Teaching science and history in secondary education. Relationship between conceptions, feelings and uses of technology.

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2015

Acknowledgments

Character cannot be developed in ease and quiet.
Only through experience of trial and suffering
can the soul be strengthened,
ambition inspired, and success achieved.
Helen Keller

This thesis represents not only my work, but a milestone of more than three years of work at the UOC University, and specially, within the department of Information and knowledge society. My experience at the UOC has been nothing short of amazing: since my first day on February 2012, until now, July 2015. Throughout these years, I have learned many characteristics about education and technology, as well as about teachers' identity, and this thesis represents the lesson learned about these topics. This work is also the result of dozens of teachers that have participated and helped me to accomplish my goal. Besides, this thesis is also the results of many experiences I have encountered while living in the USA, from many individuals who I also wish to acknowledge

First and foremost, I want to thank my advisor, Professor Antoni Badia, who has always been supportive since the day I began working with him in the master's program investigation. He has not only provided research assistance, but also academically and emotionally guidance through the rough road to finish this thesis. And during the most difficult times when writing this thesis, he provided me with the moral support and the freedom I needed to move on.

To Bigues, where the most basic source of my life vitality resides: my family. To all of them, who has listened and supported me into achieving my goal. To all of them who never allowed me to give up my dreams. To my mom, Maria Isabel, and my dad, Miquel, who has always nurtured me with unconditional love; to my brother, Miquel, who always pushed me to the inexplicable limits of knowledge.

I would also like to thank the Long and McNulty family: Trevor, Tara, Tracy and Mike, who in a dark afternoon night during thanksgiving, spent hours and hours helping me fold and arrange all the letters that were sent to the teachers.

And finally, a special thanks to Kurt, who spent interminable hours reviewing my thesis, and guiding me through the learning of academic English.

To all and each one of them, because I know that without them, this thesis would have never reached the end.

Abstract

In recent years, there has been an increasing interest in the study of teachers' conceptions, their feelings, and the use of technology in the classroom. While most of the studies primarily oriented their investigations on the conceptions of teaching and learning in general, as well as the feelings and the use of technology in the classroom, little attention has been given to secondary history and science teachers in regards to their specific subjects. It is for this reason that the present study will gather some information about some relevant studies regarding all these topics, and it will make special emphasis to secondary science and history educators.

Explanations and proposals about conceptions of teaching and learning have emerged from different perspectives. First of all, there was the consideration of the term conception defined by different authors (Chan & Elliot, 1994; Pratt, 1992); while the second perspective was the consideration of the term belief (Bai & Ertmer, 2008), which sometimes might be associated with the notion of conception. Even though both terms contain some similarities, conceptions are considered a representation of a specific phenomenon that might be based and built according to beliefs and knowledge about a specific and determined issue (Arancibia & Badia, 2014). Whereas conception might include beliefs and it is not subject to change, beliefs are built based on personal experiences, and might be influenced by teachers' perspectives, and the environment (Ertmer, 2005).

Another significant issue is the conceptions of teaching and learning science and history. In order for educators to implement the subject they impart properly, it is relevant to know the knowledge they own about the subject in which they are instructing their pupils (Krubu, 2012; Leaderman, 2002; Morrison, 2009). Because of different characteristics regarding the environment, personal experiences, or even other circumstances regarding the educator, some teachers may not have a strong knowledge about the nature of the subject they teach. Based on previous research, in disciplines such history, the teacher's view of the subject itself might affect the manner in which they teach; however, in science, teachers' views of the nature of the discipline might influence the conceptions that the students have about science (Abell & Smith, 1994).

Another component that has been considered relevant is the emotions and feelings that teachers experience when using technology. Emotions and feelings have been considered an important factor in the implementation of computers and other technology devices in the classroom, because those sentiments might influence their integration (Agvey & Voot, 2011). In addition, it might also influence teachers' perceptions, and the manner in which they teach their students.

Finally, another important issue that has been considered in this investigation is the use of technology in the classroom. Since the mid 1990's that technology began to be implemented and studied (Sigalés, Mominó, Meneses & Badia, 2009), there has been an increase of research in this specific area. It is with the implementation of technology, that there have appeared two significant positions: teachers that were more willing to use it in the classroom; and those teachers that were more reticent and distant to its implementation. It is because of this reason that it has been considered of special interest to identify the use of technology with an educational purpose, by science and history teachers from Utah.

Using a quantitative method, the aim of this research is to identify and describe the characteristics of the participants in this study, to find the relationship between conceptions, feelings and emotions, and uses of technology, and to outline the characteristics of history and science teachers. A total of one hundred and eight (108) history teachers, and one hundred and eight (108) science teachers participated in completing a questionnaire. The questionnaire contained inquiries about socio-professional information, competency using technology, conceptions about teaching and learning, conceptions about the subject they teach, feelings with the use of technology, and the use of technology by teachers and students.

Once data was collected, several analyses were conducted using the Statistical Package for the Social Sciences (SPSS) software. The first one was a descriptive and factorial analysis; then Pearsons' correlations; third a multiple regression analysis with the Enter method; and finally, a cluster Ward analysis with a t-test. The results suggested that teachers in Utah hold a high level of technology competency; two main conceptions of teaching and learning appeared; conceptions of the nature of science and history were identified; two main groups of emotions and feelings were suggested among teachers that use technology in the classroom, and different uses of technology by teachers and students were described.

In summary, this investigation deepened into the study of science and history teachers' conceptions, feelings and emotions, as well as the use technology in the classroom by teachers that participated in this research.

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I. Introduction

The implementation of technology in the educational system has led to several changes, as well as different perspectives in various aspects of the teaching process. Some of them are the conceptions that teachers have about teaching and learning (Bai & Ertmer, 2008); the conceptions about the subject they teach (Abd-el-Khalick & Anderson, 2009; Yilmaz, 2008); the emotions that they experience when using technology (Agvey & Voogt, 2011); and the use of technology as a daily basis (Toneur, Hermans, VanBraak & Valcke, 2008). All these aspects, and the conjunction of them, might be influential aspects among teaching practices at the school.

