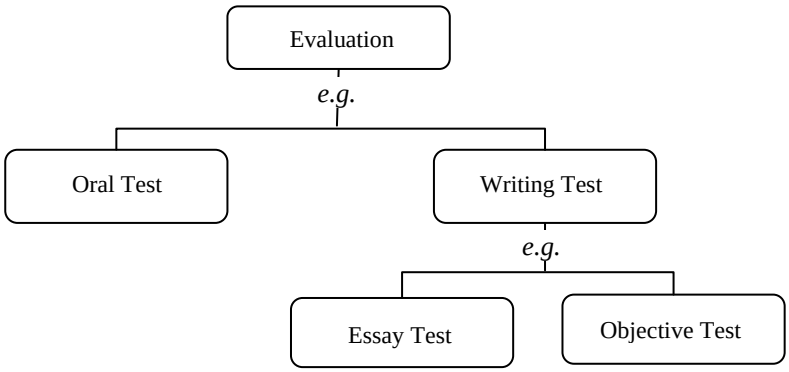


Figure 5.6: Evaluation Example from Pre-concept Map of Pre-service Teachers ID 12

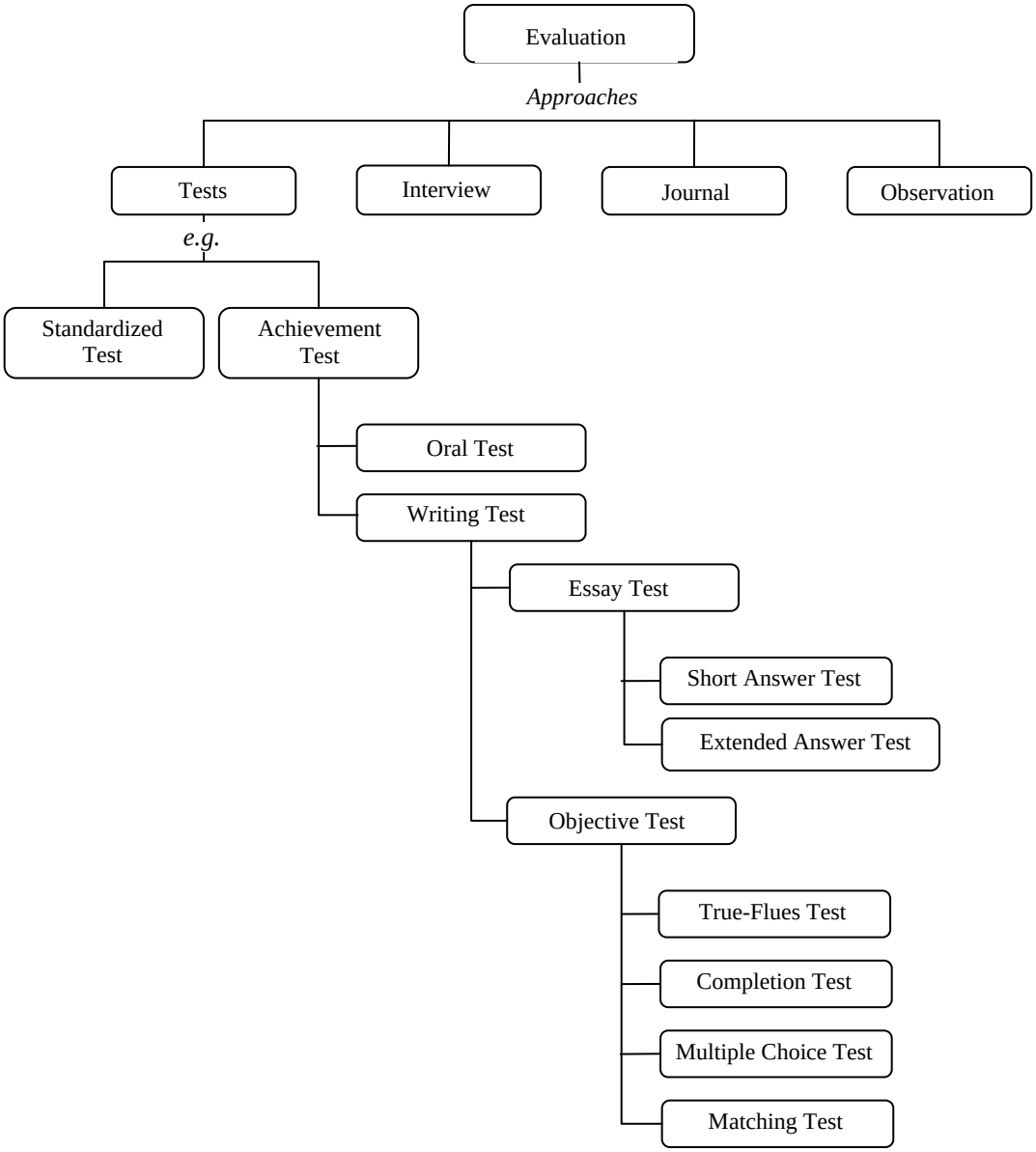


Figure 5.7: Evaluation Examples from Post-concept Map of Pre-service Teachers ID 12

In general, all participants in the study made significant advances in their repertoire of content knowledge about social studies teaching. Pre-concept maps presented broad but limited superficial knowledge of concepts. The post- concepts maps, as compared to pre- concept maps, were more clearly organised, included more abstract and inclusive organising concepts as well as more detail, and reflected more course content.

5.3 Groups' Concept Maps

This section describes the results of the quantitative and qualitative analyses of the group concept maps. Six groups each consisting of five pre-service teachers, produced three concepts maps over the Social Studies Teaching Methods course. The group concept maps were produced in Weeks 5, 9 and 11 of the semester. These are referred to as Group Concept Map 1, Group Concept Map 2 and Group Concept Map 3.

5.3.1 Overall Results

Pre-service teachers' conceptions of the social studies teaching process across time are summarised in Table 5.7. This table presents a statistical summary of the three group concept maps showing means, standard deviations and differences between means as measured by the F-test. Multivariate analysis of variance was used to examine differences in the three concept map scores across time for each of the categories relationships, hierarchies, examples, cross-links and the total score.

As shown in Table 5.7, statistically significant ($p < 0.01$) differences between group concept map means scores were found for relationships, examples, and total scores. Group Concept Map 3 had significantly more relationships and examples than Group Concept Map 2, which in turn has significantly more relationships and examples than Group Concept Map 1. As the semester progressed the pre-service teachers developed greater depth of the concept maps and moved from general concepts to more specific concepts.

No significant differences ($p > 0.05$) were found between group concept maps mean scores for hierarchies and cross-links. Approximately four levels of hierarchy were drawn by each group over the semester.

Table 5.7: Descriptive, Inferential and Comparison Statistics of Pre-service Teachers on the Developed Group Concept Maps

Category [a]	Group Concept Map 1		Group Concept Map 2		Group Concept Map 3		Differences	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	*F*-value	Eta^2
Relationships	64.50a	11.89	99.83b	14.49	140.67c	18.26	332.90***	0.99
Hierarchies	21.67a	2.58	21.67a	2.58	20.83a	2.04	1.00	0.18
Examples	25.17a	2.64	35.67b	9.31	51.00c	12.69	39.00**	0.89
Cross Links	0.00a	0.00	11.67a	16.02	18.33a	23.17	3.80	0.43
Total Scores	**110.50a**	**14.60**	**168.00b**	**31.29**	**230.00c**	**42.02**	**75.11*** **	**0.94**

Note: [a] Scoring system based upon Novak and Gowin (1984) where each relationship scores 1, hierarchy scores 5, example scores 1, and cross-link scores 10.
Means in the same row that do not share letters differ at $p < 0.01$
Six groups each consisting of five pre-service teachers
***$p < 0.001$; **$p < 0.01$

Each concept map category used in this study is described below in detail in relation to Group Concept Map 1, Group Concept Map 2 and Group Concept Map 3. This description is supported with various examples of group concept maps to highlight certain aspects.

5.3.2 Group Concept Map 1

The mean number of relationships in Group Concept Map 1 was 64.5. The mean number of hierarchies in Group Concept Map 1 was 21.67, which equates to approximately four levels of hierarchy. Groups 1 and 2 drew five level of hierarchy on their concept maps, while Groups 3, 4, 5, and 6 drew four levels of hierarchy on their concept maps. The mean number of examples in Group Concept Map 1 was 25.17 (see Table 5.7) and ranged from a minimum of 23 examples in Groups 2 and 3 to a maximum of 30 examples in Group 6. There were no cross links drawn on any concept map.

Seven major concepts and 13 sub-concepts emerged in Group Concept Map 1. Table 5.8 summarizes the seven major concepts and their occurrence across the six groups'

concept maps. The seven major concepts were Educational Means, Objectives, Teaching Methods, Evaluation, Tests, Curriculum and Textbook. Educational Means, Objectives and Teaching Methods occurred in all six group concept maps. Evaluation as a major concept was identified in four of the six group concept maps. Test, Curriculum and Textbook were identified as major concepts in two of the six group concept maps. Sub-concepts and examples from Group Concept Map 1 are presented in Table 5.8.

Table 5.8: Major Concepts, Occurrence, Sub-concepts and Examples that Emerged from Group Concept Map 1

Major Concept	Occurrence[a]	Sub-Concepts	Examples	
Educational Means	6	•Audio •Visual •Audio-visual	•Photos •Computers •PowerPoint •Trips -Museums -Factories -Libraries •Maps -Political -Economical -Population -Density -Topographical	•Graphs •Natural Sound •Radio •Cinema •O/H Projector •TV •Representation •Recorded Sound •Samples -Rock -Water -Plant -Solid
Objectives	6	•General •Instructional •Aims •Goals •Behaviour •Cognitive •Affective •Psychomotor		
Teaching Methods	6	•Deductive •Inductive	•Lecture •Discussion •Problem solving •Brainstorming •Instructional package	•Cooperative learning •Micro teaching •Story
Evaluation	4		•Oral test •Writing test •Objective test •Completion test •True-Flues •Continue evaluation	•Matching choices •Assignments •Essay test
Tests	2		•Oral test •Writing test •Essay test •Objective test	
Curriculum	2			
Textbook	2			

Note: [a] Maximum of six concept maps

A summary of the branching for Group Concept Map 1 is presented in Table 5.9. This table provides a mechanism for summarizing the distribution of branching, and highlights the frequency of different branchings and range of branching for each group. It also presents the mean frequency of branching across all six group concept maps. The mean frequency presented at the bottom of Table 5.9 illustrates that there was, on average, one single-branching (0.67), six double-branchings (6.17), three triple-branchings (2.83), two quadruple-branchings (2.00), three five-branchings (2.67), two six-branchings (2.00), one eight-branching (0.83) and very few nine-branchings (0.3) for each group concept map.

Table 5.9: Branching Scores of Group Concept Map 1 as Measured by the Scoring System Developed by the Researcher

	Branchings (Frequency)									
Group	1	2	3	4	5	6	7	8	9	Relationship
1	3	11	5	4	1	3	0	1	0	87
2	0	3	2	2	2	2	0	1	1	59
3	0	4	2	2	1	2	0	1	1	56
4	0	6	2	2	3	2	0	1	0	61
5	1	7	2	1	5	1	0	0	0	56
6	0	6	4	1	4	2	0	1	0	68
Total	4	37	17	12	16	12	0	5	2	387
Mean Frequency	0.67	6.17	2.83	2.00	2.67	2.00	0.00	0.83	0.33	64.5
Range	0-3	3-11	2-5	1-4	1-5	1-3	0-0	0-1	0-1	0-11

Figure 5.8 presents the Group Concept Map 1 of Group 6. Group 6 was chosen as it presented the greatest development over the three concept maps. As shown in Figure 5.8, 68 relationships and five major concepts (Objectives, Curriculum, Teaching Methods, Educational Means, and Evaluation) were drawn. This map included four hierarchy levels and 30 examples. It was drawn with six double-branchings, four triple-branchings, one quadruple-branching, four five-branchings, two six-branchings, and one eight-branching. There were no cross-links.

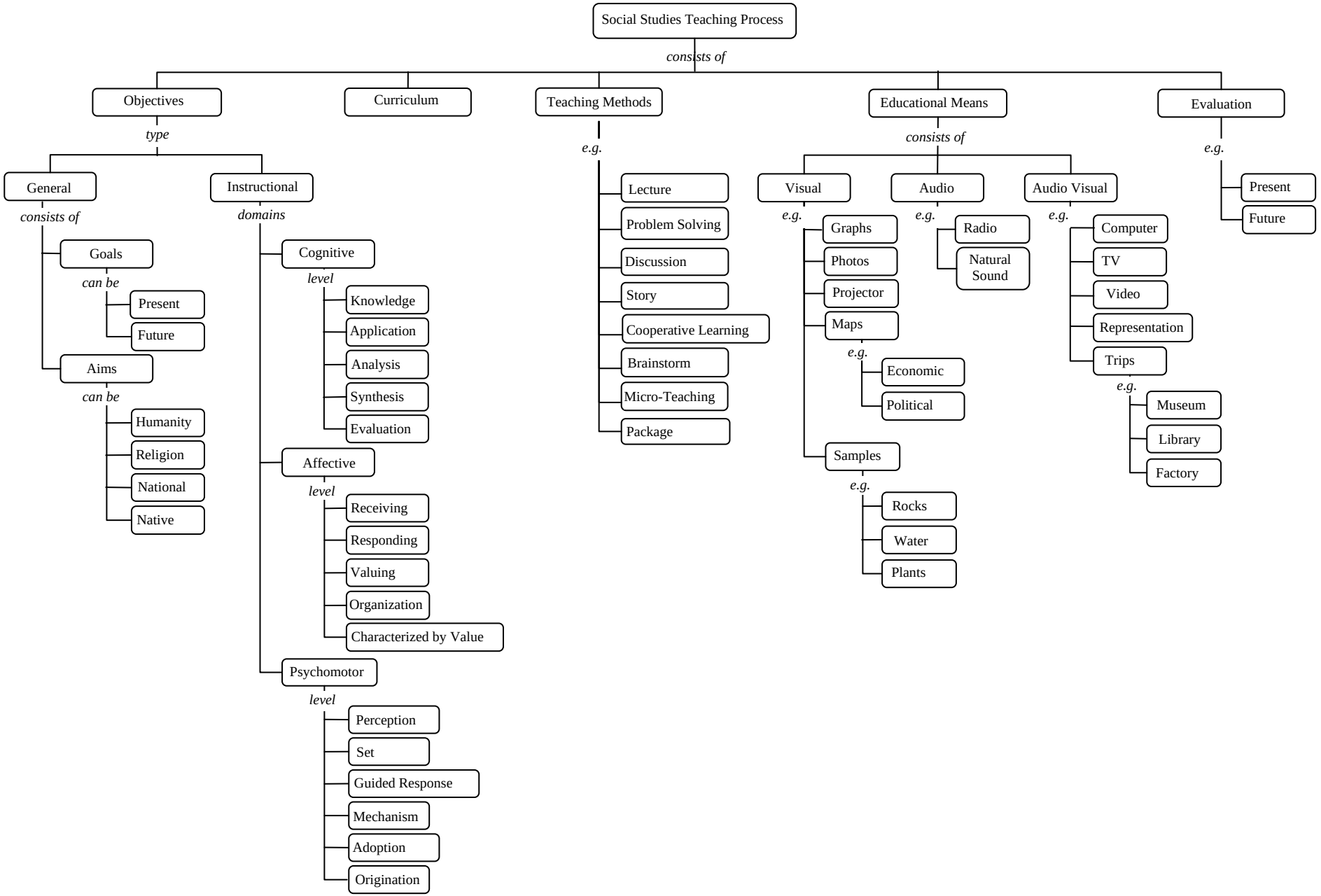


Figure 5.8. Concept Map 1 of Group 6

5.3.3 Group Concept Map 2

The number of relationships, examples and cross-links increased between the pre-service teachers drawing their first and second group concept maps. As shown in Table 5.7, the mean number of relationships for Group Concept Map 2 was approximately 100, an increase of 35 from the mean of Group Concept Map 1. This ranged from 83 in Group 5 to 118 in Group 6. Group Concept Map 2 had the same mean number of hierarchies as Group Concept Map 1, this being four levels. Groups 1 and 2 drew five levels of hierarchy, while Groups 3, 4, 5 and 6 drew four levels of hierarchy. The mean number of examples in Group Concept Map 2 was 35.67 (Table 5.7) and ranged from a minimum of 29 examples in Group 5 to a maximum of 54 examples in Group 6. The specific examples were often terminal in a line of concepts, reflecting that Group Concept Map 2 tended to flow from general to more specific concepts. While not statistically significant, a major difference between Group Concept Map 1 and Group Concept Map 2 was the number of cross-links. While no cross-links were drawn in Group Concept Map 1, the mean number of cross-links in Group Concept Map 2 was 11.67. Group 1 drew one cross-link, Group 6 drew two cross-links, and Group 4 drew four cross-links.

Five major concepts and 73 sub-concepts emerged from Group Concept Map 2. These five major concepts of Educational Means, Objectives, Teaching Methods, Evaluation and Curriculum occurred in all six groups' concept maps. Sub-concepts and examples from Group Concept Map 2 can be found in Table 5.10.

Table 5.10: Major Concepts, Occurrence, Sub-Concepts and Examples that Emerged from Group Concept Map 2

Major Concept	Occurrence[a]	Sub-concepts	Examples	
Educational Means	6	•Audio •Visual •Audio-visual	•Photos •Computers •Concept map •Trips -Museums -Factories -Libraries •Maps -Political -Economical -Climate -World -Population -Geology -Historical	•Graphs •Natural Sound •Radio •Cinema •O/H Projector •TV •Samples -Rock -Water -Plant -Solid •Representation
Objectives	6	•General •Instructional •Aims •Goals •Behaviour •Cognitive •Affective •Psychomotor		
Teaching Methods	6		•Discussion •Problem solving •Brainstorming •Instructional package	•Cooperative learning •Micro teaching •Story •Lecture
Evaluation	6		•Oral test •Writing test •Objective test •Completion test •Assignments	•Matching •Multiple choices •Essay test •True-Flues •Continue evaluation
Curriculum	6	•Facts •Concepts •Attitudes •Skills •Values •Generalisation •Principles	•Hear •See •Taste •Symbols •Words •Five Hours •Century	•Mountains •Country •Deserts •Rivers •Valley •Pollution •Seas

Note: [a] Maximum of six concept maps

A summary of the branchings for Group Concept Map 2 is presented in Table 5.11. The mean frequency illustrates that there were, on average, one single-branching (0.83), nine double-branchings (8.67), seven triple-branchings (7.00), four quadruple-branchings (4.00), three five-branchings (3.17), two six-branchings (2.50),

one seven-branching (0.67), one eight-branching (0.83) and very few nine-branchings (0.16) for each group concept map.

Table 5.11: Branching Scores of Group-Concept Map as Measured by the Scoring System Developed by the Researcher

Group	Branchings (Frequency)									Relationship
	1	2	3	4	5	6	7	8	9	
1	3	10	7	4	4	2	2	1	0	114
2	2	7	7	5	1	3	0	2	0	96
3	0	10	8	1	4	1	0	1	1	91
4	0	9	7	3	4	2	1	0	0	90
5	0	7	8	1	2	4	1	0	0	83
6	0	9	5	10	4	3	0	1	0	118
Total	5	52	42	24	19	15	4	5	1	592
Mean Frequency	0.83	8.67	7.00	4.00	3.17	2.50	0.67	0.83	0.16	98.67
Range	0-3	7-10	5-8	1-10	1-4	1-4	0-2	0-2	0-1	0-10

Figure 5.9 presents Concept Map 2 of Group 6. As shown in Figure 5.9, 118 relationships and five major concepts (Objectives, Curriculum, Teaching Methods, Educational Means, and Evaluation) were drawn. This map included four hierarchy levels and 54 examples. It was drawn with nine double-branchings, five triple-branchings, ten quadruple-branchings, four five-branchings, three six-branchings, and one eight-branching. There were two cross-links. Compared with Figure 5.8, the concept map in Figure 5.9 is more complex, branches more frequently and precisely from each major concept, and is more integrated as revealed by the presence of the cross-links.