One of the largest assumptions within academics and professionals of education is that the use of technology poses great changes and challenges at an educational level: changes in how teachers confront the problems in the classroom, changes in the planning process, changes in conceptions that teachers have about teaching and learning, and so on. The Center for Applied Research in Educational Technology (CARET), a funded project of the International Society for Technology in Education (ISTE) indicated that "The impact depends on the ways the technology is used and the conditions under which applications are implemented" (Roblyer & Doering, 2007, p.13). In certain ways, the typical classroom that people conceived becomes an interactive environment prepared for any multimedia material. In these virtual classes people can find computers with Internet access, Smartboards, and projectors, for example. This creates an Educational web connection that people could not have before, when technology were not feasible.

One of the key elements to emphasize, within the issues that have appeared in the process of teaching and learning with the use of technology, has been the teacher. The teacher acts as a mediator between knowledge and students, doing different functions such as guiding or coaching. Unfortunately, there are just a few studies that have raised the question about the specific groups of science and history secondary teachers' conceptions, the conceptions about the subject they teach; and the emotions experienced as a result of the implementation of technology.

Nowadays, we can experience a large amount of research about the implementation of technology in the classroom, such as the studies conducted by Tondeur et al. (2008); or Van Braak, Tondeur and Valcke, (2004); however, none of these studies prompted questions relating to the teacher such as: what happens in secondary level school classes when science and history teachers use technology as a daily basis to implement their lessons? Can the use of technology influence in the performance of students in the classroom? In addition, we can also find a large amount of research about the use of technology at an Educational level (Beijaard, 2004; Tondeur et al. 2008), as it has been mentioned before, but there exist just a few investigations about the impact of the introduction of technology within secondary school science and history professors, as well as a lack of studies comparing both disciplines.

Because of this situation, the main purpose of this study is to identify the profile of science and history secondary school teachers that have implemented technology in their classroom for a large period of time; to recognize the educational uses that teachers and students do of technology; and to identify the relationship between the different factors involved in this study. In order to identify, analyze, explain and gather data, this study will be centered on secondary school teachers from Utah (USA) that teach science and history using technology, focusing on three aspects or components such as: teachers' conceptions of teaching and learning; science and history teacher's conceptions of the subject they teach; uses of technology; and emotions associated to teaching with technology. With the purpose of gathering data, this study will use a quantitative methodology, and also a questionnaire to collect data from a large amount of teachers.

1.1 Structure of the thesis

This research is structured in two main sections. The first one is the theoretical framework, which contains some of the significant literature of the four main components that will be investigated in this study: I) teachers' conceptions of teaching and learning; II) teachers' conceptions of the discipline they teach; III) teachers' emotions with the use of technology in the classroom; and IV) teachers' use of technology. These components will be investigated in the context of secondary science and history teachers.

The first component will be divided in two main classifications: conceptions and beliefs; the second component will include two separated sections: one for history and one for science teachers; the third component will include all the significant elements related to emotions; and the last component will emphasize the use of technology in education in general, as well as the use of technology in secondary education.

The second section will be the empirical framework, and will include the aspects related to the investigation conducted in Utah. Those aspects are the research design; the findings; the conclusions; the limitations of the study and the future lines of investigation; and educational implications. This research design will include different components such as: the research aim and objectives, the context of study, the participants, the data collection and procedure, the survey instruments and measures, the data analysis.

The findings will contain the descriptive and factorial analysis of the different components of this research, the correlations between all the items, the multiple regression analysis, and also the cluster analysis. The conclusions will introduce a description of the main characteristics of this research for both the theoretical and the empirical framework, leading to the most significant findings achieved in this investigation.

The limitations of the study and the future lines of research will present the weaknesses and strengths that have appeared in the present investigation. These will be regarding the theoretical and the empirical framework. And finally, the last chapter of the empirical framework will focus on the educational implications that this research will have in the educational field. The educational implications will be presented regarding the objectives of the investigation.

To conclude this investigation, there will be a collection of all the bibliography that has been used to fulfill the theoretical framework, as well as the annexes that contains information on the educators, the sample letter that was sent to the participants, and the science and history questionnaires.

THEORETICAL FRAMEWORK

II. Teacher' conceptions of teaching and learning

The purpose of this section is to generate a complex analysis and understanding of the meaning of the term conception, as well as of conceptions of teaching and learning from an educational perspective. First of all, the text will start with a description of the general meaning of this topic from the view of different academics that have studied this subject. Once the main definitions have been described, there will be a specific definition that has been considered the most valuable to this investigation. Second, this section will go in depth in this issue, and it will analyze the different classifications that lecturers found concerning conceptions, and conceptions with technology, focusing on two main areas: teaching and learning. As a last section, there will be an analysis of teachers' beliefs, and teachers' beliefs when they use technology in the classroom.

2.1 The meaning of teacher' conception

In the last few years, there have appeared many studies that indicate possible types of conceptions that teachers from different disciplines have about education. (Alger, 2009; Aypay, 2010; Boulton-Lewis, 2004; Chan & Elliot, 2004). Also, these conceptions are commonly influenced and related by epistemological beliefs that educators have about their practices at the school (Chan & Elliot, 2004; Ertmer, 2005).

After reviewing the literature, it has been observed that many authors provided a description of conceptions. Some of them created their own definition, and some others based their thoughts in another author's ideas. In addition, the definition of conception has been found associated or used as a synonym with other terms such as beliefs (Chen, 2008; Hermans, Tondeur, Van Braak & Valcke, 2008), thoughts (Brownlle, Purdie & Boulton-Lewis, 2003), perceptions (Drenoyianny & Selwood, 1998) or representations (Becerra, 2003; Ruthven, Hennessly & Brindley, 2004) as stated on Arancibia's research, (2012).

This statement infers that the topic of conceptions is widely used in many situations and circumstances, making it diverse from the view of different authors and their environment. Even though this subject has a vast range of meanings, this section will focus on the specific term conceptions, the term belief, and its definition by different authors. One of the authors that studied this subject was Pratt (1992), who considered that conceptions were the group of specific significances that go together with the phenomena that mediate the answer of the human beings to the situations in which they are implied.