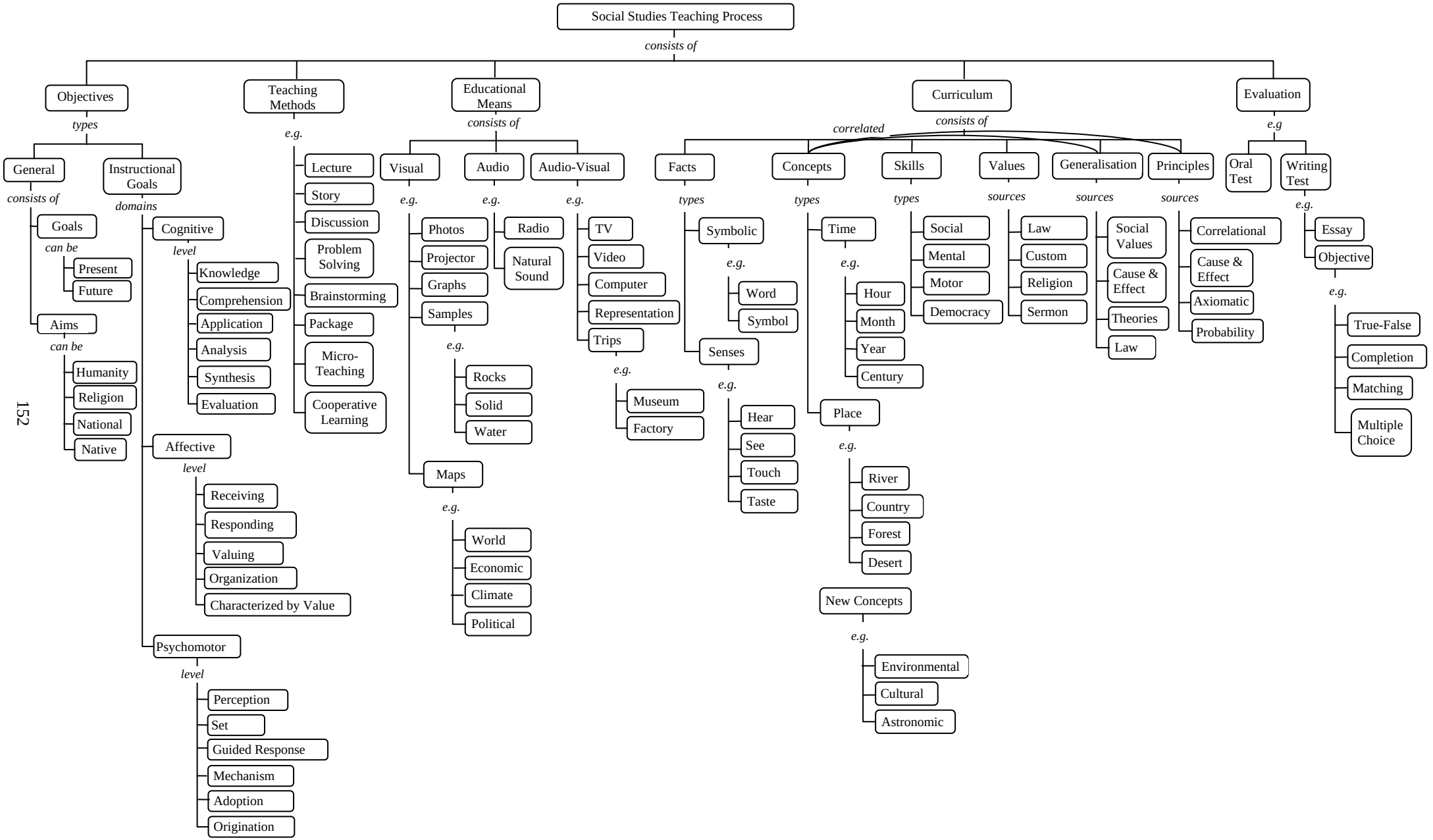


Figure 5.9: Concept Map 2 of Group 6

5.3.4 Group Concept Map 3

The third concept map for each of these six groups showed more relationships, examples and cross-links than the previous two concept maps, with the same number of hierarchies. The greater complexity associated with Group Concept Map 3 reflects the pre-service teachers' increased understanding of the social studies teaching process. As shown in Table 5.7, the mean number of relationships for Group Concept Map 3 was 140.67, an increase of 40 from Group Concept Map 2. As with Group Concept Map 2, Group Concept Map 3 had four levels of hierarchy. Groups 1, 3, 4, 5, and 6 drew four levels of hierarchies while Group 2 drew five levels. The mean number of examples in Group Concept Map 3 was 51 (Table 5.7) and ranged from a minimum of 36 examples in Group 3 to a maximum of 72 examples in Group 6. The mean number of cross-links in Group Concept Map 3 was 18.33. Groups 5 and 6 drew one cross-link, Group 1 drew three cross-links and Group 4 drew six cross-links. These cross-links reflected more in-depth thinking and broader analysis in identifying the interrelationships between concepts.

Table 5.12 shows that eight major concepts were identified from Group Concept Map 3. Across Group Concept Map 3, 99 sub-concepts were identified.

Table 5.12: Major Concepts, Occurrence, Sub-concepts and Examples that Emerged from Group Concept Map 3

Major Concept	Occurrence[a]	Sub-concepts	Examples	
Educational Means	6	•Audio •Visual •Audio-visual	•Photos •Computers •Concept map •Trips -Museums -Factories -Libraries •Maps -Political -Economical -Climate -World -Population -Geology -Historical	•Graphs •Natural Sound •Radio •Cinema •O/H Projector •TV •Samples -Rock -Water -Plant -Solid -Field •Representation •PowerPoint
Objectives	6	•General •Instructional •Aims •Goals •Behaviour •Cognitive •Affective •Psychomotor		
Teaching Methods	6		•Discussion •Problem solving •Brainstorming •Instructional package	•Cooperative learning •Micro teaching •Story •Lecture
Curriculum	6	•Facts •Concepts •Attitudes •Skills •Values •Generalisation •Principles	•Hear •See •Taste •Smell •Words •Days •Century •Symbols •Space Ship	•Mountains •Country •Deserts •Factories •Oceans •Pollution •Seas •Astronaut
Resources	6	•Current events •Local environment •Suggested readings •Effect •Suitability •Validity •Newness •Significance	•Rivers •Desert •Island •Seas •School •Hall •Valley •Books •Atlas •Stories	•Judge •Mayor •Airports •Library •Factory •Bank •University •Document •Articles •Brochures
Textbook	5	•Guide •Advice fit methods •Organise the information •Grow the skills		

Table 5.12 continued…

New Trends	4	•Correlation •Incidental correlation •Systematic correlation •Fusion •Fusion closed groups •Fusion unclosed groups •Integration		
Evaluation	4		•Oral test •Writing test •Objective test •Completion test	•Matching •Multiple choices •Essay test •True-Flues

Note: [a] Maximum of six concept maps

A summary of the branchings for Group Concept Map 3 is presented in Table 5.13. The mean frequency illustrates that there was, on average, one single-branching (0.83), eight double-branchings (8.50), nine triple-branchings (9.17), six quadruple-branchings (5.67), five five-branchings (5.50), three six-branchings (3.17), one seven-branching (1.33), one eight-branching (1.50) and very few nine and ten-branchings (0.16) for each group concept map.

Table 5.13: Branching Scores of Group Concept Map 3 as Measured by the Scoring System Developed by the Researcher

	Branchings (Frequency)										
Group	1	2	3	4	5	6	7	8	9	10	Relationship
1	1	11	11	4	3	5	4	2	0	0	161
2	1	8	10	4	6	2	1	1	0	1	130
3	0	6	4	8	4	4	0	1	1	0	117
4	1	9	9	5	8	0	3	1	0	0	135
5	1	9	11	5	5	3	0	2	0	0	131
6	0	8	10	8	7	5	0	2	0	0	159
Total	4	51	55	34	33	19	8	9	1	1	833
Mean Frequency	0.83	8.50	9.17	5.67	5.50	3.17	1.33	1.50	0.16	0.16	138.83
Range	0-1	6-11	4-11	4-8	3-8	0-5	0-4	1-2	0-1	0-1	0-11

Figure 5.10 presents Concept Map 3 of Group 6. As shown in Figure 5.10, 159 relationships and eight major concepts (Objectives, Teaching Methods, Educational Means, Resources, New Trends, Curriculum, and Evaluation) were drawn. This map

included four hierarchy levels and 72 examples. It was drawn with eight double-branchings, ten triple-branchings, eight quadruple-branchings, seven five-branchings, five six-branchings, and two eight-branchings. There was only one cross-link. Compared with Figure 5.9, the concept map in Figure 5.10 is more complex, branching more frequently and precisely from each major concept.

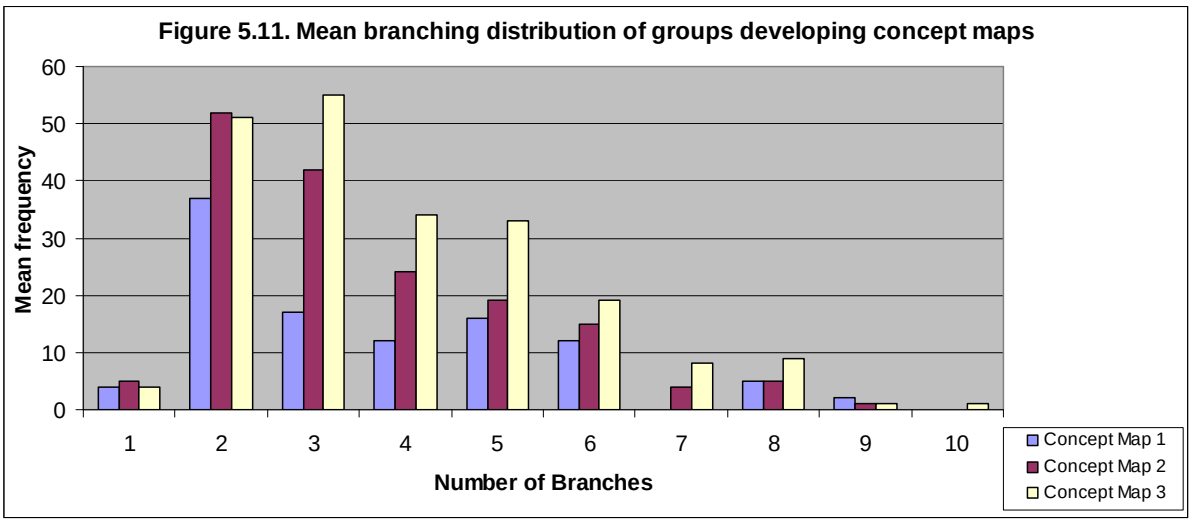
5.3.5 Development of Group Concept Maps

Analysis of the three group concept maps showed that most groups presented the relationship between concepts in a rather linear form, and there were few maps with more than two cross-links. Group Concept Maps 2 and 3 included more concepts, relationships, examples and cross-links than Group Concept Map 1, indicating that the pre-service teachers had developed both a greater knowledge of content and mapping skills as a consequence of using concept maps as an instructional tool in the Social Studies Teaching Methods course. The finding of this study is consistent with the findings from Daley et al. (1999) who investigated the effect of using concept maps as a methodology to teach and evaluate critical thinking on a culminating clinical course in a baccalaureate nursing program. Their analysis revealed that the group mean score for concept maps increased over time. The concept map scoring criteria according to Novak and Gowin (1984) has no limited scoring range; the higher the score the more comprehensive and complex the concept map. This study's findings are consistent with the literature that concept maps grow in complexity over time (e.g. Cañas et al., 2001; Chung, O'Neil, & Herl, 1999; Stoyanova & Kommers, 2002).

The information presented in Group Concept Map 1 was almost exclusively hierarchical with no cross-links. This suggests that the pre-service teachers' prior knowledge showed limited interconnections and/or they had limited skills at using the technique. Group Concept Maps 2 and 3 included more concepts and more links than Group Concept Map 1, suggesting that the pre-service teachers were more aware of interconnections. These features of the maps confirm that the pre-service teachers were making progress in developing an integrated understanding of the social studies teaching process. More specifically, Group Concept Maps 2 and 3 showed that the pre-service teachers were aware of the fundamental concepts being presented in the Social Studies Teaching Methods course. The pre-service teachers' performance was quite diverse in analysing and organising concepts at various levels of hierarchy and in connecting different information among various topics of the social studies teaching process.

Changes from Group Concept Map 1 to Group Concept Map 3 reflect growth in the pre-service teachers' conceptual knowledge of teaching social studies across time as well as increased mapping skills. Compared to Group Concept Map 1, Group Concept Maps 2 and 3 were more integrated, contained a greater number of connections, and were more logically constructed. However, most were very weak in showing cross-links. As the course progressed, the number of relationships included in the concept maps nearly doubled in all group maps. The maximum number of relationships in Group Concept Map 1 was 87 (Group 1), while the maximum number of relationships in Group Concept Map 2 and 3 was 120 (Group 6) and 164 (Group 1), respectively. The development of map complexity from Group Concept Map 1 to Group Concept Map 3 can also be seen in the number of branchings.

Figure 5.11 presents the branching distributions of the Group Concept Map 1, 2, and 3. The branching distribution for Group Concept Map 1 was centered around double-through to six-branchings, with a small occurrence of single-, eight- and nine-branchings. There was no occurrence of seven- branchings. In contrast, the branching distribution for the Group Concept Maps 2 had an increase in both mean frequency of branchings and the number of branchings (see Figure 5.11). Group Concept Map 2 branching distribution was skewed to the right: the most frequent branches were double- through to six-, however occurrences of single- and seven- to nine-branchings were also present. The branching distribution for Group Concept Map 3 had increased in both mean frequency of branchings and the number of branchings compared with each of Group Concept Maps 1 and 2. Group Concept Map 3 branching distribution was also skewed to the right: the most frequent branches were double- through to eight-, however occurrences of single-, nine- and ten-branchings were also present. These differences between Group Concept Map 1 to 3 in the frequency and the numbers of branching reflected the large change that had occurred in the pre-service teachers' knowledge structures.



The number of hierarchies did not change over time. This may be due to the pre-service teachers focusing on the overall organization of their maps. Group 6 produced the maximum number of examples for each map: 30, 54 and 72 for Group Concept Maps 1, 2 and 3, respectively. From Map 1 to Map 3, all pre-service teachers' groups moved from more general to more integrated information and more narrative detail. These findings are consistent with a similar study by Jones and Vesilind (1996) with pre-service teachers enrolled in a middle-grade teacher education program. The pre-service teachers drew concept maps on effective teaching at four different times: the beginning of the course (Map 1), twice during the course (Map 2 and Map 3), and at the end of the course (Map 4). The concept maps were scored based on Novak and Gowin (1984) scoring system. Multivariate analysis of variance was used to examine the difference in the four maps across time. The number of relationships and cross-links was found to increase from Map 1 to Map 4. The number of hierarchies did not change over time. The number of examples decreased from Map 1 to Map 4. Several pre-service teachers indicated during their Map 3 and 4 interviews that they focused more on the overall organisation of their maps and omitted specific examples of some concepts) Jones & Vesilind, 1996).

In general, the group concept maps showed that the construction of knowledge was enhanced over time. The findings of these group concept maps support the previous findings of the individual concept maps. These findings present evidence that concept mapping activities as instructional techniques are compatible with

constructivism where the pre-service teachers construct or reconstruct their conceptual framework, as expressed in concept maps. The findings also support that these pre-service teachers constructed new knowledge from the experiences in the Social Studies Teaching Methods classes which they consciously integrated with their prior knowledge.

5.4 Summary of Chapter

This chapter presented quantitative and qualitative results of the individual and group concept maps. The result from the individual concept maps showed that from pre- to post-concept maps, pre-service teachers identified significantly more concepts, significantly increased the depth of their concept maps, and were able to integrate and synthesize the course content in relevant and valid ways. The group concept maps showed that the construction of knowledge was enhanced over time and when the pre-service teachers worked in collaboration. Analysis of the three group concept maps showed that Group Concept Maps 2 and 3 included more concepts, relationships, examples and cross-links than Group Concept Map 1, indicating that the pre-service teachers had developed both a greater understanding of content and mapping skills as a consequence of using the concept map as an instructional tool in the Social Studies Teaching Methods course.

The following chapter presents the remaining results of this research: analysis learning environment, attitudes and confidence, case studies and reflection. The results reflect the change in the pre-service teachers' perception of teaching social studies as a consequence of using concept maps as a teaching and learning strategy in the Social Studies Teaching Methods course.

CHAPTER 6

LEARNING ENVIRONMENT, ATTITUDES, CONFIDENCE AND REFLECTION RESULTS

6.1 Introduction

The instruments used for collecting quantitative data in this study consisted of the modified *Constructivist Learning Environment Survey* (CLES), the *Test of Social Studies-Related Attitudes* (TOSSRA), and the *Social Studies Teacher Efficacy Belief Instrument* (SSTEBI-B) questionnaire. These three questionnaires were given to all 30 pre-service teachers at the beginning (pre-test) and end (post-test) of the semester to determine their change in perception of learning environment, attitudes towards social studies, and confidence to teach social studies as a consequence of using concept maps as a teaching strategy in the Social Studies Teaching Methods course. Qualitative data presented in this chapter consists of the case studies for three pre-service teachers, along with class and researcher reflections.

This chapter consists of five main sections. Section 6.2 reports validity and reliability of the three instruments used in this study. Section 6.3 presents descriptive and inferential statistics for the three instruments. Associations between the learning environment, attitude and confidence are presented in Section 6.4. Section 6.5 reports the three case studies along with a cross-case analysis. Class and researcher reflections are presented in Section 6.6. The chapter concludes with a summary.

6.2 Validity and Reliability of the Instruments

Internal consistency reliability was used to measure the extent to which the items within each scale were similar to one another in content. The Cronbach alpha coefficient was used as the index of scale internal consistency. The discriminant validity was calculated to check whether each scale measured a distinct construct. The mean correlation of a scale with other scales was the convenient index used to

determine discriminant validity. For all instruments the individual was used as the unit of analysis.

6.2.1 Constructivist Learning Environment Survey (CLES)

The CLES was developed in 1991 to help researchers and teachers assess the degree to which the learning environment within a science or mathematics classroom is consistent with a constructivist epistemology (Fraser, 1998b). Small and large-scale studies established that the CLES was highly valid and reliable (Taylor et al., 1997). The CLES works well when translated into a foreign language, as evidenced by studies conducted in the Republic of Korea where it was translated into Korean (Cho, Yager, Park & Seo, 1997; Lee, 2001) and Taiwan where it was translated into Mandarin (Aldridge et al., 2000). In the present study, this questionnaire was translated into Arabic to accommodate the language needs of the participants and modified to address the Social Studies focus of this research.

Table 6.1 presents that the Cronbach alpha coefficient and mean correlation for the five scales of CLES. The results for Cronbach alpha ranged from 0.71 to 0.87 in the pre-test and from 0.83 to 0.88 in the post-test. Mean correlation values ranged from 0.13 to 0.21 (pre-test) and from 0.06 to 0.14 (post-test). These results suggest that the modified Arabic version of CLES is both valid and reliable.

Table 6.1: Internal Consistency Reliability (Cronbach Alpha Coefficient) and Discriminant Validity (Mean Correlation with Other Scales) for Pre-Test and Post-Test of the Modified CLES scales (N=30)

Scale	Alpha Reliability		Mean Correlation with other Scales	
	Pre-test	Post-test	Pre-test	Post-test
Personal Relevance	0.82	0.83	0.21	0.12
Uncertainty	0.71	0.83	0.18	0.14
Critical Voice	0.76	0.85	0.21	0.13
Shared Control	0.87	0.88	0.13	0.06
Student Negotiation	0.72	0.88	0.14	0.12

6.2.2 Test of Social Studies-Related Attitudes (TOSSRA)

The TOSRA was originally validated with secondary school students (Allen & Fraser, 2002). The TOSRA has been translated into Chinese and Indonesian, and both language versions were found to be highly reliable when used with students above the elementary school level (Adolphe et al., 2003; Margianti, Fraser & Aldridge, 2002). In the present study, this questionnaire was translated into Arabic and modified to address the Social Studies focus of this research.

Table 6.2 shows that the Cronbach alpha coefficient of different TOSSRA scales were high, ranging from 0.62 to 0.87 in the pre-test and from 0.80 to 0.87 in the post-test. These results suggest that the Arabic version of the modified TOSSRA is as reliable as its English counterpart, and that the TOSSRA works well when translated into Arabic. As shown in Table 6.2, the pre-test mean correlation ranged from 0.22 to 0.57, while the post-test mean correlation ranged from 0.17 to 0.36. These intercorrelation coefficients show that raw scores on TOSSRA scales are reasonably distinct, but somewhat overlapping.