Because of that, people would create specific conceptions of every specific aspect of living experiences. As a consequence, the actions of individuals would basically be influenced by the conceptions they have of certain aspects of life. Based on Pratt's idea, it is understood that people act according to their conceptions of certain events. In the teaching environment, the definition of conceptions by Pratt (1992) would be applied to the condition in which teachers act in their classrooms.

In the same way, Boulton-Lewis, Smith, McCrindle, Burnett and Campbell (2001), carried out a study to identify the conceptions of educators based on the idea that the teaching conceptions were interconnected to the conceptions they had about students' knowledge, and their teaching practices. To these authors, students played a significant role in the perception they had about conceptions, and they conducted a study to contribute to this statement. As a matter of fact, students would be the basis to build a specific definition of this topic.

Brown (2003) defined conceptions as a general mental structure that is not simple, and that embraces different meanings, beliefs, concepts, images and personal preferences that act as a frame of one's action. This conception is similar to the one offered by Pratt (1992), but it implies a more cognitive frame that guides the action of the subject. In addition, it allows to give an answer to more specific questions, and it offers a more general range of possibilities to act. Conceptions would be, in fact, what would guide the people's actions.

In a similar way, Lefebvre, Deaudelin and Loiselle (2006) defined conceptions as an individual cognitive process, and knowledge that people build in contact with the environment. As it might be perceived, these authors consider that conceptions are related to personal experiences and the environment they interact with. In addition, it infers that each individual perceives these conceptions differently, and they would not acquire them by other people but by the interpretation they have of the world, and the knowledge that build the facts.

Similarly, Cheng, Chan, Tang and Cheng (2009) stated that the beliefs and the value system of the teacher will configure the conceptions and practical theories in classroom teaching, and it will, at a certain point, influence the strategies they use and the performance they employ in the classroom. These authors also considered that the term belief was associated with conceptions. Again, this definition is similar to the one stated by Pratt (1992), where conception would be mediated by the representations each individual has about aspects of the world.

In addition, Meirink, Meijer, Verloop and Bergen (2009), in the basis of Pratt (1992), stated that the perceptions and conceptions of the teacher were used reciprocally and labeled as an interconnected set of intentions, beliefs and actions. Teacher will base their instruction and conceptions on these three main aspects that may configure the teaching practices. According to these authors, the subject would acquire a sense of the environment based on personal experiences, then it would also develop beliefs about the world around, and they would finally base their actions on the basis of this cognitive frame.

Then, Domenech, Traver, Odet and Sales (2009) postulated that teacher conceptions are strongly influenced by the teaching methods, the teaching tasks, the evaluation, and all the issues related to teaching. These authors stated that the teacher might be influenced and might act according to all this factors that surrounds them in their work environment. Moreover, the perception they have about teaching might also be influenced by the external context such as parents, school or students, and their practice might be conditioned by these beliefs. Similarly to the other definitions, the conceptions are not only based on the cognitive significance of a specific matter, but also might be influenced by the environment and external factors related to teaching practices.

Aypay (2010), in the basis of Chan and Elliot (2004), stated that the term conceptions in education might be attributed to the beliefs that teachers develop about the methods they choose to teach and to learn. That would include the significance of teaching and learning, and the roles of educators and students. In the same basis than other authors, the author also considered that conceptions might be constructed differently in each individual. Moreover, the perceptions they have and the surroundings will be the base to build them.

Even though the term conceptions might differ according to different disciplines, this first section focused on the definition of conceptions at an educational level in which the focus of the action is the teacher. Teachers are the subjects occupying an important role on defining the meaning of this term by their experiences in the classroom as well as their cognitive structures. After reviewing the literature, it is observable that conceptions are a cognitive and mental construction of each individual in relationship with their personal experiences in a particular environment. In addition, conceptions can be also related to beliefs, perceptions, thoughts and representations.

It is believed that the idea of Pratt (1992) is of special interest due to the interpretation of a conception that leads to an action. This definition means that the individual perception of a specific issue lead the human being to his specific actions. In addition, this would imply the singularity of each person to act accordingly to their nature. Furthermore, a conception is not only constructed in a precise manner in which a theory might be understood by the subject. Otherwise, it has to enhance the experiences of each individual, which will construct their own meaning and significances, and the outcome in which they will interpret their conceptions.

2.2 Classifications of teachers' conceptions of teaching and learning

It is difficult to describe teachers' conceptions of teaching and learning in unambiguous terms, contemplating the uncountable ways they have been defined in the research literature. It is for this reason that this section will present a classification of the perspective of different authors regarding the conceptions of teaching and learning. Based on the extensive body of literature, a list of definitions regarding both concepts may be identified at a secondary level, and they will be classified according to two groups: (a) conceptions of teaching and learning, and (b), conceptions of teaching and learning with the use of technology. The first group will include all the authors that categorized the conceptions of teaching and learning considering different classifications, and specially based on the constructivist and traditional approach; while the second group will consider conceptions regarding the use of technology.

First of all, Säljö (1979), identified five conceptions of learning. Those conceptions were related to levels of processing: the first one was (a) a qualitative increase in knowledge, in which there is an increment of the understandings that an individual can acquire, (b) memorizing, in which learning is remembering something that is demanded, (c) acquisition of facts, methods, and so on, which can be retained and used when necessary. This mean that each individual is able to collect specific information that can be used when need it, (d) the abstraction of meaning, in which any idea could be understood in a different way, and finally (e) an interpretative process aimed at understanding reality, in which learning is a procedure to absorb knowledge, and that knowledge would further help to understand the veracity of facts. Following the same classification by Säljö (1979), Dall'Alba and Beaty (1993) found the same conceptions than the author, but they added another one: (f) learning as changing as a person, in which learning would help the individual to grow and even change their conceptions. These categories are presented on table 1.

Table 1
Classification of the five conceptions of learning.

Conceptions of learning					
A qualitative increase in knowledge.	Memorizing	Acquisition of facts, methods, etc. which can be retained and used when necessary.	The abstraction of meaning.	Interpretative process aimed at understanding reality.	Learning as changing as a person.

Source: Säljö (1979); Dall'Alba and Beaty (1993).

The classification proposed by Säljö only emphasized on teacher conceptions of learning, but did not specified any conceptions of teaching. They conducted a phenomenographic study and realized that conceptions were not conjectured, but build on the relationships stablished within subjects, and a particular assignment or situation. That would mean that different individuals in different contexts could interiorized conceptions in a different manner. Similar to other definitions of conceptions, they are built independently in each individual and depends on the context where they are at.

Fox (1983) at an early period, reported conceptions of teaching and learning ranging from different points of view. These points of view might refer to the two main approaches in education. The first one was (a) teaching as delivering, presenting or transmitting content, and the second one was (b) teaching as facilitating or helping students to grow, learn or change their conceptions of the subject matter. This categorization presented by Fox has one item that contain characteristics that leads to think of the traditional approach (item a). This item considers teaching as the mere fact of delivering instruction to the pupil and transmitting content without a specific background that implies specific meaning for the learner. Otherwise, the second item has characteristics of the constructivist approach (item b). This item is stating the teacher as a facilitator and guide, an entity that helps the student to build their own knowledge instead of being acquired by mandatory actions. Below is table 2 with a visual representation of both categories.

Table 2
Categorization of conceptions of teaching and learning based on a traditional and a constructivist approach.

Based on a traditional approach	**Based on a constructivist approach**
Teaching as delivering, presenting or transmitting content	Teaching as facilitating or helping students to grow, learn or change their conceptions of the subject matter.

Adapted from Fox (1983).

Taking a deeper look at this categorization, the author presented a classification based in the two main theoretical models. This perspective could be interesting since it is a classification that is still currently considered. In addition it has been evaluated and implemented in education by many researchers and educators over time (Boulton-Lewis et al., 2001; Chan & Elliot, 2004).

In addition, in most educational systems, teachers have to understand the principles of these two models in order to earn their degrees.

The research conducted by Prosser, Trigwell and Taylor (1994) is an example of conceptions of teachers based on personal experiences immediately related to the context where they perform the teaching action. This perspective focus on the identification of conceptions described in specific contexts, depending on the tasks that needs to be due, and it can be coming from the teacher or the student perspective.

The conceptions of teaching are: (a) teaching as transmitting concepts of the syllabus, in which the teachers make special emphasis to the concepts that are stated in the syllabus or textbooks. In addition, teachers transfer knowledge to the pupils, these relate different ideas to each other, and educators show how to apply these concepts and new ideas, (b) teaching as transmitting the teachers' knowledge, in which teachers make emphasis on their construction of knowledge, but they will transfer information depending on their conceptions to the students, (c) teaching as helping students acquire teacher knowledge, this conception is similar to the first one (a), but they will not transfer knowledge, they will rather help student to acquire it by themselves. In this conceptions, students' prior knowledge is considered important, (d) teaching as helping students acquire teacher knowledge, in which teachers focus on the students perspective of the world and base their conceptions on them instead of on themselves, (e) teaching as helping students develop conceptions, in which teachers emphasizes the conceptions that their students have instead of the conceptions that appear on textbooks. Teachers help students to develop their conceptions by deep elaboration and extension, and (f) teaching as helping students change conceptions, in which teachers try to help students to develop different conceptions of their points of view.

In the other hand, the conceptions of learning are: (a) learning as accumulating more information to satisfy external demands, in which teachers emphasizes on learning from their students. They focus on the information and believe that students have learn something if they can complete some tasks with success; (b) learning as acquiring concepts to satisfy external demands, in which it differs from the first conceptions by the facilitation of understanding. This process involves to use students' knowledge to help solve other exercises that they might have done before, (c) learning as acquiring concepts to satisfy internal demands, in which learning is achieving concepts of the subject as described in (b), but the results are seen as something to not only satisfy the demands, (d) learning as conceptual development to satisfy internal demands, in which conceptions are the product of a more elaborate knowledge to construct meaning, and finally (e) learning as conceptual change to satisfy internal demands, in which students will learn from a change in the way they see everything, and student will understand that they have learnt something.

This categorization was part of a qualitative phenomenographic study that contributed to create this categorization based on the discourse obtained from the teacher on the interviews. Once the information was gathered, this classification was the result of the deep analysis of the teacher discussion. The classification is shown on table 3.

Table 3
Classification of conceptions of teaching and learning.

Conceptions of teaching	Conceptions of learning
Teaching as transmitting concepts of the syllabus.	Learning as accumulating more information to satisfy external demands.
Teaching as transmitting the teachers' knowledge.	Learning as acquiring concepts to satisfy external demands.
Teaching as helping students acquire teacher knowledge.	Learning as acquiring concepts to satisfy internal demands.
Teaching as helping students acquire teacher knowledge.	Learning as conceptual development to satisfy internal demands.
Teaching as helping students develop conceptions.	Learning as conceptual change to satisfy internal demands.
Teaching as helping students change conceptions.	

Source: Prosser et al. (1994).

The conceptions represented by Prosser et al. (1994) involved two main subjects in their classification: teachers and students. Each of their categorization was related to the previous one, but it implied a different nuance that made it differ. Another characteristic that was considered relevant is that the authors presented six conceptions of teaching and only five conceptions of learning.

From another point of view, Kember (2000) founded his theory on a model of three levels based on the tasks that the teacher performs in the classroom: (a) teacher and content centered, being those the focus of attention and the important agent in the process, (b) student and learning centered, in which the students are the main agent involved in the process, and they are undertaking all the work, and (c) centered on the interaction between teacher, learner and knowledge, in which teacher and students work together as a whole to obtain knowledge.

In addition, in the study conducted by Kember (2000), he used five denominations for teaching and learning conceptions: (1) to impart information, in which the teacher transfers information to the students, and the students are a passive agent in the process, (2) teaching as illustrating the application of theory to practice, in which students learn on real contexts, (3) to promote the interaction between teacher and student, that is centered in the relationships established during the process of pedagogical actions, and the focus of this is in the activities that are developed in the classroom, (4) to facilitate the understanding and comprehension, that implies to prepare the student in developing concepts and principles, and their relationships to obtain competences to be an expert on the topic, and finally (5) to favor the conceptual and intellectual development for the changes, that tries to favor the teaching of autonomy, facilitating the acquisition of an own method of learning.