Table 6.2: Internal Consistency Reliability (Cronbach Alpha Coefficient) and Discriminant Validity (Mean Correlation with Other Scales) for Pre-test and Post-test of TOSSRA Scales (N=30)

Scale	Alpha Reliability		Mean Correlation with other Scales	
	Pre-test	Post-test	Pre-test	Post-test
Adoption of Social Studies Attitude	0.62	0.80	0.22	0.17
Enjoyment of Social Studies Lessons	0.87	0.87	0.57	0.20
Career Interest in Social Studies	0.83	0.85	0.49	0.36

6.2.3 Social Studies Teacher Efficacy Belief Instrument (SSTEBI-B)

High reliability and validity have been previously established for pre-service and in-service versions of the STEBI-B scale for elementary science teachers (Enochs &

Riggs, 1990; Riggs & Enochs, 1990). In the present study, this questionnaire was translated into Arabic and modified to address the Social Studies focus of this research. Table 6.3 shows that the Cronbach alpha coefficient of different SSTEBI-B scales were high, ranging from 0.79 to 0.85 in the pre-test and from 0.85 to 0.87 in the post-test. These results suggest that the Arabic version of the modified SSTEBI-B is as reliable as its English counterpart, and that the SSTEBI-B works well when translated into Arabic. As shown in Table 6.3, the pre-test mean correlation was 0.12, while the post-test mean correlation was 0.06. These intercorrelation coefficients show that raw scores on SSTEBI-B scales are reasonably distinct.

Table 6.3 Internal Consistency Reliability (Cronbach Alpha Coefficient) and Discriminant Validity (Correlation with Other Scales) for Pre-test and Post-test of SSTEBI-B Scales (N=30)

Scale	Alpha Reliability		Correlation with other Scales	
	Pre-test	Post-test	Pre-test	Post-test
Personal Social Studies Efficacy (PSSTE)	0.85	0.87	0.12	0.06
Social Studies Teaching Outcome Expectancy (SSTOE)	0.79	0.85	0.12	0.06

6.2.4 Summary

Overall, the validation process of CLES, TOSSRA and SSTEBI-B consisted of calculating both internal consistency reliability (as measured by Cronbach's alpha coefficient) and discriminant validity (as measured by the mean correlation coefficient). CLES, TOSSRA and SSTEBI-B were found to have high reliability and acceptable validity even after translation and modifications.

6.3 Descriptive and Inferential Statistics for the Instruments

Differences between the pre- and post-test for each of the three instruments are reported in this section.

6.3.1 Pre-service Teachers' Perception of the Learning Environment

Pre-service teachers' perception of the social studies learning environment was assessed using the Arabic version of the modified CLES. Five scales were used to measure CLES: Personal Relevance, Uncertainty, Critical Voice, Shared Control, and Student Negotiation. Table 6.4 shows the means, standard deviation, *t* test and effect sizes for all five scales of modified CLES. As shown in Table 6.4, for all five scales, the pre-test mean values indicated a slightly negative perception of the learning environment (where a rating of 3 is considered neutral). Personal Relevance had the highest mean (2.77), while Critical Voice had the lowest mean (2.33). In contrast, post-test mean values showed a positive perception of the learning environment, with Personal Relevance having the highest mean (4.35) and Critical Voice the lowest mean (4.08).

Table 6.4: Descriptive and Inferential Statistics of Pre-service Teachers' Learning Environment Scales on the Pre-test and Post-test as Measured by the Modified CLES (N=30)

Scale	No. of Items	Pre-test		Post-test		Differences	
		Mean	Standard Deviation	Mean	Standard Deviation	t-value	Effect Size
Personal Relevance	6	2.77	0.57	4.35	0.64	9.67***	2.61
Uncertainty	5	2.55	0.42	4.09	0.52	12.77***	3.29
Critical Voice	6	2.33	0.40	4.08	0.53	15.70***	3.73
Shared Control	6	2.44	0.58	4.12	0.55	12.25***	2.97
Student Negotiation	6	2.62	0.39	4.23	0.52	14.44***	3.50

***$p < 0.001$

For all five scales of CLES the post-test mean was significantly larger ($p < 0.001$) than the pre-test mean. Using concept maps as part of the teaching and learning process, the pre-service teachers' perceived their learning environment had become more personally relevant to them, they had a greater critical voice, and there was more shared control and greater student negotiation. They also acknowledged the evolving nature of social studies.

Wanpen and Fisher (2004) reported large positive changes for all five CLES scales in their study on undergraduate students' perceptions of their computer classroom in north-eastern Thailand. The differences between the pre-test and post-test means for the Wanpen and Fisher (2004) research ranged from 0.40 to 0.60. Notably, the differences between the pre-test and post-test means in the current study ranged from 1.58 to 1.75. Pre-test values were lower and post-test values were higher in the current study than for the Wanpen and Fisher (2004) study.

6.3.2 Pre-service Teachers' Attitudes Towards Social Studies

Pre-service teachers' attitudes toward social studies were assessed using TOSSRA. This questionnaire explored pre-service teachers' attitudes on three scales: Adoption of Social Studies Attitudes, Enjoyment of Social Studies Lessons, and Career Interest in Social Studies.

Table 6.5 shows the means, standard deviation, *t* test, and effect sizes for all three scales of TOSSRA. In the pre-test, Adoption of Social Studies Attitudes had the lowest mean (2.45), while Enjoyment of Social Studies Lessons had the highest mean (3.28). In the post-test, Career Interest in Social Studies had the highest mean (4.43) with Adoption of Social Studies Attitudes having the lowest mean (4.28). Significant differences ($p < 0.001$) were found between pre- and post-test means for all three scales of the TOSSRA (see Table 6.5), with the largest difference in Adoption of Social Studies Attitudes. Using concept maps as part of the teaching and learning process has resulted in the pre-service teachers having better attitudes toward social studies, enjoyment in their lectures, and career interest in social studies.

The mean TOSSRA values reported in Table 6.5 are higher than those from other studies that have utilised a modified TOSRA. Howitt (2007), in her study on pre-service teachers in a science methods course, reported increased mean values of Attitudes to Scientific Inquiry from 4.1 to 4.2 and Enjoyment of Science workshops from 3.9 to 4.1. Adoption of Science Workshops Attitudes did not change, remaining at 4.1. The differences between the pre-test and post-test means in the current study ranged from 1.09 (Enjoyment of Social Studies Lessons) to 1.83 (Adoption of Social

Studies Attitudes). Pre-test values were lower, and post-test values were higher, in the current study as compared to the results from Howitt (2007).

Table 6.5: Descriptive and Inferential Statistics of Pre-Service Teachers Attitude Scales on the Pre-test and Post-test as Measured by the Modified TOSSRA (N=30)

Scale	No. of Items	Pre-test		Post-test		Differences	
		Mean	Standard Deviation	Mean	Standard Deviation	t-value	Effect Size
Adoption of Social Studies Attitude	10	2.45	0.29	4.28	0.36	22.65***	5.63
Enjoyment of Social Studies Lessons	10	3.28	0.68	4.37	0.42	7.05***	1.93
Career Interest in Social Studies	10	3.13	0.68	4.43	0.41	11.01***	2.32

***$p < 0.001$

6.3.3 Pre-Service Teachers' Confidence to Teach Social Studies

To explore the pre-service teachers' confidence to teach Social Studies, SSTEBI-B was used. This questionnaire has two scales: Personal Social Studies Efficacy (PSSTE) and Social Studies Teaching Outcome Expectancy (SSTOE). Table 6.6 reports the mean, standard deviation, *t* test, and effect sizes result for both SSTEBI-B scales. Significant differences ($p < 0.001$) were found between the pre- and post-test means for both scales (see Table 6.6). As shown in Table 6.6 the mean pre-test score for PSSTE was 3.13 and 4.40 in the post-test. This indicates that pre-service teachers have quite strong personal beliefs in their own efficacy as social studies teachers as a consequence of completing the course. A similar result was produced for the SSTOE. The mean score for Outcome Expectancy was 2.68 in the pre-test and 4.28 in the post-test. This result suggests that the pre-service teachers had a reasonability high expectation of the outcomes of social studies teaching at the end of the Social Studies Teaching Methods course.

Table 6.6: Descriptive and Inferential Statistics of Pre-Service Teachers Self Efficacy Scales on the Pre-test and Post-test as Measured by SSTEBI-B (N=30)

Scale	No. of Items	Pre-test		Post-test		Differences	
		Mean	Standard Deviation	Mean	Standard Deviation	t-value	Effect Size
Personal Social Studies Efficacy (PSSTE)	13	3.13	0.54	4.40	0.31	10.37***	2.89
Social Studies Teaching Outcome Expectancy (SSTOE)	10	2.68	0.50	4.28	0.45	13.76***	3.36

***$p < 0.001$

The increases in SSTEBI-B reported in Table 6.6 are higher than those from other studies reported in the literature. Huinker and Madison (1997), in their study on pre-service teachers across a science methods course, found PSTE increased from 3.6 to 4.0 for one cohort, and 3.7 to 4.0 for a second cohort, while STOE increased from 3.4 to 3.7 for one cohort, and 3.6 to 3.8 for the second cohort. Palmer (2006), also working with pre-service teachers' over a science methods course, obtained increases from 3.2 to 4.1 for PSTE and from 3.4 to 3.8 for STOE. Similarly, Howitt (2007) obtained increases from 3.6 to 3.8 for PSTE and from 3.4 to 3.6 for STOE, with pre-service teachers over a science methods course.

The differences between the pre-test and post-test means in the current study ranged from 1.27 for PSSTE to 1.60 for SSTOE. Pre-test values were lower, and post-test values were higher in the current study as compared with results from Huinker and Madison (1997), Palmer (2006) and Howitt (2007).

6.3.4 Summary

As a consequences of using concept maps as a teaching and learning strategy in the Social Studies Teaching Methods course, the pre-service teachers developed more positive perceptions of their learning environment, improved their attitudes towards social studies and confidence to teach social studies. For all three instruments there were large differences between pre- and post-test means generally in the order of 1 to

1.5 points on the 5-point likert scale. For all three instruments pre-test means were lower and post-test means were higher than those reported in the literature.

This large difference is likely due to the concept mapping approach used in this study contrasting simultaneously with traditional Saudi teaching methods. Such a traditional approach generally involves formal lectures, limited class discussion, little questioning, and restricted engagement in interactive learning. Students are expected to listen and accept the explanation of the teacher. The pre-service teachers' perception of such an approach is reflected in the low pre-test values given in each of the three questionnaires. In contrast, the pre-service teachers' perception of using concept maps in the classroom appeared to be the opposite, and is reflected in their high post-test values. This large difference is further supported in the case studies presented in Section 6.5.

6.4 Associations Between Learning Environment, Attitude and Confidence

Pre-service teachers' associations between learning environment, attitudes and confidence were obtained with simple correlations between CLES, TOSSRA and SSTEBI-B. Very few significant correlations were obtained between the CLES scales and the TOSSRA scales. Table 6.7 shows that a statistically significant ($p < 0.05$) correlation existed between Personal Relevance and Adoption of Social Studies Attitudes (0.431) and between Critical Voice and Career Interest in Social Studies (-0.426). Improving the social studies learning environment does not appear to directly improve attitudes towards social studies.

Table 6.7: Correlation Coefficients Between Scales of the Modified CLES and the TOSSRA (N=30)

Scale	Adoption of Social Studies Attitudes		Enjoyment of Social Studies Lessons		Career Interest in Social Studies	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Personal Relevance	0.431*	0.060	0.302	-0.110	0.342	0.036
Uncertainty	-0.198	-0.234	-0.191	0.183	-0.273	-0.221
Critical Voice	-0.055	-0.033	-0.329	0.181	-0.426*	-0.076
Shared Control	0.332	-0.052	0.149	-0.308	-0.023	-0.228
Student Negotiation	-0.045	-0.091	-0.011	0.101	0.113	-0.211

Note: *Correlation is significant at the 0.05 level

Very few significant correlations were obtained between the modified CLES scales and the SSTEBI-B scales. Table 6.8 shows statistically significant ($p < 0.05$) correlations between PSSTE and Personal Relevance (0.371) and PSSTE and Critical Voice (-0.413). Improving the social studies learning environment does not appear to directly impact on the confidence to teach social studies.

Table 6.8: Correlation Coefficients Between Scales of the Modified CLES and the SSTEBI-B (N=30)

Scale	Personal Social Studies Efficacy (PSSTE)		Social Studies Teaching Outcome Expectancy(SSTOE)	
	Pre-test	Post-test	Pre-test	Post-test
Personal Relevance	0.371*	0.081	0.207	-0.003
Uncertainty	-0.054	-0.233	0.117	-0.074
Critical Voice	-0.413*	0.222	-0.020	0.217
Shared Control	-0.274	0.060	0.010	-0.096
Student Negotiation	0.342	0.218	-0.094	-0.154

*Correlation is significant at the 0.05 level

Very few significant correlations were obtained between the TOSSRA scales and the SSTEBI-B scales. Table 6.9 show a statistically significant ($p < 0.01$) correlation between Career Interest in Social Studies and PSSTE (0.588) and a statistically significant ($p < 0.05$) correlation between Enjoyment of Social Studies Lessons and PSSTE (0.441). There appears to be limited direct relationship between pre-service teachers' attitudes and confidence.

Table 6.9: Correlation Coefficients Between Scales of the TOSSRA and the SSTEBI-B (N=30)

Scale	Personal Social Studies Efficacy (PSSTE)		Social Studies Teaching Outcome Expectancy(SSTOE)	
	Pre-test	Post-test	Pre-test	Post-test
Adoption Social Studies Attitude	0.189	-0.219	-0.062	0.207
Enjoyment of Social Studies Lessons	0.441*	0.353	0.048	-0.119
Career Interest in Social Studies	0.588**	-0.032	0.095	0.309

Note: **Correlation is significant at the 0.01 level, *Correlation is significant at the 0.05 level

These results indicate very few significant associations between the three instruments. This result is different to other studies such as Martin-Dunlop and Fraser (2007) and Howitt (2007). Martin-Dunlop and Fraser (2007) found the correlations between pre-service teacher attitudes and learning environment was positive and statistically significant. Howitt (2007) also found a positive and significant correlation between pre-service teachers' attitudes and confidence. The non significant correlations in this study may be due to the low sample size (only 30 participants), which in turn resulted in a narrow range of responses to the questionnaires.

6.5 Results of Case Studies

This section presents the case studies of Omniah, Eba and Jury as they learnt about teaching social studies. Each case study is presented separately, and then followed with a cross case analysis. Information for these case studies came from three interviews (Interview 1, 2 or 3) and four journals (Pre-journals and Journal 1, 2 or 3).

6.5.1 Omniah

Omniah is a Geography student in the final year of her Bachelor degree. She enjoyed Geography because it gave her an insight into the relationships between people and the environment which surrounds them. Omniah believed that the purpose of teaching social studies was to prepare people to become socially critical and responsible. She expressed her disappointment at the teaching methods used in schools, where there was an emphasis on 'chalk and talk'. Omniah considered these "boring teaching approaches that are used in the school now. Just the teacher talking and the students writing down the notes from the board" (Pre-journal). While still developing her own teaching philosophy, Omniah would like to see more participation of students in their learning and freedom to express their own opinions. Before studying this course she knew very little about teaching Social Studies. Omniah had never heard of concept maps before this unit (Pre-journal).

From the beginning of the course Omniah held positive views regarding the use of concept maps for learning and the concept mapping activities. She found concept maps to be a "simple, easy, efficient way to learn Social Studies teaching methods. It makes concepts clearer and much easier to understand" (Interview 1). The use of concept maps "made me think and made me link the concepts together visually" (Interview 1). Omniah found concept mapping to be an "effective way to learn where everyone in the class could participate" (Interview 2). Omniah realised that constructing concept maps in groups provided many opportunities for pre-service teachers to engage in teaching methods discourse. The atmosphere during the collaborative concept mapping allowed the pre-service teachers to question each other, and ask for clarification. As Omniah explained, "the best thing about concept mapping is that I am in a group. I feel more comfortable when asking for explanations, I can speak freely" (Interview 2). Omniah also expressed her appreciation that this course provided her with an opportunity to hear and discuss alternative points of view. She found this assisted her learning immensely; "this course gave us an opportunity to hear others' views particularly when establishing concept hierarchies" (Interview 3).

In the first weeks of the semester Omniah expressed some concern regarding construction of the concept maps. "It is quite difficult. I need to think carefully about how to link the concepts together. The cross-links need deep understanding and much discussion with peers and the lecturer" (Interview 1). "I still face some difficulty in drawing the cross-links between some concepts. It needs more concentration and time, especially when I am constructing individual concept map … I found it easier when working within a group" (Interview 3).

Omniah recognised the use of concept maps as an efficient teaching strategy. Consequently, she decided to use them in her first practicum at secondary school. She indicated that she would use this strategy to support students' learning:

> "I thought that I would use this with my students because it makes students use their brain in the class. It is a good way of introducing a topic and getting the students' initial ideas and responses. It showed

me their misconceptions, so that I can address these in my teaching." (Journal 1)

Because of her lack of experience with concept maps, Omniah found it difficult to implement them into the classroom "Trying to implement concept maps in the class was difficult. I needed to manage class time, guide the students to explore their concepts and facilitate them in constructing the concept maps. I hope my skills in applying this new strategy improve over time" (Journal 1).

Omniah became more confident using concept maps in the classroom with experience. "I feel more confident in my teaching with concept maps this week. I had more experience from this [Social Studies Teaching Methods] course. I also tried to model the lecturer and the way she implemented concept maps in the course" (Journal 2). Omniah recognised the potential of concept maps as a teaching strategy, especially within her future teaching. "I really wanted to apply this new strategy. It helped me to evaluate student learning. I felt more comfortable with it over time. I will continue to use this teaching strategy in my future career as a teacher" (Journal 3).

The first time she used concept maps in class, Omniah noted the students spent a lot of time constructing them as they were a totally new concept. "They seemed a little bit nervous about how to construct the concept maps and how to arrange their concepts in hierarchical ways. They did not have enough skills" (Journal 1). After three classes the students showed more interest and were more comfortable using and constructing the maps. "They showed more enjoyment with constructing the concept maps. They liked the way that it summarized the topic and organised their knowledge" (Journal 2). Over time, Omniah noted that the students "had more skills to draw the concept maps and organise the concepts in a meaningful way, but they still had difficulty making cross-links and linking the concept together with a suitable label" (Journal 3).

6.5.2 Eba

Eba is a History student in the final year of her Bachelor degree. She was fond of history because it linked the past events with the present. History, from her point of view, was learning about past human civilisations and how these can influence our present life. Eba found History's teaching approach to be very traditionalist, where teachers focused on students copying notes from the board and textbooks. In her future teaching, Eba wanted to use discussion and debating of issues relating to current affairs. Like Omniah, Eba had never heard of concept map before this course (Pre-journal).

Eba recognised the major advantage of concept maps was their ability to organise ideas and concepts. "Concept map helped me to organise my ideas onto paper" (Interview 1). She found that concept maps were a "great way to get ideas and concepts together" (Interview 2). Eba considered the concept map to be a helpful tool for revision and memorising content before an exam. "Concept maps are useful to have as a revision tool before the exam" (Interview 3). She felt that the concept map was a helpful method for developing her understanding of the topic. "It is a helpful method to develop a more in-depth understanding of a topic. Concept maps helped me to understand the interrelationships with concepts" (Interview 3). As a learner, Eba expressed surprise at the value of the maps as a different way to learn. "It was a new way to learn for me, and I enjoyed it. Using concept maps should be continued in the future" (Interview 3). She also found "working in small groups to construct concept maps is so good for bringing key points together in the discussion" (Interview 1). Eba also found working in small groups to be an effective way to exchange ideas. "Working in small groups is more interesting, we can exchange ideas, and we can correct our wrong concepts or links together. We learn together and from each other" (Interview 3).

Eba believed the major limitation of the concept maps was "the time needed to construct the maps as they took up most of the classroom time" (Interview 1). She also had problems organising concepts. "The arrangement of concepts in a meaningful order was difficult when constructing the maps" (Interview 2). By the third interview Eba thought she had "gained more skills in constructing the concept

maps. The list of the main concepts and discussions within groups made drawing the concept map in a hierarchical way easier" (Interview 3)

As Eba explained, she found concept mapping to be an excellent teaching and learning strategy. However, she decided not to use concept maps in her teaching practicum until she had a better understanding and more experience with them. "I believe that concept maps are a very important tool for learning and I will try to use [concept maps] with my students in secondary school in the future. For now, I don't have enough experience" (Journal 1). After four weeks of using the concept maps in the Social Studies Teaching Methods course, Eba felt confident enough to use them on her practicum.