After reviewing the classification by Kember (2000), it might be distinguished a categorization that could be included in the two models of education that were stated above. The first classification could be related to the traditional approach where teachers are the center of the learning process, and all educational activities depends on them. However, the second and third classification could be approached from a constructivist view where student and learning are important, as well as their interaction with the teacher to acquire knowledge. Below is table 4 that represents this classification.

Table 4
Model of three levels based on the traditional and the constructivist approach.

Traditional approach	Constructivist approach

a) Teacher and content centered.	b) Student and learning centered.	c) Centered on the interaction between teacher, learner and knowledge.

Adapted from Kember (2000).

In addition to this main categorization, Kember (2000) went in depth and differentiated the conceptions of teaching and learning in five categories as shown on table 5.

Table 5
Classification of conceptions of teaching and learning from a constructivist and a traditional approach.

Traditional approach	**Constructivist approach**	**Constructivist approach**	**Constructivist approach**	**Constructivist approach**
To impart information.	Teaching as illustrating the application of theory to practice.	To promote the interaction between teacher and student.	To facilitate the understanding and comprehension.	To favor the conceptual and intellectual development for the changes.

Adapted from Kember (2000).

Even though this categorization is more in depth that the only division of conceptions by being traditional or constructivist, most of the conceptions presented by this author are based on a constructivist approach. The only conceptions that would be traditional would be the first one that implied the teacher transmitting information to the student, being the pupil a mere passive agent in the process; however, all the other conceptions implied a deeper interaction with the other agents implied in education. In other words, it would not be a separation between teacher and students, but both of them working together to achieve a certain objective; in this situation, the acquirement of knowledge. One of the problems regarding this classification is that conceptions of teaching and learning would be together and not differentiated as two different concepts: to teach, and to learn.

The study conducted by Boulton-Lewis et al. (2001) also analyzed the conceptions of teaching and learning. They established four categories of analysis to conceptions of teaching that are: (a) transmission of contents and skills, where they perceive teaching as imparting information and skills that students need to take in, where the teacher and the content is in focus and the students are a passive agent in the process. (b) Development of skills and understanding, where the teacher directs the learning process, allowing students to participate, focusing on students achieving the teacher's level of skill and understanding. (c) Facilitation of the understanding, that focuses on the teacher and the learner working together to build personal meaning, and (d) transformation, that allow the teacher to create and organize the situation in order to provide the sufficient stimulus for the student to learn, and then, vanishing into a second term for student to take action in extending themselves cognitively/behaviorally/affectively.

Moreover, they also established four categories of conceptions of learning: (a) acquisition and reproduction of content and skills, where the focus is in the skills and content that the student needs to learn, understand and practice, (b) development and application of skills and understanding, that engages the student as a participant in the learning process, which is to accomplish a certain level of competency in a specific subject area by teacher instruction, (c) development of understanding, that focuses on the student working with the teacher in the process of building meaning and understanding, and (d) transformation, that focuses on the learner as a whole individual engaged in growing cognitively, behaviorally and affectively.

This classification suggested by Boulton-Lewis et al. (2001) not only proposed four categories for teaching conceptions and four for learning conceptions, but also the reader can differentiate the constructivist and traditional approaches inferred in the categorization. As a matter of fact, it can be implied that there are two categories for each conception in the constructivist approach, and two categories for each conception in the traditional approach. This investigation was also directed to determine categories of teaching and learning at a secondary school level. The conceptions are presented in table 6.

Table 6
Conceptions of teaching and learning based on a constructivist and a traditional approach.

Constructivist teaching		**Traditional teaching**	
Conceptions of teaching	**Conceptions of learning**	**Conceptions of teaching**	**Conceptions of learning**
Facilitation of understanding.	Development of understanding.	Transmission of contents/skills.	Acquisition and reproductions of content/skills.
Transformation	Transformation	Development of skills/understanding.	Development and application of skills/understanding.

Adapted from Boulton-Lewis et al. (2001).

Again, it is stated in another research that the conceptions of teaching and learning can be seen from the two main models in education. In addition, the classification by Boulton-Lewis et al. (2001) consists of the same amount of items in each category, so conceptions of teaching and learning have the same amount of categories, and it also correlates with the traditional and constructivist approach.

Chan and Elliot (2004), and later Cheng, Kwok-Way, Tang and Cheng (2009), considered that teachers' conceptions were found on their experiences and beliefs working as teachers, as well as the methodology they used to implement their practices. These authors classified conceptions in two big groups: (a) traditional conceptions, and (b) constructivist conceptions.

The traditional learning conception views the educator as a capable agent to transfer knowledge, and the learner as a passive individual in the teaching process. This model or conception give special attention to learning by receiving information, especially from the professor, and from textbooks and school materials. These would help students achieve and learn concepts that need to be assimilated. In addition, the teacher is seen as a body of authority and a source of knowledge. Teaching is seen as a process of transferring knowledge from an expert (the teacher) to a novice (the student). Learning, then, is the absorption of this.

Otherwise, the constructivist learning conception emphasizes the construction of active learning atmospheres that allows critical thinking, discovery, and collaboration. This is also accomplished by teachers having sophisticated epistemologies. In addition, learning takes place when the learner acquires knowledge through a higher level of thinking abilities. Teaching is then a provision and facilitation of the learning process, rather than a transmission of knowledge. In addition, constructivism beliefs that individuals construct their knowledge by interacting with other students and the teacher, as well as the environment. The external factors would build the understanding of the world. Below is table 7 with this representation.

Table 7
Classification of conceptions from a constructivist and a traditional approach.

Constructivist approach	Traditional approach

Centered on the student.	Centered on the teacher.

Source: Chan and Elliot (2004).

Chan and Elliot (2004) proposed a perspective centered in these two main models in particular. These authors did not establish any subsection in the main categorization, but they based their research on conceptions in the constructivist and traditional approaches. Their approach is simple and synthesized, and they considered the student and the teacher as the most important agents in education. In addition, the categorization that they proposed was well defined and stated, and other authors further used it in their investigations (Cheng et al., 2009). Finally, they tried to unify the gap between beliefs and conceptions, and they found that some beliefs correlated with the conceptions about teaching and learning.

Woolley, Woan-Jue and Williams (2006) started some research on teachers' beliefs about teaching and learning. They first established a categorization based on the constructivist and traditional teaching processes, and they recognized four types of conceptions: (a) traditional management (TM) which is teacher centered, and it implies to create control over students, to direct instruction, to take care of material for the students, and the teacher to be the principal agent controlling and directing classroom management. In summary, the teacher was in control of the environment and the classroom situation. (b) Traditional teaching (TT), in which teacher are responsible of the teaching process. They are the principal agent when teaching, and students follow the teacher and their practices. In addition, it is based on a more classic style of teaching where tests are based on a paper-pencil basis instead of using computers.

(c) Constructivist teaching (CT), which is based on students to build and develop curriculum. In addition, it believes in the interaction with other students, in deeper assessments that give meaning to leaning, and classroom activities that are based on student's interest. Finally, the (d) constructivist parent (CP), which implies the teacher supporting families, communicating with parents, and inviting families to be part of the educational community. After the implementation of their survey, the authors decided to reduce the classification from four items to three because it seemed more reasonable. In addition, constructivist parent was not an item that could correlate with conceptions. Below is table 8 with the aspects that they proposed.

Table 8
Classification of conceptions of teaching and learning from a traditional and a constructivist approach.

Traditional approach	Constructivist approach
Traditional management (TM)	Constructivist teaching (CT)
Traditional teaching (TT)	Constructivist parent (CP) (this item was further removed from the study)

Adapted from Woolley et al. (2006).

This classification was intended to create awareness of the theoretical basis of the teaching practices by educators. In addition, it wanted to show the change experienced by student-teachers on their journey to become in-service teachers. However, one of the weaknesses of this classification is that it was more based on beliefs than in conceptions, and sometimes these two concepts may be considered different, even though both concepts hold some similarities.

From another perspective, Doménech, Traver, Odet and Sales (2006) stated four sorts of teaching categories based on: (a) the teacher (traditional approach) that would be centered on the teacher, and he would be considered as the individual that holds all the knowledge. Teaching would be directed by the professor, and centered on his authority. In addition, knowledge would be valued by the quantity of content that students could assimilate and learn instead of by the quality. The methods used by the teachers would be basically the exposition, and the evaluation would be formative.

(b) The student (cognitive approach), where the student would be the center of the teaching process. In addition, the teacher would not direct instruction, but would guide the process. It would also allow the student to build its own knowledge and would center the evaluation in the process instead of only in one assessment. (c) The process (humanistic approach, psychotherapy), where human beings have a natural desire to learn and it is important to develop socio-affective abilities. The instructional design would be flexible, and they would criticize the strictness at the school. In addition, the evaluation would be a constant process instead of a unique assessment. Finally, (d) the product (behaviorist approach), where the planning and establishment of objectives would be the basics of this category. The teacher would also allow the student to exercise a large amount of practical activities, and the evaluation would be based on the assimilation of the objectives. Below is table 9 with a representation of this classification.

Table 9
Classification of teacher conceptions based on four approaches.

Traditional approach	**Cognitive approach**
Centered on the teacher	Centered on the student
Humanistic approach	**Behaviorist approach**
Centered on the process	Centered on the product

Source: Doménech et al. (2006).

This classification allows to describe clearly and operatively the educational beliefs of the teacher from two opposite axis that are the teacher versus the student; or the process versus the product. Differently from the other classifications that have been reviewed above, the classification by Doménech et al. (2006) would be based in four main approaches of teaching and learning instead of two. In addition, this categorization would allow to classify the conceptions of teachers efficiently and quickly. These authors created a questionnaire with different items in each approach, to gather data from quantitative studies. They believed that it would be faster and would allow to gather more information in less time. However, it would not be as in depth as the qualitative analysis. In accordance to what they stated, the questionnaire would allow to identify the educational profile of the teachers and to analyze the correlations that become from their beliefs.

Then, Alger (2009) conducted a study to determine if teachers' conceptions of teaching and learning could change over time, and what would be the factors that could control the assimilation of one or another conception. In their investigation they identified teachers' conceptions according to six metaphors. Four of these were teachers-centered: (a) guiding, where the teacher leads the student to acquire knowledge even though the path might be hard sometimes. Never leaves the student alone. (b) Nurturing, where teachers will help and provide student with the proper environment they need to learn and grow. (c) Molding, where the teacher will provide and encourage pupils to learn knowledge. Sometimes, the teacher will have to push and insist them to get the proper development, and (d) transmitting, which it implies the teacher to transmit his knowledge to the student.

The last two were student-centered: (e) providing tools, where the teacher will ensure the facilitation of understanding by providing tools to students, and (f) engaging in community, in which the teacher will encourage the student to participate in social constructivism. Students will build knowledge not only individually, but also with the interaction with other student and the teacher.

By the metaphors established by this author, it could be inferred that the student-centered metaphors were related to a more constructivist approach, while the teachers-centered were associated to a traditional approach. This perspective is shown below on table 10.

Table 10
Classification of teacher conceptions from a traditional and a constructivist approach.

Traditional approach/teacher-centered				Constructivist approach/ Student-centered	
Guiding	Nurturing	Molding	Transmitting	Providing tools	Engaging in community.

Adapted from Alger (2009).

Alger (2009) defined the teacher-centered metaphors related to a plant that needed to grow. The author compared this plant to the student. In the student-centered metaphor, the student was compared to a worker that was building a project. One of the weaknesses of this classification could be the teacher-centered approach in which some of the metaphors could also be used on a student-centered process. As stated in literature, when instruction is teacher-centered, the teacher is the main subject in teaching and learning; however, it seems that this classification allows for the student to be part of the process instead of only being a passive agent.

In addition, Tigchelaar, Vermunt and Brouwer (2014), conducted a study among second-career teacher conceptions of teaching and learning. Among those teachers, they found four different categorizations: (a) subject-centeredness, in which the respondents considered that the subject they taught was the most significant element in the teaching practices. In addition, the teacher was seen as an instructor and authority who had the main job of sending messages. (b) Learning environment-centeredness, in which different types of teaching are significant as a central issue. The teacher is seen as an instructor and a classroom manager. (c) Learning-centeredness, in which the most important is the different manner in which educators instructs their pupils. In this situation, the role of the teacher is as an instructor, adapting the teaching practices to the different levels of the students, and finally (d) student-centeredness, in which the construction of knowledge is the main element to build this conception. The teacher is a mere facilitator of the students' learning, in which students are the most significant element of the process. The classification proposed by these authors also corresponds to a constructivist and a traditional perspective. A categorization will be presented below on table 11.