> "I used the concept map as a teaching tool this week in my class. I was a little nervous in the beginning, but then I had more confidence with this new strategy of teaching. I found the students' perceptions very good. They seemed to like it. I will continue using this strategy in more classes." (Journal 2)

Eba emphasised in her third journal that her students enjoyed this type of teaching. She found her class to be more active and motivated when using concept maps. "They enjoyed developing the concept maps. I found concept maps a useful way to draw connections between concepts to gain understanding of a topic" (Journal 3). Eba found there was more discourse in her class when using the concept maps. "Using this strategy made my class more active and all students motivated to participate in discussion and development of the concept maps" (Journal 3).

The major problem Eba expressed in her practicum was large class size. "In the classroom there were 39 students. I found it difficult to divide them into smaller groups to construct the concept maps together, and there was insufficient space in the class. So, I let my students make individual concept maps although it took more time from the class" (Journal 2). Eba also reported time as a limitation in her using concept maps in the class.

> "In the first class, I could not manage class time. The students spent all the class time drawing the concept maps. In the next classes, I tried to avoid this problem by facilitating construction of the concept map to the students through explaining the steps of drawing the concept map and illustrating the relationships between the concepts, and made more clarifications around the topic. I am succeeding. But I still think that this strategy needs good skills in managing class time and I need more practice. It is not easy." (Journal 3)

6.5.3 Jury

Jury is a Geography student in the final year of her Bachelor degree. She found the knowledge of how mountains, seas, oceans and rivers formed to be the most interesting aspects of Geography. As a future teacher, Jury wants all students to be provided with meaningful learning that connects their knowledge with the real world. Jury had never heard of concept maps before this course (Pre-journal).

Jury found that concept maps helped her to learn. "Learning from [the] concept map was helpful. I found it easier for me to understand the relationship between different concepts… It is a good way to integrate ideas together" (Interview 2). She considered concept maps an effective tool to "look at the topic in a bigger picture" (Interview 3). Jury pointed out that the list of concepts that the lecturer provided was very helpful. "The list of concepts forced us to start to look for relationships" (Interview 1). She also recognised the important role of working in small groups. "I felt that our active involvement in connecting concepts and the visual nature of the concept maps made it easier for me to understand and remember the concepts of the Social Studies Teaching Methods course" (Interview 2). Jury found the group discussion gave her opportunity to talk and express her ideas as well as helping other pre-service teachers. "This way is great. We all had a chance of talking and presenting our ideas and we can help other pre-service teachers who don't really understand" (Interview 3).

Jury considered the greatest difficulty with concept maps was with constructing the link words. She commented on this at two interviews. "The hard time was trying to

find the perfect link word to connect two ideas together" (Interview 1). "Trying to choose a word related to two concepts is the difficult part in constructing the concept map" (Interview 2). But Jury felt this difficulty reduced as time passed and she had more skills and was more familiar with the process of constructing concept maps. "After I followed the lecturer's steps in constructing concept maps, I felt that choosing a suitable link word became easier. My skills to construct the concept map were enhanced over time" (Interview 3). She found sometimes that the map was too complex, containing too many concepts, and became difficult to understand. "Sometimes the map is very confusing because it is too large, contains many concepts and the lines go everywhere" (Interview 3).

Jury expressed her enjoyment in this class and her feelings when she was more involved through discussions. The sharing of ideas to construct concept maps prompted her to use them with her students on practicum.

> "This class is very wonderful and enjoyable because we are given a chance to share opinions and discuss the key concepts of the topic before constructing the concept map. I will use this strategy in my practicum next week." (Journal 1)

After two weeks of using concept maps in the Social Studies Teaching Methods course, Jury wrote the following.

> "I thought at the beginning it will be easy using this strategy [in school] but when I used it in the classroom the first time I faced many problems. The first one was the big number of students in the class. Changing the shape of the desk arrangement took time. Each group's discussions made the classroom noisy because the students were not familiar with this type of learning. I spent a lot of time trying to make the class quiet." (Journal 2)

After using concept map in a few classes Jury noted changes in the class. "This week, I felt students were quieter, more engaged in theirs groups, every one wanted

to participate in constructing the concept map, and they were trying hard to connect the concepts together" (Journal 3).

Jury believed that her students were enjoying this new way of learning.

> "I found my students had more enjoyment, and more interaction with me and their peers. They worked in a friendly atmosphere trying to construct the concept maps and connect the concepts by the most suitable link. Each of them listened to other viewpoints in trying to draw the concept maps." (Journal 3)

She revealed that if the student puts in enough time the concept map will be valuable. Jury thought that motivation and time were important aspects in constructing the concept maps.

> "I think that time is very important in constructing good concept maps. Students need more time to construct the maps. I think teacher help is necessary during the construction of the map when there is limited time…the teacher should facilitate to help students to connect the concepts by giving more explanations and examples…she must work to motivate them to construct the relationships and concepts by questions and discussion." (Journal 3)

Jury's confidence in using concept maps improved with each class she taught. "In the first class I was less confident because it was the first time, but then my confidence increased from class to class" (Journal 2). "This new strategy helped me to improve my self-confidence in managing the class discussion and developed a good relationship with my students" (Journal 3).

6.5.4 Cross Case Analysis

In these case studies, the three pre-service teachers found concept mapping to be a helpful teaching and learning strategy. Omniah, Eba, and Jury generally felt that concept mapping was a good way of dealing with the subject matter presented by the

textbook, to make sense of the material in the topic, or to organise the concepts of a topic into a meaningful whole. As such, concept maps have become for Eba a legitimate way of preparing for tests and examinations. The three pre-service teachers felt that they could easily remember the visual aspects of a concept map that aided them in generating the relationships of concepts and thus their meaning.

All three case studies provided clear evidence for the importance of constructing concept map in groups. They identified concept mapping as a tool that provides opportunities for engaging in collaborative construction of knowledge and negotiation of meaning. The emphasis on justifying, explaining, and elaborating of their own views assisted the pre-service teachers in understanding their own ideas and constructing concept maps. Previous studies using concept maps have reported that the interactions with others became the predominant feature of the learning environment (Roth & Roychoudhury, 1992, 1993a; Fischer et al., 2002; Khamesan & Hammond, 2004). From the pre-service teachers' perspective, concept mapping became a tool for bringing them together to construct and negotiate their understandings. In this way, concept maps are tools that structure learners' interactions and their learning. While the rationale for establishing concept maps as a teaching and learning strategy was that learning occurs through the reflection on the structure of the field (Novak & Gowin, 1984), a collaborative environment enabled dialogue and communication to take place in the classroom. The pre-service teachers in this research gained support and confidence from working through various stages with their peers. They were able to discuss the differences and similarities in their concept maps. Developing concept maps through group work created an environment that facilitated more discussion and supported the active learning. The use of concept maps assisted learners to obtain the 'big picture' with regard to the topic by helping them to establish connections between concepts.

All three case studies reported the difficultly students faced when constructing concept maps. Specifically, propositions, cross-links, organisation, and making connections were considered the most difficult aspects of developing concept maps. The pre-service teachers suggested that more elaboration and explanation was required to help students create cross-links and appropriate labels. The primary benefit of concept mapping is to allow students to articulate or construct connections

or links among the various concepts they are learning for any particular topic. Articulating these connections is designed to enhance the memory of the students by attaching the concepts to learning that has taken place in the past as well. Connection also serves to establish a more intact structure for new learning (Battle et al., 2003). Previous studies reported that students often comment that it is hard to add linking words onto the lines of their concept map (Novak & Cañas, 2006). This is because they have a poor understanding of the relationship between the concepts, or the meanings of the concepts, and it is the linking words that specify this relationship. This process involves what Bloom (1956) identified as high levels of cognitive performance, namely evaluation and synthesis of knowledge. Concept mapping can be an effective strategy to encourage high levels of cognitive performance, when the process is done well.

Omniah, Eba, and Jury were enthusiastic about using concept maps as a teaching strategy in their practicum. However, they all faced substantial barriers in this process. Their lack of experience with concept maps was considered a significant barrier to using them. However, as they became more familiar with using concept maps over the period of the course, their confidence and their ability to use them increased. In order to use concept maps effectively, the pre-service teachers needed to become familiar with their use and learn about the theory underlying concept mapping.

Omniah, Eba, and Jury identified the time students needed to construct the concept map within the classroom as another limitation. They observed in their practicum that the students spent a long time trying to construct the maps. This claim is supported by research that found students' most frequent complaint regarding concept mapping to be the time it takes to create a quality concept map (Bolte, 1999a). According to Elhelou (1997, p. 316) "the only cost to the teacher is the time required to generate a master map, which can be used indefinitely for instruction and testing". Markow and Lonning (1998) found that the time involved for the one credit earned may have limited students' motivation to construct more complex concept maps. Classroom teachers may realise some time savings during guided practice. Producing maps under the guidance and facilitation of the teacher, as a means to

organise and elaborate course content, can help students learn the material (Novak & Gowin, 1984) while they are acquiring concept mapping skills.

Eba and Jury reported the large number of students in the classroom as a further limitation of using concept map as a teaching strategy. They found there was insufficient space in the classroom to suitability arrange the students' desks to facilitate their discussions and construction of the concept maps in small groups. Also, they found it took time to rearrange large classes into small groups, and then return the class to the normal arrangement for the next class. In dealing with this limitation, Eba decided to let students do individual concept maps and have a whole class discussion. Jury found her students were not familiar with this new teaching approach. In their discussion, the students spoke loudly and made a lot of noise in the classroom. This problem reduced in the following classes as the students became more familiar with this style of discussion and cooperation.

Omniah, Eba and Jury all found that their secondary students had developed positive attitudes towards working with concept maps. The students enjoyed this approach and became more involved in their learning process. These three case studies revealed that the use of concept maps made learning more meaningful for the students, developed more engagement and discourse in the class, and helped them reinterpret their subject matter.

Overall, Omniah, Eba and Jury found the use of concept maps to be an effective teaching and learning strategy. More importantly, they found the interaction between/among learners to be an important source of idea generation and knowledge construction in a collaborative learning situation.

6.6 Reflection

Class reflections and researcher's reflections are presented in this section.

6.6.1 Class Reflections

Class reflection (CR) took place in the last 15 minutes in each of the 10 lectures. The reflection was used to guide the pre-service teachers in constructing and reconstructing their underlying ideas about teaching social studies. Results obtained from this class reflection are presented in three parts related to each of the three questions that were asked: What did you learn in this lecture?, What happened during the lecture to help you learn?, and How and why would you use this information in your future teaching?

What did you learn in this lecture?

The comments from this question were classified into two categories, on the basis of whether they were related to content or pedagogy. A range of examples are presented below, each indicating the lecture and date of the quote.

Content

The pre-service teachers' comments tended to reflect the content of the topic studied in the same lecture. For example, in the first lecture on instructional objectives the pre-service teachers reflections centered around objectives.

> The social studies objectives are necessary to plan the curriculum. (CR 1, 22.09.07)
> Writing behavior objectives according to Bloom's Taxonomy of instructional objectives. (CR 1, 22.09.07)

In the fourth and fifth lectures relating to curriculum, the pre-service teachers' reflections on what they learned tended to relate to curriculum.

> The curriculum content of the Social Studies is anchored by facts, values, and attitudes. (CR 4, 20.10.07)
> The concepts, generalization and skills are the main content of the Social Studies curriculum. (CR 5, 27.10.07)

In the lecture on using local environment, events and contemporary issues in social studies teaching, the comments tended to relate to the local environment, events and contemporary issues.

> The current events and local environment is considered the main sources of social studies curriculum. (CR 8, 17.11.07)
> The suitability and validity are the most important criteria to choose the current events in teaching social studies. (CR 8, 17.11.07)

The last lecture, the pre-service teachers' comments reflected the lecture on evaluation of social studies.

> There are various producers to evaluate student's performance. (CR 10, 01.12.07)
> The tests are the most common evaluation approaches. (CR 10, 01.12.07)

Pedagogy

The pre-service teachers' comments in the class reflection revealed various teaching strategies. Comments from this question were summarised for each lecture and classified into common themes. Table 6.10 provides a summary of the identified teaching strategies across the 10 lectures. As this was a class reflection a tick table was used to summarise these results. Each teaching strategy is discussed below, and supported with quotes.

Table 6.10: Teaching Strategies the Pre-service Teachers Identified as Learning During the 10 Lectures

Teaching Strategies	Lecture Number									
	1	2	3	4	5	6	7	8	9	10
Concept Maps	√	√	√	√	√	√	√	√	√	√
Cooperative Learning	√	√	√	√	√	√	√	√	√	√
Constructivism	√	√		√	√			√	√	√
Construct Knowledge		√	√	√		√	√		√	
Teacher Role			√		√	√		√		√
Engagement	√	√				√	√	√		
Active Learning			√	√						√

Concept maps as a tool to explore students' prior knowledge was identified in all 10 lectures. The pre-service teachers found that concept maps used as a teaching strategy was important to organize student knowledge.

> The concept maps used to explore students' prior knowledge. (CR 1, 22.09.07)
> The concept map as teaching tool allowed time for students to think and construct knowledge collaboratively. (CR 3, 06.10.07)
> Helpful method to develop a more in depth perspective of a topic. (CR 2, 29.09.07)

Cooperative learning was also identified in all 10 lectures. The pre-service teachers commented that cooperative learning was an important strategy to help student learning and gave them opportunity to exchange their ideas freely.

> Cooperative learning groups create active learning environments in the social studies classroom. (CR 7, 10.11.07)
> In the cooperative learning groups, students exchange their ideas in a free atmosphere. (CR 2, 29.09.07)

The pre-service teachers identified the use of constructivist teaching in seven lectures.

> Effective use of constructivist teaching can change the role of teachers and students. (CR 8, 17.11.07)
> In constructivist teaching, students take the responsibility of their own learning. (CR 4, 20.10.07)

Construct knowledge was identified as useful pedagogy in six lectures. The pre-service teachers' emphasised the important role of social experiences and prior knowledge in the construction of new knowledge.

> Social experiences are important to construct the knowledge. (CR 2, 29.09.07)
> Integrating new knowledge with what was previously known. (CR 6, 02.11.07)

The teacher role in the classroom was identified in five lectures. The pre-service teachers commented on the use of concept maps as a learning strategy. They also commented on the teacher role in the classroom to be that of a facilitator for learning.

> Adopting concept mapping as an assistive learning strategy. (CR 5, 27.10.07)
> Encourage students to assume increasing responsibility for managing their own learning. (CR 10, 01.12.07)

The pre-service teachers identified student engagement in five lectures. They believed that more engagement in the lesson lead to better learning.

> Make lessons more engaging helps students learn better. (CR 1, 22.09.07)
> More engagement in lesson makes more active and motivated students, who participate more in the classroom. (CR 7, 10.11.07)

Finally, active learning as a positive strategy to enhance learning was identified in three of the 10 lectures.

> The students in the classroom will be more active learners when concept maps are used. (CR 3, 06.10.07)
> The learning was very active where every student participates in the classroom activities. (CR 10, 01.12.07)

What happened during the lecture to help you learn?

The class reflection allowed the pre-service teachers to comment on what had happened during the Social Studies Teaching Methods lectures to help them learn. Comments from this question were summarized for each lecture and classified into common themes. Table 6.11 provides a summary of the common themes across the lectures.

Table 6.11: Teaching Strategies the Pre-service Teachers Identified as Assisting in their Learning During the 10 Lectures

Teaching Strategies	Lecture Number									
	1	2	3	4	5	6	7	8	9	10
Concept Maps	√	√	√	√	√	√	√	√	√	√
Group Work	√	√	√	√	√	√	√	√	√	√
Class Discussion	√		√	√		√	√	√	√	
Time to Explore		√	√						√	√

The pre-service teachers identified the use of concept maps and group work as teaching strategies that assisted their learning in all 10 lectures. The pre-service teachers identified class discussion as helping their learning in seven lectures. Time to explore was identified as a positive teaching strategy to enhance learning in four of the lectures.

The pre-service teachers found that the use of concept maps helped their learning and organised their knowledge in interesting way. They stated that using concept maps as a teaching strategy encouraged them to use their prior knowledge to construct new knowledge. The following comments reflected the importance of using concept maps to assist the pre-service teachers' learning.

> Using concept maps helps us to organize our knowledge. (CR 1, 22.09.07)
> Using concept maps allowed to us construct new knowledge upon our prior knowledge. (CR 4, 20.10.07)
> Using concept maps in this class made our learning more enjoyable. (CR 7, 10.11.07)
> Concept maps assisted us in remembering the Social Studies Teaching Methods concepts. (CR 10, 01.12.07)

The pre-service teachers mentioned group work in all 10 lectures as a strategy that helped them in their learning. Group work helped them exchange ideas with their peers and increased the interaction between the pre-service teachers and their lecturer.

> The group work made learning in this class more free. (CR 2, 29.09.07)
> The group work encouraged us to share the knowledge. (CR 5, 27.10.07)
> In this class working in the group made the learning very active. (CR 8, 17.11.07)
> The group work allowed all pre-service teachers to work and express their opinion. (CR 9, 24.11.07)

The pre-service teachers identified class discussion as a teaching strategy that assisted their learning in seven of the 10 lectures. Class discussion provided them with confidence to talk to the whole class, exchange ideas and generate knowledge.

> Class discussion helped us to express our opinion in a free atmosphere. (CR 3, 06.10.07)
> Class discussion made us more confident to express our ideas. (CR 6, 02.11.07)
> The class discussion helped us to shape the final conclusion. (CR 7, 10.11.07)
> Class discussion helped our learning to be more active. (CR 9, 24.11.07)

Finally, in four of the 10 lectures the pre-service teachers identified time to explore as assisting their learning in this course. They believed that the time given to them to

explore their prior knowledge and to construct the concept maps was important in their learning.

> The time given to construct pre-concept maps is very useful to explore our prior knowledge. (CR 2, 29.09.07)
> Giving time in the brainstorming session is very important to identify the relevant aspects. (CR 3, 06.10.07)
> The time that the lecturer gave us to explore our prior ideas was helpful. (CR 9, 24.11.07)
> It was helpful when the lecturer gave us time to explore our ideas and draw pre-concept maps. (CR 10, 01.12.07)

How and why would you use this information in your future teaching?

The purpose of this question was to encourage the pre-service teachers to make connections between what was being presented in the lectures and how it could be used in the secondary classroom. Comments from this question were summarized for each lecture and classified into common themes. Table 6.12 provides a summary of the common themes across the lecture.

Table 6.12: Teaching Strategies across the 10 Lectures that the Pre-service Teachers Identified as Being Useful in their Future Teaching

Teaching Strategies	Lecture Number									
	1	2	3	4	5	6	7	8	9	10
Concept Maps	√	√	√	√	√	√	√	√	√	√
Small Group	√	√	√	√	√	√	√	√	√	√
Constructivist Teaching			√	√	√	√	√	√	√	√
Class Discussion	√	√	√	√			√		√	
Engagement			√		√	√		√		√
Facilitator				√	√			√		

In their responses on this question, the pre-service teachers identified concept maps to be a useful teaching strategy in their future career in all 10 lectures. They commented that they would use concept maps as a tool to explore students' prior knowledge and as an instructional tool.

> Using concept maps to explore the students' prior knowledge. (CR 1, 22.09.07)
> Using concept maps as a teaching tool. (CR 2, 29.09.07)

The pre-service teachers mentioned group work in all 10 lectures as a strategy they will be using in their future teaching.

> Applying small group work in the social studies classroom. (CR 1, 22.09.07)
> Using small group work in the future to create more cooperation between the students. (CR 8, 17.11.07)

The pre-service teachers identified the constructivist teaching approach in eight lectures as a teaching strategy they would use in the future.

> Using constructivist teaching strategies to achieve the goals of powerful social studies teaching and learning. (CR 3, 06.10.07)
> Do more constructivist activities in social studies classroom. (CR 10, 01.12.07)

The pre-service teachers identified class discussion in six lectures. They found that class discussion created more interaction between students in the social studies classroom.