Table 11
Conceptions of teaching and learning based on the traditional and the constructivist approach.

Traditional approach		**Constructivist approach**	
Subject-centered	**Learning-environment centered**	**Learning-centered**	**Student-centered**
Subject is the most important.	Different issues are important.	Instruction is the most important.	Students are the most important.

Adapted from Tigchelaar et al. (2014).

The classification proposed by Tigchelaar et al. (2014) contained four different categorizations of teaching and learning. This four categorization could also be divided into two main categories referred to a traditional and a constructivist approach. In addition, this research was conducted among a large number of teacher that already hold a degree, and they were pursuing a second career.

Another study conducted by Martin, Pozo, Mateos, Martin and Pérez-Echeverría (2014), investigated infant, primary and secondary teacher conceptions of teaching and learning, and they found a plurality in their responses. This meant that most of the teachers hold more than one conception resulting in a type of profile. In addition, they seemed to observe that teachers in upper levels and with more experience hold a more traditional approach to teaching and learning.

In their investigation, they found three conceptions of teaching; as well as three conceptions of learning. Those conceptions were associated with educational theories. The first one was (a) interdirect, in which teacher gave a high amount of interpretative and direct responses, and very few constructive responses. (b) Interconstructive, that were those teachers that based their responses into a constructivist and an interpretive theory, and finally (c) constructive, that were the teacher that hold a more constructive view with some interpretative responses. Those responses will be shown below on table 12.

Table 12
Conceptions of teaching and learning based on three perspectives.

Interdirect	Interconstructive	Constructive
Interpretative view	Constructive and interpretative view	Constructive view

Source: Martin et al. (2014).

The results presented by these authors resulted in the appearance of the three conceptions for teaching and learning that were based in the interdirect and constructivist theory. The constructive theory is based in the constructivist approach while the interdirect is based in a more traditional approach. This classification would also refer to the two main theories in education such as the constructivist and the traditional approaches.

Finally, Arancibia and Badia (2014) led an investigation among secondary history teachers' conceptions of teaching and learning. They considered conceptions as a set of cognitive representations with an explicit characteristic about a specific topic, and they found three categories of conceptions: (a) transmissive/reproductive, where knowledge is objective and can be transmitted from one individual to another; (b) individual constructive, where learning consists of an internal process of acquiring knowledge through personal views; and (c) social constructive, in which knowledge is acquired through interaction with the environment and other individuals. Their representations will be presented below on table 13.

Table 13
Conceptions of teaching and learning based on a traditional and a constructivist approach.

Traditional	Constructivist	
Transmissive/reproductive	**Individual constructive**	**Social constructive**
Knowledge is objective and can be transmitted.	Knowledge is subjective and is acquired through personal perspective and experiences.	Knowledge is subjective and acquired through interaction with environment and other individuals.

Adapted from Arancibia and Badia (2014).

The classification proposed by Arancibia and Badia (2014) presented three types of conceptions that could refer to a traditional and a constructivist approach. In this situation, the first category of transmission and reproduction of knowledge be included into the traditional approach, while the individual and social constructive would refer to a more constructivist view of teaching and learning. The classification is relevant and interesting for this research because it considers the two main theories of education.

After reviewing this first section of the literature, it can be appreciated that most of the authors separated conceptions in a more traditional or a more constructivist approach. Even though some of the researchers did not state it in their investigation, it can be appreciated by the descriptions and categorizations that they considered. It was also believed that a table would be more visual to understand these similarities in each classification, and because of these reasons, the tables stated above included the authors' conceptions, and the addition of the constructivist and traditional titles.

Because of the nature of this research, it is believed that one of the most significant classification was the one presented by Chan and Elliot (2004); and further used by Cheng et al. (2009). The reasoning will be further explained in another section below, but overall, it may be considered a classification that obtained significant results and also explained the two main theoretical approaches in education.

2.3 Classification of teacher' conceptions of teaching and learning with technology

If there are only a few studies that focus on the conceptions of teaching and learning, there are still fewer studies regarding the conceptions of teaching and learning with the use of technology. Furthermore, only a few authors implemented research on history and science high school teachers that use technology in the classroom. This section is intended to gather some studies that referred to conceptions, in order to construct the theoretical framework for conceptions of teaching and learning with the use of technology.

First of all, the study conducted by Drenoyianni and Selwood (1998) described British professors from elementary school thoughts regarding the use of technology in the classroom. They analyzed the conceptions of teachers when they used technology in the classroom, and they found four conceptions: (a) social, using technology to prepare students for the challenges of the future, (b) vocational, to prepare students for the work field, (c) pedagogical, to use technology to help in the educational processes of learning defined in the curriculum, and (d) catalytic, as a tool to transform and innovate in the teaching practices.

In this main four categorization, the reader can identify two groups of teachers: (1) vocational: the ones that believe that they need to know the functionality of computers; and (2) pedagogical: the ones that believe that technology is a tool to facilitate and improve the educational practices of teaching and learning. The results of this study exposed a connection within the conceptions of the use of computers, and the actual use that educators do of computers in the classroom. Even though the study was focused on the use of technology in the classroom, the authors also included a categorization that could be used from the perspective of conceptions of teaching and learning with technology. Below is table 14 with a representation of this classification.

Table 14
Classification of teacher conceptions with the use of technology.

Teachers' conceptions when they use technology in the classroom			
Vocational		**Pedagogical**	
Social	Vocational	Pedagogical	Catalytic

Adapted from Drenoyianni and Selwood (1998).

In these four categorizations, it is implied that the first two used technology as a tool, as a simple device to fulfill a goal or objective. However, the two following sections that implied the pedagogical and catalytic conceptions considered technology not only a device, but also a tool to improve educational practices. This conceptions could also lead to better educational performances by teachers, who would see technology as an innovative tool to improve in education. In addition, they could do a more in depth use of this devices providing not only an instrument for the students, but also a source of knowledge.