> Use the class discussion to create social interaction in the social studies classroom. (CR 4, 20.10.07)
> Use class discussion to give students opportunity to express their ideas in a free atmosphere. (CR 9, 24.11.07)

The pre-service teachers' desire to actively engage students in their future teaching was mentioned in five lectures.

> Let the students engage more with one another to help them to learn. (CR 6, 02.11.07)
> Engage the students in social studies lessons. (CR 10, 01.12.07)

Finally, in three lectures the pre-service teachers mentioned that they wanted to take the role of a facilitator in their future teaching.

> My role will be a facilitator to student learning. (CR 8, 17.11.07)
> I will work to facilitate students' learning. (CR 5, 27.10.07)

All pre-service teachers' comments reflected a willingness to use the teaching strategies presented in the lectures in their future social studies teaching and learning. Many comments related to the use of concept maps that were presented in the lectures.

6.6.2 Researcher Reflection

As the lecturer-researcher within this project, I found myself in a unique position to reflect upon what was happening in my class, to the pre-service teachers and to me. Initially, the implementation of concept mapping supported many of the theoretical assertions established in the literature. After the pre-service teachers received instruction that modeled the process and completed a practice session, many of them reported that they felt comfortable with the process. I observed that the pre-service teachers used active collaboration in developing concept maps after the first week. I noticed that the construction of the pre-concept map provided the first opportunity for the pre-service teachers to focus on the important concepts of the content, and required them to examine the relationships between concepts. During the introductory instruction for each lecture, the pre-service teachers began to structure their pre-concept maps. When I used appropriate linking words to clarify relationships between concepts, some pre-service teachers made mental notes or wrote notes to themselves. In some lectures each pre-service teacher constructed an initial concept map individually, giving me feedback on the level of understanding of every pre-service teacher. During individual construction of the initial map, the pre-service teachers were able to interact using a Knowledge Soup (Cañas, Ford, Brennan, Reichherzer & Hayes, 1995; Cañas et al., 2001). This enabled pre-service teachers to share propositions, but not see each other's maps. Pre-service collaborated actively during this process. In other lectures concept maps were constructed by pre-service teachers working in small groups. In these groups I was able to pay attention to the level of participation of every pre-service teacher. In the small group work most of the pre-service teachers collaborated with a peer.

The pre-service teachers took 20 minutes to an hour to construct each concept map. Some pre-service teachers requested more time to finish their concept maps, as they had problems with drawing the maps, or spent too long discussing suitable

propositions where each member tried to justify their opinion. I encouraged the pre-service teacher to ask for assistance from other groups or from myself when they could not make a decision about a suitable proposition or link. In this manner, I encouraged the pre-service teachers to share their knowledge with other groups.

During the first three weeks of concept map construction, I noticed the pre-service teachers hesitated to express their ideas or opinions. They were worried that they would give a wrong answer or idea. Once they became familiar with this process of learning, they realised the importance of alternative views in their learning. I observed them asking their peers for explanations, and talking with members of their group in a free atmosphere. For example, one pre-service teacher indicated that during work in her group she chatted and got to know the other members in her group better. Consequently, she felt she could speak freely and without hesitation. However, there were still some pre-service teachers who were shy and had difficulty expressing their thoughts to their peers. I encouraged them to be an active member in their group. In each lecture, I would ask for their opinion and provide positive feedback when they expressed an opinion. I also highlighted the importance of individual opinion in the construction of concept maps. These processes helped the pre-service teachers to become more comfortable in expressing their personal views. Such an approach is not part of traditional Saudi teaching.

During the first three weeks of instruction, I observed that when the pre-service teachers worked in small groups to construct their concept maps the same people were in each group. I informed the pre-service teachers how important it was to change their groups around and work with different peers to obtain new ideas and confidence to express their opinion in front of new colleagues. They hesitated at the beginning; but with encouragement they worked to change their groups each week.

The pre-service teachers had a range of perceptions on the worth of the time spent concept mapping. Some of the maps were immediately or subsequently used as a basis for class discussion to emphasise the meaning of the concepts (focusing on content) and to provide immediate self-corrective feedback. Each group became competitive for their concept map to be the basis for class discussion.

I noticed that the pre-service teachers felt a sense of ownership over their personal learning and their perspective on mapping in general. They recognised the importance of constructing concept maps themselves, especially exploring links and interrelationships within the map. They avoided asking me for assistance, to prove that they could learn by themselves. I also observed that there was friendly competition between the groups to construct their concept map without asking for assistance.

A collaborative environment enabled dialogue and communication to take place in the classroom. The pre-service teachers gained support and confidence from working with their peers. They were able to discuss the differences and similarities in constructing the concept map by comparing their concept maps with other concept maps. From this, they realised that there was no one correct map and more than one model map for a concept was possible.

I noticed that the most challenging and difficult aspect of constructing a concept map for the pre-service teachers was the propositions; determining what linking phrases would clearly depict the relationship between concepts. In the second week, I observed one pre-service teacher sitting away from her group. When I asked her why she was not working with her group in constructing the concept map, she told me that she could not link the concepts together and she was very upset. In this situation, I suggested that we construct the concept map together. We took a new sheet of paper and started drawing the concept map. I explained each concept to her and how it related to other concepts. Step by step, I found her gaining confidence in herself. In the following week, I observed this same pre-service teacher working with her group and expressing her ideas freely. In order to assist the pre-service teachers to construct propositions and links, from the third lecture onwards I provided a list of concept and link phrases to use to construct the concept map. In this manner, I simplified and explained the relationships between concepts to enable the pre-service teachers to explore the appropriate propositions.

I found cross-links to be one of the most challenging aspects of concept maps for the pre-service teachers. I explained the interrelationships between concepts and encouraged the pre-service teachers to explore these interrelationships. As the

semester progressed, I found that most pre-service teachers improved their drawing of the cross links. There was detailed discussion with their peers about these interrelationships. Sometimes this discussion turned to whole class discussion to explore the interrelationships. In this case, my role was to facilitate and guide this discussion. I learned to step back and let the pre-service teachers take the lead. As a teacher, I learned to listen to the class discussion and make myself available for comment when asked.

In general, I found that most pre-service teachers developed a deeper knowledge of teaching social studies and were able to relate concepts to their prior knowledge. They were also able to convey their knowledge in an interesting way. In this course, pre-service teachers were expected to construct and reconstruct their own understandings about social studies teaching by self-articulation during class reflection. The pre-service teachers expressed the view that the learning experiences in this course were unlike anything they had experienced before. To them, learning seemed to be fun, humorous and collaborative. I observed that most of the pre-service teachers were highly motivated, participating actively in class and group discussions. They worked well in groups, encouraging and motivating each another. In this manner, they developed an interest in learning together. As a result of teaching and learning with concept maps, I noticed the pre-service teachers were more autonomous and independent in their learning, their groups became more organised and efficient, and their level of interest and commitment increased as the semester progressed.

On a personal level, I was interested in and enjoyed using concept maps as a teaching strategy. I learned to be more of a listener than a speaker. This approach is different from the traditional approach used in Saudi Arabia where the teacher does all the talking and the students just listen. I worked to create an active classroom through the use of concept maps, small group discussion, class discussion, and cooperative learning. I found this new approach to be challenging, particularly at the beginning when I had to be more active in the classroom, encourage the pre-service teachers to participate in their own learning, and provide positive interactions between myself and the pre-service teachers and between the pre-service teachers.

6.7 Summary of Chapter

This chapter has presented a range of quantitative and qualitative data from the research. After using concept maps as a teaching strategy, the pre-service teachers perceived the learning environment to be more personally relevant, they had a greater critical voice, there was more shared control, greater student negotiation, and greater acknowledgement of the evolving nature of social studies. Using concept maps as part of the teaching and learning process has assisted the pre-service teachers to develop better attitudes towards social studies, experience greater enjoyment of lessons and has enhanced pre-service teachers' career interest in social studies. The pre-service teachers had quite strong personal beliefs in their own efficacy as teachers and had a reasonably high expectation of the outcomes of social studies teaching at the end of the Social Studies Teaching Methods course.

The case studies results showed that the three pre-service teachers believed that concept mapping was an effective teaching and learning strategy in the classroom. All three case studies identified in concept mapping a tool that provided opportunities for engaging in collaborative construction of knowledge and negotiation of meaning. Omniah, Eba, and Jury were enthusiastic about using concept maps as a teaching strategy in their practicum. They revealed that the use of concept maps made learning more meaningful for their students, improved their students' understanding of social studies, and assisted in revealing student misconceptions. Omniah, Eba, and Jury generally felt that concept mapping was an effective way of dealing with the subject matter presented in the textbooks, to make sense of the material in the topic, or to organise the concepts of a topic into a meaningful whole.

In the class reflection, the pre-service teachers revealed various teaching and learning strategies they learned during lectures, such as concept mapping, cooperative learning, and constructivism. The pre-service teachers identified the use of concept maps, group work, class discussion, and time to explore, as teaching strategies that assisted in their learning in the Social Studies Teaching Methods lectures. All pre-service teachers' comments reflected a willingness to use the teaching strategies

presented in the lectures in their future social studies teaching and learning. Many comments related to the use of concept maps.

In her reflection, as a result of teaching and learning with concept maps, the researcher noticed that the pre-service teachers were more autonomous and independent in their learning, their groups became more organised and efficient, and their level of interest and commitment increased as the semester progressed.

The next chapter provides a discussion of the findings, implications and limitations of this study. Suggestions for further research are also provided.

CHAPTER 7

DISCUSSION AND CONCLUSION

7.1 Introduction

The main purpose of this thesis was to investigate the influence of using concept mapping as a teaching and learning strategy on Saudi pre-service teachers' knowledge of teaching social studies. It also investigated Saudi pre-service teachers' perceptions of their learning environment, attitudes towards social studies and confidence towards teaching social studies as a consequence of using concept maps during a Social Studies Teaching Methods course. The previous two chapters presented the results of this research. The purpose of the present chapter is to reflect on the study results and how they answer each of the four research questions; discuss the implications of the research in relation to the researcher, policy makers and lecturers; describe the limitations of the research; and provide recommendations for further research.

This chapter consists of four main sections. Section 7.2 summarises and discusses the results of this study in relation to each of four research questions proposed in Chapter 1. The implications of the results of this study are described in Section 7.3. Section 7.4 discusses the limitations of the study, while Section 7.5 contains suggestions for further research. The chapter concludes with a summary.

7.2 The Major Findings of the Study

The major findings of this study are organised around the four research questions presented throughout the study.

Research Question 1: How does the use of concept maps in a Social Studies Teaching Methods course change Saudi pre-service teachers' knowledge of teaching social studies?

This research question was answered using information from the pre- and post-individual concept maps, group concept maps, case studies, pre-service teachers' weekly class reflections and the researcher's self-reflections.

The results of the individual concept maps showed that the post-concept map mean scores were significantly higher ($p < 0.001$) than the pre-concept map mean scores for all four categories of relationships, hierarchies, examples, and cross-links, as well as the total score. The mean number of relationships was more than tripled (from 12.03 to 56.07) as a result of instruction. The mean number of hierarchies was 20.33, which equates to approximately four levels of hierarchy and represents a doubling in the number of hierarchies as a result of instruction. The mean number of examples in the post-concept maps was 20.70 and ranged from a minimum of eight examples to a maximum of 34 examples. The specific examples illustrated how the post-concept maps tended to flow from general to more specific concepts. Only one cross-link was written in the post-concept maps. Thus, from pre- to post-concept maps, pre-service teachers identified significantly more concepts, significantly increased the depth of their concept knowledge, and were able to integrate and synthesise the course content in more relevant and valid ways. The post-concept maps were found to be more extensive and complex, more clearly organised, included more abstract and inclusive organising concepts as well as more detail, and reflected more course content than the pre-concept maps.

Large differences in the complexity of branchings were found between pre- and post-concept maps. The branching distribution for the post-concept maps had an increase in both mean frequency of branching and the number of branchings. The branching differences between the pre- and post-concept maps further reflected the large changes that had occurred in the pre-service teachers' representation of their knowledge structures.

The results of the group concept maps showed that Group Concept Map 1 was almost exclusively hierarchical with no cross-links. This finding suggested that even among the concepts the pre-service teachers brought into the course there was limited awareness of interconnections. Group Concept Maps 2 and 3, in general, included more concepts and more cross-links. The appearance of cross-links in these maps suggested that the pre-service teachers were starting to see interconnections between concepts. Compared to the previous two maps, Group Concept Map 3 revealed growth in the pre-service teachers' conceptual understanding, with more integration, greater connections, greater differentiation using more precise vocabulary, and more coherent construction, although most were very weak in showing cross-links. The branching distribution for the group concept maps increased over time for both mean frequency of branching and the number of branchings. The branching differences between Group Concept Maps 1 to 3 reflect the large change that had occurred in the pre-service teachers' knowledge structures, revealed through the extent of branching depicted. The increased detail of the maps over time highlights that the pre-service teachers were developing an integrated knowledge of the social studies teaching process, were becoming more aware of the fundamental concepts of the course content, and had developed greater mapping skills as a consequence of using concept maps as an instructional tool.

The findings of the group concept maps are consistent with the findings of the individual concept maps. Concept mapping, as an instructional technique, is compatible with constructivism. The pre-service teachers constructed or reconstructed their conceptual framework of teaching social studies as expressed in the concept maps. They constructed new knowledge from the experiences in the classroom which they consciously integrated into their prior knowledge.

The results of the case studies revealed that the pre-service teachers found concept mapping to be a helpful teaching and learning strategy. They generally felt that concept mapping was an effective way of dealing with the subject matter presented by the textbook, to make sense of the material in the topic, and to organise the concepts of a topic into a meaningful whole. The case studies provided clear evidence for the importance of constructing concept maps in groups, identifying in concept mapping a tool that provides opportunities for engaging in collaborative

construction of knowledge and negotiation of meaning. The emphasis on justifying, explaining, and elaborating on their own views assisted the pre-service teachers in understanding their own ideas and constructing concept maps.

The three case study pre-service teachers were enthusiastic about using concept maps as a teaching strategy in their practicum. They all enjoyed this type of teaching and found their class was more active and motivated when using concept maps. The three case study teachers found there was more discourse in their class when using the concept maps. However, they all faced substantial barriers in using concept mapping as an instructional tool in their practicum. Their lack of experience with concept maps was considered a significant barrier to using them. However, as they became more familiar with using concept maps over the period of the course, their confidence and their ability to use them increased. The time students needed to construct concept maps within the classroom and the large number of students in the classroom were identified as other limitations. All three case study pre-service teachers believed that the use of concept maps made learning more meaningful for the secondary school students, developed more engagement and discourse in the class, and helped students reinterpret their subject matter.

In the class reflections, the pre-service teachers believed that the concept maps aided their learning and assisted them to organise their knowledge. They believed that using concept maps as a teaching strategy encouraged them to use their prior knowledge to construct new knowledge. These findings extend the accumulating evidence of the effectiveness of concept mapping on the improvement of pre-service teachers' knowledge of teaching social studies.

In general, the researcher found that most pre-service teachers developed a deeper knowledge of teaching social studies and were able to relate concepts to their prior knowledge. They were also able to convey their knowledge in an interesting way. In this course, the pre-service teachers were expected to construct and reconstruct their own understanding about social studies teaching by self-articulation during class reflection. This was made possible through the use of concept maps.

These findings present evidence that using concept maps in the Social Studies Teaching Methods course improved Saudi pre-service teachers' knowledge of different ways to teach social studies. The pre-service teachers made significant advances in their repertoire of course content knowledge about teaching social studies as well as their concept mapping skills. Using concept maps in the Social Studies Teaching Methods course improved the pre-service teachers' skills to use concept maps as an instructional tool in their own classroom.

Research Question 2: How does the use of concept maps in a Social Studies Teaching Methods course change Saudi pre-service teachers' perceptions of their social studies learning environment?

This research question was answered using information from the pre- and post-test CLES questionnaire, the case studies, class reflection and the researcher's self-reflections.

The results of the CLES questionnaire illustrated that the mean scores of all five scales had significantly ($p < 0.001$) increased over the period of Social Studies Teaching Methods course. The pre-service teacher perceived their learning environment had become more personally relevant to them, they had a greater critical voice, and there was more shared control and greater student negotiation. They also acknowledged the evolving nature of social studies. These results imply that the pre-service teachers perceived that concept mapping as a constructivist teaching approach improved their learning environment in the Social Studies Teaching Methods course.

The findings of the three case studies supported the questionnaire findings. The pre-service teachers found that the use of group work in developing concept maps created an environment that facilitated discussion and active learning. This indicated that, through facilitating dialogue in a collaborative environment, pre-service teachers were encouraged to discuss their ideas and views on concepts. When the pre-service teachers created concept maps collaboratively with their peers, they discovered, constructed and became more aware of their own cognitive structures. They did this by representing and explaining their concepts and ideas graphically.

In the class reflection, the pre-service teachers commented that cooperative learning was an important strategy to help student learning and gave them the opportunity to exchange their ideas freely. They also stated that class discussion provided them with confidence to talk to the whole class, exchange ideas and generate knowledge.

In this study, pre-service teachers collaboratively generated concept maps in groups and were actively engaged in creating concept maps for social studies teaching methods learning. The pre-service teachers gained support and confidence from working through various stages of learning with their peers. They were able to discuss the differences and similarities in their concept maps. This process encouraged the pre-service teachers to think independently, as well as actively listen to each others' point of view.

Using concept maps as a teaching and learning strategy in the Social Studies Teaching Methods course improved Saudi pre-service teachers' perceptions of their social studies learning environment. The implication from these findings is that the actual learning environment had improved when compared with the traditional approach pre-service teachers were accustomed to.

Research Question 3: How does the use of concept maps in a Social Studies Teaching Methods course change Saudi pre-service teachers' attitudes towards social studies?

This research question was answered using information from the pre- and post-test of the TOSSRA questionnaire, the case studies, and the researcher's self-reflections.

The results of the TOSSRA illustrated that the mean scores of all three scales had significantly ($p < 0.001$) improved across the Social Studies Teaching Methods course. Using concept maps as part of the teaching and learning process resulted in the pre-service teachers having better attitudes towards social studies, enjoyment of social studies lessons and career interest in social studies. These results illustrate that pre-service teachers' attitudes had changed in a positive manner as a consequence of using concept maps in the Social Studies Teaching Methods course.

The results of the case studies indicated that the pre-service teachers enjoyed their social studies lessons. The case study pre-service teachers indicated that they enjoyed learning through an active process and in small group work. The researcher observed that most of pre-service teachers were very well-motivated, participating actively in class and in group discussions. They worked well in groups, encouraging and motivating one another. In this manner, they developed an interest in learning together. As a result of teaching and learning with concept maps, the pre-service teachers were more independent in their learning and their level of interest and commitment in constructing concept maps increased as the semester progressed.

These findings present evidence that using concept maps in the Social Studies Teaching Methods course improved Saudi pre-service teachers' attitudes towards social studies.

Research Question 4: How does the use of concept maps in a Social Studies Teaching Methods course change Saudi pre-service teachers' confidence to teach Social Studies?

This research question was answered using information from the pre- and post-test of the SSTEBI-B questionnaire, the case studies and the researcher's self-reflections.

The results of the SSTEBI-B questionnaire showed that the mean score for Self-Efficacy and Outcome Expectancy had significantly ($p < 0.01$) increased over the period of the Social Studies Teaching Methods course. The pre-service teachers had strong personal beliefs in their own efficacy as social studies teachers along with a reasonably high expectation of the outcomes of social studies teaching at the end of the course.

An overall analysis of the pre-service teachers' journals from the case studies revealed evidence of improved confidence. The pre-service teachers constantly referred to their increased confidence using concept maps over time, both in the Social Studies Teaching Methods course and in their practicum. They expressed that the first time they used the concept map in their practicum in secondary schools they were nervous and uncomfortable. This was due to a lack of experience with concept

maps. With more experience, they became more confident in teaching social studies using concept maps. The case study pre-service teachers identified the time students needed to construct concept maps within the classroom as another limitation. Guiding and facilitating the students during construction of their concept maps were strategies the pre-service teachers used to save time. Large numbers of students in a classroom were identified as a further limitation when using concept mapping as a teaching strategy. The case study pre-service teachers found there was insufficient space in the classroom to suitably arrange the students' desks to facilitate their discussions and construct concept maps in small groups. Various solutions to these problems included the use of individual concept map preparation and whole class discussion. The pre-service teachers expressed a willingness to use concept maps in their teaching in the future.

As a result of using concept maps as a teaching and learning strategy, the pre-service teachers became more comfortable in expressing their personal views. They gained confidence from working with their peers. They participated in group and class discussion freely. The researcher noticed that using concept mapping in the Social Studies Teaching Methods course made the pre-service teachers comfortable, confident and more fluent in using concept maps as a learning and teaching strategy.

These findings present evidence that using concept maps in the Social Studies Teaching Methods course improved Saudi pre-service teachers' confidence to teach social studies.

7.3 Implications of the Study

The findings reported in this thesis provided a detailed insight into a range of facets concerning the delivery of social studies teaching methods with Saudi pre-service teachers as perceived by the pre-service teachers and the researcher as lecturer. If the findings are to be of practical value in the improvement of social studies teaching methods and educational practices relating to it, their implications need to be considered and translated into recommendations for future actions. How to do this is the purpose of this section of the chapter.

7.3.1 Implications for the Researcher

Placing learners in collaborative settings leads to more complex dynamics of learning. There are many factors that may impact students' learning outcomes in collaborative concept mapping, such as the amount of information needed for problem-solving, and participants' strategies to collaboratively solve problems. The complexity of the learning-dynamics points to the need for more systematic research in this area. Such research should embrace multiple methods of data collection to obtain both quantitative and qualitative data.

There are many variations in the way concept mapping is conducted. This makes it difficult to draw trends and generalisations across different studies as variations may lead to different map construction processes and learning outcomes. Concept mapping tasks can vary with respect to three aspects of the task itself (Ruiz-Primo et al., 2001): tasks demands (demands made on the students in generating concept maps), task constraints (constraints placed on the task), and content structure (the interaction of task demands and constraints with the structure of the subject domain to be mapped). In addition, the response mode (e.g., paper and pencil, oral, computer), format characteristics, and the identity of the concept mapper (i.e., teacher, student) can affect the mapping process. How those factors interact with each other and how they individually and collectively mediate the map construction process, and ultimately the learning outcomes, needs further systematic and more in-depth investigation.

In addition, educators are encouraged to experiment with using concept maps in combination with other learning and teaching methods or prior to undertaking practical/quantitative social studies exercises to see if their use can make such procedures more meaningful. The need to maximise the time available for students to become familiar with using concept mapping might be addressed by introducing the technique in a first year study skills module.

The majority of pre-service teachers in this study used concept mapping effectively. However, limited studies in the social studies education domain make it difficult to be confident that this approach really does lead to improvements in learning.

Therefore, social studies researchers are encouraged to experiment with concept mapping within their teaching, assessment and curriculum development practices and assess how such an approach might encourage their students to learn in a more meaningful manner.

Within this research, the role of the researcher as a facilitator should be emphasised. The development of a collaborative learning environment assisted the pre-service teachers in exchanging ideas and learning from each other. The role of the researcher was to establish this learning environment and to facilitate pre-service teacher learning during group discussions. This role involved scaffolding the learning of the concept mapping technique, along with careful yet unobtrusive monitoring of the correctness of the concept maps.

7.3.2 Implications for Policy Makers

The role of educational administrators and policy makers in a process leading to the modification of existing teaching methods is vital: any changes to be introduced depend on appropriate policy decisions if they are to have a significant impact. Without such decisions, little change is likely to result. The key issues for consideration (and action) by administrators and policy makers in relation to social studies teaching methods in Saudi Arabia are a re-examination of the social studies teaching methods to develop soft skills such as analytical thinking, problem-solving, communicating effectively, flexibility, diplomacy and creativity; and a critical appraisal of existing teaching methods to be undertaken in order to identify which aspects can be shortened, added, deleted and/or simplified. Support and encouragement should be provided for those teachers and educators who are prepared to embrace teaching strategies that support constructivist learning and the subsequent development of higher order thinking skills.

7.3.3 Implications for Lecturers

The research findings imply that lecturers need to consider the importance of developing a positive classroom learning environment. Before applying concept maps, more time training learners to use concept maps and more practice using them

prior to the study would have better facilitated students' map constructions. Research studies in other subject areas report different amounts of time needed for training in concept mapping. For example, in several studies previously reviewed (Ruiz-Primo et al., 1997; Ruiz-Primo & Shavelson, 1996; Yin, Vanides, Ruiz-Primo, Ayala, & Shavelson, 2004; 2005), the researchers used a 50-minute, four-part training program to teach learners about concept mapping. They maintained that this brief training was enough to both familiarise learners with concept mapping and enable them to create concept maps which presented their understandings.

Group work or cooperative learning should be encouraged. This is not just to achieve improved cognitive understanding but also to develop pre-service teachers as future workers. In this study, the pre-service teachers worked in small groups in a cooperative manner. They became interested in this new learning approach and commented that they would use concept maps in their future teaching. Changing the traditional teaching approaches to those that support a constructivist teaching and learning approach can lead to an improved learning environment and engagement, resulting in increased knowledge.

To plan and teach using constructivist approaches, lecturers must have a good understanding of the principles behind constructivism. For lecturers, professional development would provide an ideal mechanism to learn about this teaching and learning approach. Such professional development should focus on the factors affecting teaching and learning, such as methods of determining prior knowledge and challenging pre-service teachers' alternative conceptions about social studies concepts. It is also important for lecturers to know how to use examples from real world problems and situations that are relevant to the pre-service teachers. In this manner pre-service teachers can develop new knowledge by building on their past experiences.

7.4 Limitations of the Study

This study has investigated aspects of implementing concept maps into a Social Studies Teaching Methods course in a Saudi Arabian university. Although many of the findings of this research can relate to studies in social studies teaching methods in

other societies, caution must be taken in generalising the results due to the limitation of the study. Such limitations relate to the research sample, time frame, instruments used, course implementation, concept map scores, course assessment and interpretation the results.

7.4.1 Limited Study Samples

The study was limited due to the small number of pre-service teachers enrolled in the Social Studies Teaching Methods course (n=30). The small sample size meant that a factor analysis could not be performed on the various instruments. Consequently, the individual became the unit of analysis. A larger sample would allow the class to be the unit of analysis, and a detailed factor analysis to be performed, thus improving the reliability of the results (Fraser, 1998b). To minimise this limitation, triangulation techniques were used in order to confirm that the results were similar using different research methods.

7.4.2 Limited Time-frame

One of the limitations of the study was the time constraint placed upon the pre-service teachers' concept map training. Due to the structure of the Social Studies Teaching Methods course, there were limits to the practice time that the pre-service teachers use to become more proficient in concept mapping as a way to express their ideas and reflect their knowledge structure. In other studies (Roth & Roychoudhury, 1992, 1993a), concept mapping has been embedded in the learning process over a semester, thus becoming a familiar way for students to express their ideas. In such cases, the positive outcomes observed (e.g., scientist-like discourses among the learners) could be partly attributed to the use of concept mapping by students to communicate their ideas with others.

7.4.3 Instruments Used

This study used three instruments that were adopted from well-established questionnaires originally developed in a Western context. The processes of translating these instruments into Arabic and modifying their structure to

accommodate a social studies focus followed a standardised procedure. The findings have confirmed that all three instruments developed in this study were reliable and provided valid data. The interpretation of the data may have limitations because the context of this study differs from the original for questionnaire development.

The data came from the pre-service teachers' questionnaires upon which they were asked to state their degree of response using a five-point Likert-type scale to a series of statements regarding particular perceived 'events' said to occur in their classroom. The reliability of the findings was therefore dependent largely on the care, consistency, and discernment with which they responded to the items. The researcher also sought to corroborate the questionnaire findings through pre-service teachers' journals, class reflections, and semi-structured interviews. The use of triangulation of data from these sources within the study reduced the degree of subjective bias. Researcher self-reflections were used throughout the process to contextualise the results from the questionnaires.

7.4.4 Course Implementation

The researcher was a participant-observer in this research. Being a participant-observer allowed the researcher to share many experiences and meanings with the pre-service teachers. However, the participant-observer status of the researcher also presented a limitation for the research; that of potential bias and misinterpretation within the data collection, analysis and interpretation. Collection of data through different methods provided a mechanism to overcome this limitation.

The case studies provided a good basis for evaluation of the pre-service teachers' acceptance of concept maps as a learning and teaching tool. The case studies also provided information of how the pre-service teachers implemented concept maps in the classroom. The pre-service teachers found the concept maps to be useful and appropriate as a teaching strategy. This more detailed analysis of individual pre-service teachers' perspectives made it possible to better understand how the pre-service teachers' views changed from the beginning to the end of the study.

7.4.5 Concept Map Scores

Another limitation of this research relates to the accuracy of concept map scores. As concept maps become more complex and the number of links, cross links, and hierarchies increase, the ability to read the hand drawn maps becomes more difficult (Meagher, 2006). The difficulty resulted from the differences in hand writing quality, space restriction on the A4 paper where the pre-service teachers drew their maps, length of link lines separating concept topics, and translation to the English language. The researcher had to re-score some of the concept maps because of the irregular handwriting, unclear hierarchical levels, and crowded appearance of the concept maps.

7.4.6 Course Assessment

The study was also limited by the traditional approach of assessment. While this study implemented constructivist approach to learning through the use of concept maps, the assessment methods were in complete contrast. The researcher was restricted to using the formal assessment methods of test and examination that are used in the Education College of the Umm Al-Qura University.

7.4.7 Interpreting the Results

A final limitation of this study is in the interpretation of the results. The increased detail of the concept maps over time could be due to the pre-service teachers developing more integrated knowledge of the social studies teaching process, becoming more aware of the concepts being covered in the Social Studies Teaching Methods course, or having developed greater mapping skills as a consequence of using concept maps over the course. It is more likely that the increased detail associated with the concept maps is due to all three points, and any interpretation of results needs to take this into account.

7.5 Recommendations for Further Research

The results of this research open up several potential avenues for future research. This research used concept mapping as a teaching and learning strategy in social studies education. With respect to replication of this study there are two areas that should be further examined: time and scoring system. The timing of introduction of a new study strategy is important. In order to help students to develop the skills of concept mapping and metacognition, this study could be replicated with meaningful learning activities beginning earlier and continuing longer in the curriculum. This may allow for the new strategies to become better established and allow the students to more easily adapt the meaningful nature of concept mapping to practical situations that would require overt rather than subtle connections to be made.

In this study, Novak and Gowin's (1984) scoring system was used because it is generally accepted as the most common scoring method (Van Zele et al., 2004). However, there are many methods of scoring and identifying the complexity of concept maps. Future research might use other concept mapping scoring methods to obtain more practical and reliable results instead of Novak and Gowin's scoring method.

Further research could investigate how effectively a cohort of pre-service teachers implements concept maps in the classroom. While only three pre-service teachers were case studies in this study, much insight was gained about the application of concept maps in authentic settings. Studying a larger cohort of pre-service teachers, along with their students, would provide greater information about the pre-service teachers' ability to teach social studies concepts effectively in the classrooms using concept maps.

The number of pre-service teachers was limited in this study because of the current enrolment of pre-service teachers in this program. Future research could increase the sample size of pre-service teachers and build in years of teaching and grade level taught as independent variables. An evaluation of the impact of implementing concept mapping as an instructional tool through a longitudinal study would be

appropriate to confirm the results of this study. This follow-up study could reconsider the criteria associated with the concept map and its impact on current learning strategies. Case studies should be part of the longitudinal study as more detailed information would be obtained on the pre-service teachers and their students.

The use of the constructivist teaching approaches to properly assess pre-service teachers' outcomes before and after an intervention should be used more widely in Saudi educational research. Further research should be encouraged to investigate pre-service teachers'/students' and lecturers'/teachers' beliefs regarding alternative teaching and learning strategies in Saudi Arabia. This research project was conducted for female pre-service teachers in the Education College, Umm Al-Qura University in the Saudi Arabia. A similar study should be conducted for male pre-service teachers at the Education College, Umm Al-Qura University in the Saudi Arabia. Concept maps should also be implemented at different educational levels (public, higher) and with students having different study majors in Saudi Arabia.

7.6 Summary

This chapter has completed this study by presenting the discussion and conclusion obtained through careful analysis of the data. It is the researcher's intention that this research can be used as an addition to the existing body of knowledge regarding the use of concept maps in social studies teaching. The study presented had a positive impact on the pre-service teachers' knowledge of teaching social studies, perceptions of the learning environment, attitudes towards social studies, and confidence toward teaching social studies. The limitations and implication of the study and recommendations for further research were discussed.

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Appendix A

Geography Courses of Bachelor Degree

First level (15 hours)	
Unit	**Hours/week**
Islamic Culture (1)	2
Holy Quran (1)	2
Introduction to Geography	3
Introduction to Methods of Geography	2
Geography of the Muslim World	2
Introduction to Information Science	2
Introduction to Cartography	2

Second level (17 hours)	
Unit	**Hours/week**
Arabic Language	2
English Language	2
Geography of Relief	2
Climatology	3
Applications in Cartography	2
Introduction to Social Sciences	2
Africa Geography	2
Biogeography	2

Third level (19 hours)	
Unit	**Hours/week**
The Biography of Prophet Muhammad (peace be upon him)	2
Population Geography	2
Agricultural Geography	2
Geography of the Arabic World	2
The Development of Geographic Thought	2
Quantitative and Statistical Geography	3
Geography of Services	2
Computer Applications in Geography	2
Saudi Arabian Society & Environment	2

Fourth level (18 hours)	
Unit	**Hours/week**
Arabic Language	2
Geography of civilization	3
Political Geography	3
Islamic Culture (2)	2
Holy Quran (2)	2
Geography of Mining and Industry	2
Geography of Asia and Australia	2
Introduction to air photos	2

Fifth level (19 hours)	
Unit	**Hours/week**
Old History of Arab	2
Islamic Culture (3)	3
Holy Quran (3)	2
Geomorphology	3
History of the Orthodox Caliphs and Amaoi's country	2
Geography of Dry Region	2
Europe Geography	2
Entrance for psychology	1
Directing and guiding	1
Psychology formation	1

Sixth level (20 hours)	
Unit	**Hours/week**
Islamic Geography Heritage	2
Astronomy Geography	2
Solid Geography	2
North America Geography	2
Holy Quran (4)	2
Geography of Transportation & Commercial	2
Islamic Culture (4)	2
Entrance for education	2
Principles of Curricula	2
Principles Islamic of Education	2

Seventh level (23 hours)	
Unit	**Hours/week**
Ecology	3
General Statistics	2
Geography of Tourism	2
Urban Geography	3
Field Work	4
Medical Geography	2
Psychology educational	2
General teaching methods	2
Introduction to Educational Management	2
Education history in Saudi Arabia	1

Eight level (25 hours)	
Unit	**Hours/week**
Hydrology Geography	2
South America Geography	2
Geography of Hajj and the Holy Sites	2
Geography of Saudi Arabia	3
Field Work	4
Educational Means	2
Practicum	2
Social Studies Teaching Methods	2
Tests and Assessments	4

Appendix B

Courses of Bachelor Degree

First level (20 hours)	
Unit	**Hours/week**
The Biography of Prophet Muhammad (peace be upon him)	2
Introduction to History Science	2
Previous Arab History	3
Worships Jurisprudence	3
Introduction to study Doctrine	2
Islamic Culture (1)	2
Arabic Language	2
Islamic Civilization	2
Holy Quran (1)	2

Second level (19 hours)	
Unit	**Hours/week**
History of the Orthodox Caliphs	3
Egypt and Old East	3
Biography of Prophet Muhammad (peace be upon him)	3
Introduction to study Law	2
Islamic Antiques	2
Introduction to study Prophetic Tradition (Hadith)	2
Arabic Language (1)	2
English Language	2

Third level (18 hours)	
Unit	**Hours/week**
Amaoi's country	3
Greeks and Romans	2
Islamic Systems (1)	2
Byzantine Country	2
Prophets History	2
Principles of Islamic Economy	2
Worships Jurisprudence	2
Islamic Building	2

Fourth level (21 hours)	
Unit	**Hours/week**
First Abbasi's Era	3
Islamic West History	2
Europe on Middle Era	2
Research Methods (1)	2
Introduction to Holy Quran Science	2
Holy Quran (2)	2
Islamic Systems (2)	2
Arabic Home Geography	2
Prophetic Tradition (Hadith) Science	2
Islamic Culture (2)	2

Fifth level (20 hours)	
Unit	**Hours/week**
Shiak Muhammad bin Abdul Wahab Propaganda	3
Second Abbasi's Era	3
Islamic Culture (3)	3
Islamic Arts	2
Islam Spread	3
Entrance for psychology	1
Islamic Spain History	3
Psychology formation	1
Directing and guiding	1

Sixth level (18 hours)	
Unit	**Hours/week**
Saudi Arabia History (1)	2
Islam on Middle Era	3
Entrance for education	2
Arabic Language (2)	2
Muslim and Magool	2
Principles of Curricula	2
Islamic Culture (4)	2
Research Methods (2)	1
Principles Islamic of Education	2

Seventh level (21 hours)	
Unit	**Hours/week**
Islamic Uthmani Turkish country	3
History of building Two Holy Mosques	2
General teaching methods	2
Saudi Arabia Geography	2
Psychology educational	2
Saudi Arabia History (2)	3
The centres of Islamic Civilization	2
Education history in Saudi Arabia	1
Holy Quran (3)	2
Introduction to Educational Management	2

Eight level (23 hours)	
Unit	**Hours/week**
Europe on Modern Era	2
New Arabic World	3
Educational Means	2
Effects of Islamic Civilization on Europe	2
Muslim in Modern Era	2
Political Geography	2
Social StudiesTeaching Methods	2
Practicum	4
Holy Quran (4)	2
Tests and assessments	2

Appendix C
Modified Constructivist Learning Environment Survey (CLES)

Directions for pre-service teachers

These questionnaires contain statements about practices which could take place in this class. You will be asked how often each practice takes place.

There are no 'right' or 'wrong' answers. Your opinion is what is wanted. Think about how well each statement describes what this class is like for you.

Draw a circle around:

1	if the practice takes place	**Almost Never**
2	if the practice takes place	**Seldom**
3	if the practice takes place	**Sometimes**
4	if the practice takes place	**Often**
5	if the practice takes place	**Almost Always**

Be sure to give an answer for all questions. If you change your mind about an answer, just cross it out and circle another.

Some statements in this questionnaire are fairly similar to other statements. Don't worry about this. Simply give your opinion about all statements.

Practice Example

Suppose you were given the statement 'I choose my partners for group discussion'. You would need to decide whether you choose your partners 'Almost always', 'Often', 'Sometimes', 'Seldom' or 'Almost never'. If you selected 'Often', then you would circle the number 4 on your questionnaire.

Learning about the world	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
In this class ….					
1. I learn about the world outside of university.	**1**	**2**	**3**	**4**	**5**
2. My new learning starts with problems about the world outside of university.	**1**	**2**	**3**	**4**	**5**
3. I learn how English language can be part of my out-of- university life.	**1**	**2**	**3**	**4**	**5**
In this class ….					
4. I get a better understanding of the world outside of university.	**1**	**2**	**3**	**4**	**5**
5. I learn interesting things about the world outside of university.	**1**	**2**	**3**	**4**	**5**
6. What I learn has nothing to do with my out-of- university life.	**1**	**2**	**3**	**4**	**5**
Learning about English Language	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
In this class ….					
7. I learn that English language cannot provide perfect answers to problems.	**1**	**2**	**3**	**4**	**5**
8. I learn that English language has changed over time.	**1**	**2**	**3**	**4**	**5**
9. I learn that English language is influenced by people's values and opinions.	**1**	**2**	**3**	**4**	**5**
In this class ….					
10. I learn about the different English language used by people in other cultures.	**1**	**2**	**3**	**4**	**5**
11. I learn that modern English language is different from that of long ago.	**1**	**2**	**3**	**4**	**5**
Learning to speak out	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
In this class ….					
12. It's OK for me to ask the lecturer 'Why do I have to learn that?'	**1**	**2**	**3**	**4**	**5**
13. It's OK for me to question the way I'm being taught.	**1**	**2**	**3**	**4**	**5**
14. It's OK for me to complain about teaching activities that are confusing.	**1**	**2**	**3**	**4**	**5**

In this class ….					
15. It's OK for me to complain about anything that prevents me from learning.	**1**	**2**	**3**	**4**	**5**
16. It's OK for me to express my opinion.	**1**	**2**	**3**	**4**	**5**
17. It's OK for me to speak up for my rights.	**1**	**2**	**3**	**4**	**5**
Learning to learn	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
In this class ….					
18. I help the lecturer to plan what I'm going to learn.	**1**	**2**	**3**	**4**	**5**
19. I help the lecturer to decide how well I am learning.	**1**	**2**	**3**	**4**	**5**
20. I help the lecturer to decide which activities are best for me.	**1**	**2**	**3**	**4**	**5**
In this class ….					
21. I help the lecturer to decide how much time I spend on learning activities.	**1**	**2**	**3**	**4**	**5**
22. I help the lecturer to decide which activities I do.	**1**	**2**	**3**	**4**	**5**
23. I help the lecturer to assess my learning.	**1**	**2**	**3**	**4**	**5**
Learning to communicate	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
In this class ….					
24. I get the chance to talk to other students.	**1**	**2**	**3**	**4**	**5**
25. I talk with other students about how to solve problems.	**1**	**2**	**3**	**4**	**5**
26. I explain my understandings to other students.	**1**	**2**	**3**	**4**	**5**
In this class ….					
27. I ask other students to explain their thoughts.	**1**	**2**	**3**	**4**	**5**
28. Other students ask me to explain my ideas.	**1**	**2**	**3**	**4**	**5**
29. Other students explain their ideas to me.	**1**	**2**	**3**	**4**	**5**

Appendix D

The Arabic Version of Modified Constructivist Learning Environment Survey (CLES)

استبانة البيئة التعليمية البنائية

تعليمات لمعلمي ما قبل الخدمة

هذه الاستبانه تحوي جمل تتحدث عن المقرر، سوف تسألك عن طبيعة هذا المقرر. ليس هناك إجابة صحيحة و إجابة خاطئة, رأيك هو المطلوب. فكر جيداً قبل أن تجيب على هذه الجمل.

ضع دائرة حول الإجابة المختارة

1 إذا كانت الإجابة دائماً
2 إذا كانت الإجابة غالباً
3 إذا كانت الإجابة أحياناً
4 إذا كانت الإجابة نادراً
5 إذا كانت الإجابة أبداً

تأكد من أنك أجبت على جميع الأسئلة, إذا غيرت رأيك حول إجابة فقط ضع عليها علامة خطأ و ضع دائرة حول إجابة أخرى.

مثال تطبيقي

إذا أردت الإجابة على هذه الجملة "أتطلع دائماً لحضور محاضرات هذا المقرر", تحتاج أن تتار أحد الإجابات دائماً, غالباً, أحياناً, نادراً, أبداً. إذا كان اختيارك غالباً فهذا يعني أنك سوف تضع دائرة حول الرقم 2 في استبانتك.

التعلم عن العالم	دائماً	غالباً	أحياناً	نادراً	أبداً
في هذا الفصل	-	-	-	-	-
1. أتعلم عن العالم خارج الجامعة.	1	2	3	4	5
2. تعلمي الجديد يبدأ مع مشاكل العالم خارج الجامعة.	1	2	3	4	5
3. أتعلم كيف يمكن أن تكون اللغة الإنجليزية جزء من حياتي خارج الجامعة .	1	2	3	4	5
4. حصلت على فهم أفضل للعالم خارج الجامعة.	1	2	3	4	5
5. أتعلم أشياء مشوقة حول العالم خارج الجامعة .	1	2	3	4	5
6. ما تعلمته لا يضيف شيئاً لحياتي خارج الجامعة.	1	2	3	4	5
التعلم حول المواد الاجتماعية	**دائماً**	**غالباً**	**أحياناً**	**نادراً**	**أبداً**
في هذا الفصل	-	-	-	-	-
7. أتعلم أنه لا يمكن للغة الإنجليزية أن تقدم إجابات تامة للمشاكل.	1	2	3	4	5
8. أتعلم أن اللغة الإنجليزية قد تغيرت مع مرور الوقت.	1	2	3	4	5
9. أتعلم أن اللغة الإنجليزية قد تأثرت بآراء و قيم الناس.	1	2	3	4	5
10. أتعلم حول اللغة الإنجليزية المختلفة التي يستخدمها الناس في الثقافات الأخرى.	1	2	3	4	5
11. أتعلم أن اللغة الإنجليزية الحديثة مختلفة عن تلك الماضية.	1	2	3	4	5
تعلم التصريح	**دائماً**	**غالباً**	**أحياناً**	**نادراً**	**أبداً**
في هذا الفصل	-	-	-	-	-
12. إنه من الممكن أن أسأل المحاضر لماذا أتعلم هذا؟	1	2	3	4	5
13. إنه من الممكن أن أسأل عن الطريقة التي دُرست بها.	1	2	3	4	5
14. إنه من الممكن أن أشتكي حول الأنشطة التي تحيرني.	1	2	3	4	5
15. إنه من الممكن أن أشتكي حول أي شيء يمنع تعلمي.	1	2	3	4	5
16. إنه من الممكن أن أعبر عن آرائي.	1	2	3	4	5
17. إنه من الممكن أن أتحدث عن أفكاري.	1	2	3	4	5
التعلم للتعلم	**دائماً**	**غالباً**	**أحياناً**	**نادراً**	**أبداً**
في هذا الفصل	-	-	-	-	-
18. أساعد المحاضر ليخطط ماذا سوف أعمل.	1	2	3	4	5
19. أساعد المحاضر ليقرر كيف أتعلم جيداً.	1	2	3	4	5
20. أساعد المحاضر ليقرر ما هي الأنشطة الأفضل لي.	1	2	3	4	5
21. أساعد المحاضر ليقرر كم من الوقت أقضي في أنشطة التعلم.	1	2	3	4	5
22. أساعد المحاضر ليقرر ما هي الأنشطة التي أقوم بها.	1	2	3	4	5
23. أساعد المحاضر ليقيس تعلمي.	1	2	3	4	5
التعلم للتواصل	**دائماً**	**غالبا**	**أحياناً**	**نادراً**	**أبداً**
في هذا الفصل	-	-	-	-	-
24. أحصل على فرصة للتحدث مع الطلاب الآخرين.	1	2	3	4	5
25. أتحدث مع الطلاب الآخرين حول كيفية حل المشكلات.	1	2	3	4	5
26. أشرح فهمي للطلاب الآخرين.	1	2	3	4	5
27. أسأل الطلاب الآخرين ليشرحوا أفكارهم وآرائهم.	1	2	3	4	5
28. الطلاب الآخرون يسألونني أن أشرح أفكاري.	1	2	3	4	5
29. الطلاب الآخرون يشرحون أفكارهم لي.	1	2	3	4	5

Appendix E

Back Translation of the Arabic Version of Modified Constructivist Learning Environment Survey (CLES)

Learning about the world	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
In this class ….	-	-	-	-	-
1. I learn about the world outside of university.	**1**	**2**	**3**	**4**	**5**
2. My new learning starts with the world's problems outside of university.	**1**	**2**	**3**	**4**	**5**
3. I learn how English language can be part of my life outside of university.	**1**	**2**	**3**	**4**	**5**
In this class ….	-	-	-	-	-
4. I get a better understanding about the world outside of university.	**1**	**2**	**3**	**4**	**5**
5. I learn interesting things about the world outside of university.	**1**	**2**	**3**	**4**	**5**
6. What I learn has nothing to do on my life outside of university.	**1**	**2**	**3**	**4**	**5**
Learning about social studies	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
In this class ….	-	-	-	-	-
7. I learn that English language cannot present perfect answers to problems.	**1**	**2**	**3**	**4**	**5**
8. I learn that English language has changed over time.	**1**	**2**	**3**	**4**	**5**
9. I learn that English language is influenced by people's values and opinions.	**1**	**2**	**3**	**4**	**5**
In this class ….	-	-	-	-	-
10. I learn about the different English language used by people in other cultures.	**1**	**2**	**3**	**4**	**5**
11. I learn that modern English language is different from that ago.	**1**	**2**	**3**	**4**	**5**
Learning to speak out	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
In this class ….	-	-	-	-	-
12. It's OK for me to ask the lecturer 'Why do I learn that?'	**1**	**2**	**3**	**4**	**5**
13. It's OK for me to ask about the way I'm being taught.	**1**	**2**	**3**	**4**	**5**
14. It's OK for me to complain about teaching activities that confused me.	**1**	**2**	**3**	**4**	**5**

In this class ….	-	-	-	-	-
15. It's OK for me to complain about anything prevents my learning.	1	2	3	4	5
16. It's OK for me to express my opinion.	1	2	3	4	5
17. It's OK for me to talk about my rights.	1	2	3	4	5
Learning to learn	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
In this class ….	-	-	-	-	-
18. I help the lecturer to plan what I will learn.	1	2	3	4	5
19. I help the lecturer to decide how well I am learning.	1	2	3	4	5
20. I help the lecturer to decide what the best activities are for me.	1	2	3	4	5
In this class ….					
21. I help the lecturer to decide how much time I spend on learning activities.	1	2	3	4	5
22. I help the lecturer to decide which activities I do.	1	2	3	4	5
23. I help the lecturer to assess my learning.	1	2	3	4	5
Learning to communicate	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
In this class ….	-	-	-	-	-
24. I get the chance to talk to other students.	1	2	3	4	5
25. I talk with other students about how to solve problems.	1	2	3	4	5
26. I explain my understandings to other students.	1	2	3	4	5
In this class ….	-	-	-	-	-
27. I ask other students to explain their ideas.	1	2	3	4	5
28. Other students ask me to explain my ideas.	1	2	3	4	5
29. Other students explain their ideas to me.	1	2	3	4	5

Appendix F

A Modified Test of Science-Related Attitudes (TOSRA)

Adoption of English language Attitudes	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
1. I enjoy reading about things which disagree with my previous ideas.	**1**	**2**	**3**	**4**	**5**
2. I dislike repeating experiments to check that I get the same results.	**1**	**2**	**3**	**4**	**5**
3. I am curious about the world in which we live.	**1**	**2**	**3**	**4**	**5**
4. Finding out about new things is unimportant.	**1**	**2**	**3**	**4**	**5**
5. I like to listen to people whose opinions are different from mine.	**1**	**2**	**3**	**4**	**5**
6. I find it boring to hear about new ideas.	**1**	**2**	**3**	**4**	**5**
7. In English language experiments, I like to use new methods which I have not used before.	**1**	**2**	**3**	**4**	**5**
8. I am unwilling to change my ideas when evidence shows that the ideas are poor.	**1**	**2**	**3**	**4**	**5**
9. I English language experiments, I report unexpected results as well as expected one.	**1**	**2**	**3**	**4**	**5**
10. I dislike listening to other people's opinions.	**1**	**2**	**3**	**4**	**5**
Enjoyment of English language Lessons	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
11. English language lessons are fun.	**1**	**2**	**3**	**4**	**5**
12. I dislike English language lessons.	**1**	**2**	**3**	**4**	**5**
13. University should have more English language lessons each week.	**1**	**2**	**3**	**4**	**5**
14. English language lessons bore me.	**1**	**2**	**3**	**4**	**5**
15. English language is one of the most interesting university subjects.	**1**	**2**	**3**	**4**	**5**
16. English language lessons are a waste of time.	**1**	**2**	**3**	**4**	**5**
17. I really enjoy going to English language lessons.	**1**	**2**	**3**	**4**	**5**
18. The material covered in English language lessons is uninteresting.	**1**	**2**	**3**	**4**	**5**
19. I look forward to English language lessons.	**1**	**2**	**3**	**4**	**5**
20. I would enjoy university more if there were no English language lessons.	**1**	**2**	**3**	**4**	**5**

Career Interest in English language	Almost Never	Seldom	Sometimes	Often	Almost Always
21. I would dislike being English language professor after I leave university.	1	2	3	4	5
22. When I leave university, I would like to work with people in English language.	1	2	3	4	5
23. I would dislike a job in English language laboratory after I leave university.	1	2	3	4	5
24. Working in English language laboratory would be an interesting way to earn a living.	1	2	3	4	5
25. A career in English language would be dull and boring.	1	2	3	4	5
26. I would like to teach English language when I leave university.	1	2	3	4	5
27. A job as English language professor would be boring.	1	2	3	4	5
28. A job as English language professor would be interesting.	1	2	3	4	5
29. I would dislike becoming English language professor because it needs too much education.	1	2	3	4	5
30. I would like to be English language professor when I leave university.	1	2	3	4	5

Appendix G

The Arabic Version of a Test of Science-Related Attitudes

(TOSRA)

استبانة اختبار الاتجاهات نحو اللغة الإنجليزية

فحص الاتجاهات نحو اللغة الإنجليزية	دائماً	غالباً	أحياناً	نادراً	أبداً
1. أستمتع بقراءة الأشياء التي لا تتوافق مع أفكاري السابقة.	1	2	3	4	5
2. لا أرغب في إعادة التجارب للتأكد من حصولي على نفس النتيجة.	1	2	3	4	5
3. مندهش من العالم الذي نعيش فيه .	1	2	3	4	5
4. التعرف على الأشياء الجديدة غير مهم.	1	2	3	4	5
5. أحب الإستماع إلى الأشخاص الذين تختلف آرائهم عن رأيي.	1	2	3	4	5
6. أجد أنه من الممل أن أستمع إلى الأفكار الجديدة.	1	2	3	4	5
7. في تجارب **اللغة الإنجليزية** ؛ أحب أن أستخدم طرق جديدة لم استخدمها من قبل.	1	2	3	4	5
8. أكره أن أغير أفكاري عندما يُظهر الدليل رداءة هذه الأفكار.	1	2	3	4	5
9. في تجارب **اللغة الإنجليزية** ؛ حصلت نتائج متوقعة و أخرى غير متوقعة.	1	2	3	4	5
10. لا أحب الاستماع لآراء الناس الآخرين.	1	2	3	4	5
الاستمتاع بدروس اللغة الإنجليزية	**دائماً**	**غالباً**	**أحياناً**	**نادراً**	**أبداً**
11. دروس **اللغة الإنجليزية** مرحة.	1	2	3	4	5
12. أكره دروس **اللغة الإنجليزية**.	1	2	3	4	5
13. الجامعة يجب أن تعطي محاضرات أكثر كل أسبوع عن دروس **اللغة الإنجليزية**.	1	2	3	4	5
14. تصيبني دروس **اللغة الإنجليزية** بالملل.	1	2	3	4	5
15. **اللغة الإنجليزية** واحدة من أكثر مواد الجامعة تشويقاً.	1	2	3	4	5
16. دروس **اللغة الإنجليزية** مضيعة للوقت.	1	2	3	4	5
17. حقاً استمتع بالذهاب إلى دروس **اللغة الإنجليزية**.	1	2	3	4	5
18. الأدوات التي تشملها دروس **اللغة الإنجليزية** غير مشوقة.	1	2	3	4	5
19. أتطلع لدروس **اللغة الإنجليزية**.	1	2	3	4	5
20. سوف استمتع أكثر بالجامعة إذا لم يكن هنالك دروس **للغة الإنجليزية**.	1	2	3	4	5
الاهتمام الوظيفي للغة الإنجليزية	**دائماً**	**غالباً**	**أحياناً**	**نادراً**	**أبداً**
21. لا أرغب أن أكون خبيراً متخصصاً في **اللغة الإنجليزية** بعد أن أغادر الجامعة.	1	2	3	4	5
22. عندما أغادر الجامعة أرغب العمل مع أشخاص متخصصين في **اللغة الإنجليزية**.	1	2	3	4	5
23. لا أرغب العمل في معمل **اللغة الإنجليزية** بعد أن أغادر الجامعة.	1	2	3	4	5
24. العمل في معمل **اللغة الإنجليزية** سوف يكون طريقة مشوقة لتحسين الدخل..	1	2	3	4	5
25. الوظيفة في **اللغة الإنجليزية** سوف تكون متواضعة و مملة.	1	2	3	4	5
26. أرغب في تدريس **اللغة الإنجليزية** بعد أن أغادر الجامعة.	1	2	3	4	5
27. العمل كخبير متخصص **للغة الإنجليزية** سوف يكون ممل.	1	2	3	4	5
28. العمل كخبير متخصص **للغة الإنجليزية** سوف يكون مشوق.	1	2	3	4	5
29. لا أرغب أن أصبح خبير متخصص **للغة الإنجليزية**2 لأنه سوف يحتاج الكثير من التعليم.	1	2	3	4	5

30. أرغب أن أكون خبير متخصص في **اللغة الإنجليزية** بعد أن أغادر الجامعة.	**1**	**2**	**3**	**4**	**5**

Appendix H

Back Translation of the Arabic Version of a modified Test of Science-Related Attitudes (TOSRA)

Adoption of English Language Attitudes	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
1. I enjoy reading about things that disagree with my previous ideas.	**1**	**2**	**3**	**4**	**5**
2. I dislike repeating experiments to check the same results.	**1**	**2**	**3**	**4**	**5**
3. I am curious about the world we live in.	**1**	**2**	**3**	**4**	**5**
4. Finding out new things is not important.	**1**	**2**	**3**	**4**	**5**
5. I like listening to people whose different opinions from mine.	**1**	**2**	**3**	**4**	**5**
6. I find it boring to listen to new ideas.	**1**	**2**	**3**	**4**	**5**
7. In English language experiments, I like using new methods not used before.	**1**	**2**	**3**	**4**	**5**
8. I am unwilling to change my ideas when evidence shows that the ideas are poor.	**1**	**2**	**3**	**4**	**5**
9. In English language experiments, I report unexpected results as well as expected one.	**1**	**2**	**3**	**4**	**5**
10. I dislike listening to other people's opinions.	**1**	**2**	**3**	**4**	**5**
Enjoyment of English Language Lessons	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
11. English language lessons are fun.	**1**	**2**	**3**	**4**	**5**
12. I dislike English language lessons.	**1**	**2**	**3**	**4**	**5**
13. University should have more English language lessons every week.	**1**	**2**	**3**	**4**	**5**
14. English language lessons bore me.	**1**	**2**	**3**	**4**	**5**
15. English language one of the most interesting university subjects.	**1**	**2**	**3**	**4**	**5**
16. English language lessons are a waste of time.	**1**	**2**	**3**	**4**	**5**
17. I really enjoy to go to English language lessons.	**1**	**2**	**3**	**4**	**5**
18. The material covered in English language lessons is uninteresting.	**1**	**2**	**3**	**4**	**5**
19. I look forward to English language lessons.	**1**	**2**	**3**	**4**	**5**
20. I would more enjoyable on university if there were no English language lessons.	**1**	**2**	**3**	**4**	**5**
Career Interest in English Language	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
21. I dislike be a English language professor after I leave university.	**1**	**2**	**3**	**4**	**5**
22. When I leave university, I would like to work with people in English language.	**1**	**2**	**3**	**4**	**5**

23. I would dislike work in a English language laboratory after I leave university.	**1**	**2**	**3**	**4**	**5**
24. Working in a English language laboratory will be an interesting way to earn in a live.	**1**	**2**	**3**	**4**	**5**
25. A career in English language will be dull and boring.	**1**	**2**	**3**	**4**	**5**
26. I would like to teach English language when I leave university.	**1**	**2**	**3**	**4**	**5**
27. Working as a English language professor will be boring.	**1**	**2**	**3**	**4**	**5**
28. Working as English language professor will be interesting.	**1**	**2**	**3**	**4**	**5**
29. I would dislike becoming a English language professor because it needs too much education.	**1**	**2**	**3**	**4**	**5**
30. I would like to be a English language professor when I leave university.	**1**	**2**	**3**	**4**	**5**

Appendix I

A modified Science Teaching Efficacy Belief Instrument (STEBI-B)

Self-efficacy	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
1. I will continually find better ways to teach English language.	**1**	**2**	**3**	**4**	**5**
2. Even when I try hard, I will not teach English language as well as I will most subjects.	**1**	**2**	**3**	**4**	**5**
3. I know the steps necessary to teach English language concepts effectively.	**1**	**2**	**3**	**4**	**5**
4. I will not be very effective in teaching English language concepts.	**1**	**2**	**3**	**4**	**5**
5. I will generally teach English language ineffectively.	**1**	**2**	**3**	**4**	**5**
6. I understand social studies concepts well enough to be effective in teaching secondary English language.	**1**	**2**	**3**	**4**	**5**
7. I will find it difficult to explain to students English language concepts.	**1**	**2**	**3**	**4**	**5**
8. I will typically be able to answer students' English language questions.	**1**	**2**	**3**	**4**	**5**
9. I wonder if I will have the necessary skills to teach English language.	**1**	**2**	**3**	**4**	**5**
10. Given a choice, I will not invite the principal to evaluate my English language teaching.	**1**	**2**	**3**	**4**	**5**
11. When a student has difficulty with a English language concept, I will usually be at a loss as to how to help the student understand it better.	**1**	**2**	**3**	**4**	**5**
12. When teaching English language, I will usually welcome student questions.	**1**	**2**	**3**	**4**	**5**
13. I do not know what to do to motivate students in English language.	**1**	**2**	**3**	**4**	**5**
Outcome expectancy	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
14. When a student does better than usual in English language, it is often because the teacher exerted a little extra effort.	**1**	**2**	**3**	**4**	**5**
15. When the English language grades of students improve, it is often due to their teacher having found a more effective teaching approach.	**1**	**2**	**3**	**4**	**5**
16. If students are underachieving in English language, it is most likely due to ineffective teaching.	**1**	**2**	**3**	**4**	**5**
17. The inadequacy of student's English language background can be overcome by good teaching.	**1**	**2**	**3**	**4**	**5**
18. The low English language achievement of some students cannot generally be blamed on their teachers.	**1**	**2**	**3**	**4**	**5**

19. When a low-achieving student progresses in English language, it is usually due to extra attention given by the teacher.	**1**	**2**	**3**	**4**	**5**
20. Increased effort in English language teaching produces little change in some students' English language achievement.	**1**	**2**	**3**	**4**	**5**
21. The teacher is generally responsible for the achievement of students in English language.	**1**	**2**	**3**	**4**	**5**
22. Students' achievement in English language is directly related to their teacher's effectiveness in English language teaching.	**1**	**2**	**3**	**4**	**5**
23. If parents comment that their child is showing more interest in English language at school, it is probably due to the performance of the child's teacher.	**1**	**2**	**3**	**4**	**5**

Appendix J

The Arabic Version of a modified Science Teaching Efficacy Belief Instrument (STEBI-B)

استبانة اعتقاد فعالية تدريس اللغة الإنجليزية

الفعالية الشخصية	دائماً	غالباً	أحياناً	نادراً	أبداً
1. سوف أعمل باستمرار على إيجاد طرق أفضل لتدريس اللغة الإنجليزية.	1	2	3	4	5
2. حتى و إن حاولت بجدية؛ لن أقوم بتدريس اللغة الإنجليزية و لا حتى المواد الأخرى.	1	2	3	4	5
3. أعرف الخطوات الضرورية لتدريس مفاهيم اللغة الإنجليزية بفعالية .	1	2	3	4	5
4. لن أكون فعال جداً في تدريس مفاهيم اللغة الإنجليزية.	1	2	3	4	5
5. سوف أدرس اللغة الإنجليزية عموماً بدون فعالية.	1	2	3	4	5
6. أفهم جيداً مفاهيم اللغة الإنجليزية بشكل كافاً لأكون فعالاً في تدريس اللغة الإنجليزية للمرحلة الثانوية .	1	2	3	4	5
7. سوف أجد أنه من الصعب أن أشرح مفاهيم اللغة الإنجليزية للطلاب.	1	2	3	4	5
8. سوف أكون قادراً على إجابة أسئلة اللغة الإنجليزية للطلاب.	1	2	3	4	5
9. أتساءل إذا كنت سوف امتلك المهارات الضرورية لتدريس اللغة الإنجليزية.	1	2	3	4	5
10. إذا كان الموضوع اختياري، لن أدعو المسؤول لتقييم تدريسي للغة الإنجليزية.	1	2	3	4	5
11. سوف أعمل دائماً على مساعدة الطلاب للحصول على فهم أفضل إزاء الصعوبات التي تعترضهم حيال مفاهيم اللغة الإنجليزية.	1	2	3	4	5
12. عندما أدرس اللغة الإنجليزية سوف أرحب دائماً بأسئلة اللغة الإنجليزية للطلاب.	1	2	3	4	5
13. لا أعرف كيف أجذب انتباه الطلاب في اللغة الإنجليزية.	1	2	3	4	5
الحصيلة المتوقعة	**دائماً**	**غالباً**	**أحياناً**	**نادراً**	**أبداً**
14. عندما يعمل الطلاب بشكل أفضل من المعتاد في اللغة الإنجليزية ؛ غالباً يعود ذلك لأن المدرس بذل قليلاً من الجهد الزائد.	1	2	3	4	5
15. عندما تتحسن درجات الطلاب في اللغة الإنجليزية ؛ فإن مدرسهم غالباً يكون قد وجد أسلوب تدريسي أكثر فعالية.	1	2	3	4	5
16. إذا كان تحصيل الطلاب في اللغة الإنجليزية منخفضاً فإنه بسبب التدريس غير الفعال.	1	2	3	4	5
17. قصور خلفية الطلاب للغة الإنجليزية يمكن أن يتغلب عليه بالتدريس الجيد.	1	2	3	4	5
18. ضعف تحصيل بعض الطلاب في اللغة الإنجليزية لا	1	2	3	4	5

يمكن أن يلام عليه مدرسهم بشكل عام.					
19. الأهتمام المفرط من قبل المدرس بالطلاب سوف يؤدي إلى ضعف تحصيلهم في اللغة الإنجليزية.	**1**	**2**	**3**	**4**	**5**
20. الجهود المتزايدة في تدريس اللغة الإنجليزية حققت تغير طفيف لمستوى بعض الطلاب في اللغة الإنجليزية.	**1**	**2**	**3**	**4**	**5**
21. المدرس مسؤول بشكل عام عن تحصيل الطلاب في اللغة الإنجليزية.	**1**	**2**	**3**	**4**	**5**
22. تحصيل الطلاب في اللغة الإنجليزية مرتبط بشكل مباشر بفعالية مدرسهم في تدريس اللغة الإنجليزية.	**1**	**2**	**3**	**4**	**5**
23. إذا ذكر الآباء بأن أبنائهم قد أظهروا اهتماماً أكثر باللغة الإنجليزية في المدرسة؛ فإنه قد يكون بسبب أداء مدرس أبنائهم.	**1**	**2**	**3**	**4**	**5**

شكراً جزيلاً على تعاونك؛وأقدر الوقت، وأثمن الجهد؛ الذي بذلتيه في الإجابة،،،،،،

Appendix K

Back Translation of the Arabic Version of a modified Science Teaching Efficacy Belief Instrument (STEBI-B)

Self-efficacy	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
1. I will continually find better ways to teach English language.	**1**	**2**	**3**	**4**	**5**
2. Even when I try hard, I will not teach English language as well as I will most subjects.	**1**	**2**	**3**	**4**	**5**
3. I know necessary steps to teaching English language concepts effectively.	**1**	**2**	**3**	**4**	**5**
4. I will not be very effective in teaching English language concepts.	**1**	**2**	**3**	**4**	**5**
5. I will generally teach English language ineffectively.	**1**	**2**	**3**	**4**	**5**
6. I understand English language concepts good enough to be effective in teaching secondary English language.	**1**	**2**	**3**	**4**	**5**
7. I will find it difficult to explain English language concepts to students.	**1**	**2**	**3**	**4**	**5**
8. I will be able to answer English language questions to students.	**1**	**2**	**3**	**4**	**5**
9. I wonder if I will have the necessary skills to teach English language.	**1**	**2**	**3**	**4**	**5**
10. I will not invite the principal to evaluate my English language teaching if it a choice.	**1**	**2**	**3**	**4**	**5**
11. When a student has difficulty with a English language concept, I will usually help the student to have better understanding.	**1**	**2**	**3**	**4**	**5**
12. When I teaching English language, I will usually welcome student questions.	**1**	**2**	**3**	**4**	**5**
13. I do not know how I motivate students in English language.	**1**	**2**	**3**	**4**	**5**
Outcome expectancy	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
14. When a student doing better than usual in English language, it is often because the teacher did a little extra effort.	**1**	**2**	**3**	**4**	**5**
15. When the students' grades in English language are improved, it is often due to their teacher that found a more effective teaching approach.	**1**	**2**	**3**	**4**	**5**
16. If students are underachieving in English language, it is due to ineffective teaching.	**1**	**2**	**3**	**4**	**5**
17. The inadequacy of student's English language background can be overcome by good teaching.	**1**	**2**	**3**	**4**	**5**
18. The low achievement of some students in English language cannot generally	**1**	**2**	**3**	**4**	**5**

be blamed on their teachers.					
19. When a low-achieving student progresses in English language, it is usually due to extra attention given by the teacher.	**1**	**2**	**3**	**4**	**5**
20. Increased effort in English language teaching achieves little change in some students' English language achievement.	**1**	**2**	**3**	**4**	**5**
21. The teacher is generally responsible about the students' achievement in English language.	**1**	**2**	**3**	**4**	**5**
22. Students' achievement in English language is directly related to their teacher's effective in English language teaching.	**1**	**2**	**3**	**4**	**5**
23. If parents mention that their child is appearing more interest in English language at school, it is probably due to their teacher's performance.	**1**	**2**	**3**	**4**	**5**

Thank you for your time and cooperation

Appendix L

Modified Constructivist Learning Environment Survey (CLES)

Learning about the world	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
In this class ….					
1. I learn about the world outside of university.	**1**	**2**	**3**	**4**	**5**
2. My new learning starts with problems about the world outside of university.	**1**	**2**	**3**	**4**	**5**
3. I learn how social studies can be part of my out-of- university life.	**1**	**2**	**3**	**4**	**5**
In this class ….					
4. I get a better understanding of the world outside of university.	**1**	**2**	**3**	**4**	**5**
5. I learn interesting things about the world outside of university.	**1**	**2**	**3**	**4**	**5**
6. What I learn has nothing to do with my out-of- university life.	**1**	**2**	**3**	**4**	**5**
Learning about social studies	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
In this class ….					
7. I learn that social studies cannot provide perfect answers to problems.	**1**	**2**	**3**	**4**	**5**
8. I learn that social studies has changed over time.	**1**	**2**	**3**	**4**	**5**
9. I learn that social studies is influenced by people's values and opinions.	**1**	**2**	**3**	**4**	**5**
In this class ….					
10. I learn about the different social studies used by people in other cultures.	**1**	**2**	**3**	**4**	**5**
11. I learn that modern social studies is different from that of long ago.	**1**	**2**	**3**	**4**	**5**
Learning to speak out	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
In this class ….					
12. It's OK for me to ask the lecturer 'Why do I have to learn that?'	**1**	**2**	**3**	**4**	**5**
13. It's OK for me to question the way I'm being taught.	**1**	**2**	**3**	**4**	**5**
14. It's OK for me to complain about teaching activities that are confusing.	**1**	**2**	**3**	**4**	**5**

In this class ….					
15. It's OK for me to complain about anything that prevents me from learning.	**1**	**2**	**3**	**4**	**5**
16. It's OK for me to express my opinion.	**1**	**2**	**3**	**4**	**5**
17. It's OK for me to speak up for my rights.	**1**	**2**	**3**	**4**	**5**
Learning to learn	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
In this class ….					
18. I help the lecturer to plan what I'm going to learn.	**1**	**2**	**3**	**4**	**5**
19. I help the lecturer to decide how well I am learning.	**1**	**2**	**3**	**4**	**5**
20. I help the lecturer to decide which activities are best for me.	**1**	**2**	**3**	**4**	**5**
In this class ….					
21. I help the lecturer to decide how much time I spend on learning activities.	**1**	**2**	**3**	**4**	**5**
22. I help the lecturer to decide which activities I do.	**1**	**2**	**3**	**4**	**5**
23. I help the lecturer to assess my learning.	**1**	**2**	**3**	**4**	**5**
Learning to communicate	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
In this class ….					
24. I get the chance to talk to other students.	**1**	**2**	**3**	**4**	**5**
25. I talk with other students about how to solve problems.	**1**	**2**	**3**	**4**	**5**
26. I explain my understandings to other students.	**1**	**2**	**3**	**4**	**5**
In this class ….					
27. I ask other students to explain their thoughts.	**1**	**2**	**3**	**4**	**5**
28. Other students ask me to explain my ideas.	**1**	**2**	**3**	**4**	**5**
29. Other students explain their ideas to me.	**1**	**2**	**3**	**4**	**5**

Appendix M

A Test of Social Studies-Related Attitudes (TOSSRA)

Adoption of Social Studies Attitudes	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
1. I enjoy reading about things which disagree with my previous ideas.	**1**	**2**	**3**	**4**	**5**
2. I dislike repeating experiments to check that I get the same results.	**1**	**2**	**3**	**4**	**5**
3. I am curious about the world in which we live.	**1**	**2**	**3**	**4**	**5**
4. Finding out about new things is unimportant.	**1**	**2**	**3**	**4**	**5**
5. I like to listen to people whose opinions are different from mine.	**1**	**2**	**3**	**4**	**5**
6. I find it boring to hear about new ideas.	**1**	**2**	**3**	**4**	**5**
7. In social studies experiments, I like to use new methods which I have not used before.	**1**	**2**	**3**	**4**	**5**
8. I am unwilling to change my ideas when evidence shows that the ideas are poor.	**1**	**2**	**3**	**4**	**5**
9. I social studies experiments, I report unexpected results as well as expected one.	**1**	**2**	**3**	**4**	**5**
10. I dislike listening to other people's opinions.	**1**	**2**	**3**	**4**	**5**
Enjoyment of Social Studies Lessons	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
11. Social studies lessons are fun.	**1**	**2**	**3**	**4**	**5**
12. I dislike social studies lessons.	**1**	**2**	**3**	**4**	**5**
13. University should have more social studies lessons each week.	**1**	**2**	**3**	**4**	**5**
14. Social studies lessons bore me.	**1**	**2**	**3**	**4**	**5**
15. Social studies is one of the most interesting university subjects.	**1**	**2**	**3**	**4**	**5**
16. Social studies lessons are a waste of time.	**1**	**2**	**3**	**4**	**5**
17. I really enjoy going to social studies lessons.	**1**	**2**	**3**	**4**	**5**
18. The material covered in social studies lessons is uninteresting.	**1**	**2**	**3**	**4**	**5**
19. I look forward to social studies lessons.	**1**	**2**	**3**	**4**	**5**
20. I would enjoy university more if there were no social studies lessons.	**1**	**2**	**3**	**4**	**5**

Career Interest in Social Studies	Almost Never	Seldom	Sometimes	Often	Almost Always
21. I would dislike being a social studies professor after I leave university.	1	2	3	4	5
22. When I leave university, I would like to work with people in social studies.	1	2	3	4	5
23. I would dislike a job in a social studies laboratory after I leave university.	1	2	3	4	5
24. Working in a social studies laboratory would be an interesting way to earn a living.	1	2	3	4	5
25. A career in social studies would be dull and boring.	1	2	3	4	5
26. I would like to teach social studies when I leave university.	1	2	3	4	5
27. A job as a social studies professor would be boring.	1	2	3	4	5
28. A job as social studies professor would be interesting.	1	2	3	4	5
29. I would dislike becoming a social studies professor because it needs too much education.	1	2	3	4	5
30. I would like to be a social studies professor when I leave university.	1	2	3	4	5

Appendix N

Social Studies Teaching Efficacy Belief Instrument (SSTEBI-B)

Self-efficacy	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
1. I will continually find better ways to teach social studies.	**1**	**2**	**3**	**4**	**5**
2. Even when I try hard, I will not teach social studies as well as I will most subjects.	**1**	**2**	**3**	**4**	**5**
3. I know the steps necessary to teach social studies concepts effectively.	**1**	**2**	**3**	**4**	**5**
4. I will not be very effective in teaching social studies concepts.	**1**	**2**	**3**	**4**	**5**
5. I will generally teach social studies ineffectively.	**1**	**2**	**3**	**4**	**5**
6. I understand social studies concepts well enough to be effective in teaching secondary social studies.	**1**	**2**	**3**	**4**	**5**
7. I will find it difficult to explain to students social studies concepts.	**1**	**2**	**3**	**4**	**5**
8. I will typically be able to answer students' social studies questions.	**1**	**2**	**3**	**4**	**5**
9. I wonder if I will have the necessary skills to teach social studies.	**1**	**2**	**3**	**4**	**5**
10. Given a choice, I will not invite the principal to evaluate my social studies teaching.	**1**	**2**	**3**	**4**	**5**
11. When a student has difficulty with a social studies concept, I will usually be at a loss as to how to help the student understand it better.	**1**	**2**	**3**	**4**	**5**
12. When teaching social studies, I will usually welcome student questions.	**1**	**2**	**3**	**4**	**5**
13. I do not know what to do to motivate students in social studies.	**1**	**2**	**3**	**4**	**5**
Outcome expectancy	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
14. When a student does better than usual in social studies, it is often because the teacher exerted a little extra effort.	**1**	**2**	**3**	**4**	**5**
15. When the social studies grades of students improve, it is often due to their teacher having found a more effective teaching approach.	**1**	**2**	**3**	**4**	**5**
16. If students are underachieving in social studies, it is most likely due to ineffective teaching.	**1**	**2**	**3**	**4**	**5**
17. The inadequacy of student's social studies background can be overcome by good teaching.	**1**	**2**	**3**	**4**	**5**
18. The low social studies achievement of some students cannot generally be blamed on their teachers.	**1**	**2**	**3**	**4**	**5**
19. When a low-achieving student	**1**	**2**	**3**	**4**	**5**

progresses in social studies, it is usually due to extra attention given by the teacher.					
20. Increased effort in social studies teaching produces little change in some students' social studies achievement.	**1**	**2**	**3**	**4**	**5**
21. The teacher is generally responsible for the achievement of students in social studies.	**1**	**2**	**3**	**4**	**5**
22. Students' achievement in social studies is directly related to their teacher's effectiveness in social studies teaching.	**1**	**2**	**3**	**4**	**5**
23. If parents comment that their child is showing more interest in social studies at school, it is probably due to the performance of the child's teacher.	**1**	**2**	**3**	**4**	**5**

Appendix O

Participant Information Sheet

My name is Widad Musleh Alansari. I am currently completing a piece of research for my doctoral thesis at Science and Mathematics Education Centre (SMEC), Curtin University of Technology in Perth, Australia.

Purpose of Research
The purpose of this research is to assess how pre-service teachers' perception and thinking change following the implementation of concept mapping into the course Social Studies Teaching Methods.

Your Role
If you chose to participate in this research, you will be asked to complete three different questionnaires and two journals over the semester. You will also be involved in concept mapping and class reflection as a normal part of the teaching and learning routine. Benefits of participating in this research include improved teaching practice and understanding of social studies.

Three students will be invited to be case studies. This will involve journals and interviews on a fortnightly basis. The interviews will be conducted at a time and place convenient to the participants. This process should assist the participants to develop better reflective skills.

Consent to Participate
Your involvement in the research is entirely voluntary. You have the right to withdraw at any stage without it affecting your rights or my responsibilities. When you have signed the consent form I will assume that you have agreed to participate and allow me to use your data in this research.

Confidentiality
The information you provide will be kept separate from your personal details, and I will only have access to this. The interview transcript will not have your name or any other identifying information on it and in adherence to university policy, the interview tapes and transcribed information will be kept in a locked cabinet for five years, before it is destroyed.

Further Information
This research has been reviewed and given approval by Curtin University of Technology Human Research Ethics Committee (Approval Number SMEC20070044).

If you have any questions or would like further information please contact me on phone +966 0504392757or Email: wed_00000@hotmail.com. Or contact my supervisor Dr. Christine Howitt. Phone: **+61 08 9266 2328 or Email: c.howitt@curtin.edu.au**

Thank you very much for your involvement in this research, your participation is greatly appreciated.

Appendix P

CONSENT FORM FOR THE CLASS PARTICIPANTS

- I understand the purpose and procedures of the study.
- I have been provided with the participant information sheet.
- I understand that the procedure itself may not benefit me.
- I understand that my involvement is voluntary and I can withdraw at any time without problem.
- I understand that no personal identifying information like my name and address will used and that all information will be securely stored for 7 years before being destroyed.
- I have been given the opportunity to ask questions.
- I agree to participate in the study outlined to me.

Signature Date

Witness Signature Date

Appendix Q

CONSENT FORM FOR CASE STUDY PARTICIPANTS

- I understand the purpose and procedures of the study.
- I have been provided with the participant information sheet.
- I understand that the procedure itself may not benefit me.
- I understand that my involvement as a case study is voluntary and I can withdraw at an time without problem.
- I understand that no personal identifying information like my name and address will used and that all information will be securely stored for 7 years before being destroyed.
- I have been given the opportunity to ask questions.
- I agree to participate as a case study in the study outlined to me.

Signature Date

Witness Signature Date