In addition, another study regarding conceptions of teaching and learning with the use of technology was found. The investigation conducted by Levin and Wadmany (2006) analyzed the conceptions of teachers about teaching, learning and technology in correlation with the teaching practices in the classroom. The results of their study showed that after many years of teaching with technology, the conceptions of teaching changed significantly. However, the implementation and introduction of a considerable amount of technology did not mean to introduce it in an innovative and successful way in the teaching environment. Below is table 15 that the authors created to compare the conceptions, models and technology.

Table 15
Categories of teachers' views on learning, teaching, and technology, and their actual teaching practices.

Conceptions of learning	Conceptions of teaching	Teaching models	Views on technology
Behaviorist orientation	Passing information	Direct instruction	Technical interest
Cognitive constructivism	Transmission of knowledge	Collaborative learning	Communicative or practical interests
Social constructivism	Meeting students' needs	Cognitive apprenticeship	Emancipatory knowledge interests
Radical constructivism	Helping students become independent learners	Discovery learning	

Source: Levin and Wadmany (2006).

In the first row of the table, it can be appreciated that technology is a tool to help educators transfer knowledge to students. In addition, there is not a specific goal to achieve competencies with technology; the second row is described as a feeble form of constructivism, in which there is still the transmission of knowledge but it might be in a collaborative way. Technology is also used in a more subjective perspective; the third row, learning implies the construction of meaning cooperatively within social activities and interaction. In addition, it implies to meet the students' needs, as well as to teach from a more constructivist paradigm. Finally, the last row implies a more constructivist approach, where learning is discovering how knowledge is built.

This perspective is also related to the traditional and constructivist models, but it implies technology, which is the reason why it was not considered in the first section of the studies reviewed above. Even though there has been a vast amount of research on this topic, literature has indicated that not a lot of authors studied the conceptions of teaching and learning from the perspective of using technology. Because of this reason, this section was only able to include a couple of studies focused on this matter.

2.4 Classification of teachers' beliefs

If it is true that the aim of this research is to focus on the conceptions of teaching and learning, it is also important to take into consideration the authors that mentioned teachers' beliefs of teaching and learning. The principal reason to consider beliefs is because conceptions and beliefs have similar meanings in writing, even though the academic literature has made significant efforts to differentiate between both terms. In the following paragraph, the reader will be able to find a little summary of some of the most relevant classifications regarding this topic. In addition, the classifications proposed by these authors save close similarities with the denomination of conceptions that has been analyzed before.

Richardson (1996), and later mentioned in another research conducted by Leavy, McSorley and Boté (2007), identified teachers' beliefs as being resultant from three main sources. The first one was (a) personal practices of distinct teachers have been understood to affect methods of teaching, in particular experiences of community (Clandinin & Connelly, 1991) and of parenting (Bullough & Knowles, 1991). In this first belief, it is understood that teachers are affected by their experiences while teaching, at the same time that they consider that to become a good teacher cannot be achieved, unless facilitated through experience. (b) Experience with education and teaching influences beliefs about children's acquisition of knowledge (Anning, 1988) and the role of educators (Britzman, 1991), and are considered to be more powerful impacts on beliefs than practices supported by teacher education courses (Brousseau, Book, & Byers, 1988; Feiman-Nemser, 1983; Lortie, 1975).

Again, it is believed that personal experiences are the base of teacher beliefs more than any other course or professional development that educators can attend to. Even though theory might play a large role on the understanding and the foundation of one's perspective, teachers' beliefs will not be acquired until it comes to the real practice when individuals have contact with the real environment where they teach. Finally, (c) formal knowledge in the background of educational knowledge (Clift, 1987; Grossman, 1990), which even though it is not considered as relevant as other factors, has been recognized to effect teacher beliefs. This last classification would imply that the achievement of specific knowledge at schools could determine teachers' beliefs, however, it might not be as important as other beliefs. Below is table 16 with a summary of this classification.

Table 16
Classification of teachers' beliefs.

	Teachers' beliefs	
Personal practices.	Experience with education and teaching.	Formal knowledge in the background of educational knowledge.

Source: Richardson (1996); Leavy et al. (2007).

After reviewing these beliefs about teaching, it can be appreciated that teachers strongly believe that they can only become good teachers through experience. This experience is acquired at the educational environment where they can interact with students. In addition, once the individual gains these beliefs, it is extremely difficult to change because they internalize them. Possibly, one of the ways to change these beliefs that are already adopted would be through building the new ones on the beliefs that teachers already have (Calderhead & Robson, 1991). In addition, these beliefs related to the conceptions of teaching and learning related to personal experiences and the environment, which would affect the outcomes of the teachers.

2.5 Classification of teachers' beliefs with the use of technology

In this second section regarding beliefs, the focus will be on beliefs of teaching and learning with the use of technology. In addition, this section might include some classifications that related to the theoretical models in education, but from a beliefs' perspective.

A first classification would be the one proposed by Albion (1999), who suggested four classifications of the nature of beliefs: (a) teacher efficacy, that included beliefs about confidence that might affect the performance of the student, (b) epistemological beliefs, that referred to the nature of knowledge and wisdom, (c) self-concept, about perceptions of oneself, and (d) self-efficacy, that referred to the confidence of the individual to perform specific tasks. This belief is also about the capacity that each individual has to affect a behavior, and the belief that the behavior will result in a particular ending. The classification is shown below on table 17.

Table 17
Classification of beliefs about teaching and learning with technology.

Beliefs about teaching and learning with technology			
Teacher efficacy	Epistemological beliefs	Self-concept	Self-efficacy

Source: Albion (1999).

In this classification, there is a specific category that the authors considered of special interest. That one was the "self-efficacy". The reason was because this belief plays an important role defining behavior.

Even though beliefs might influence teachers to use technology in a determined manner, there are other factors that might influence the use of technology in the classroom. As an example, the quantity of technology as well as the accessibility of hardware and software. In addition, it also implies a large amount of time for the teachers to prepare their lessons correlated with the curriculum. If it is true that beliefs are forged by teachers' experiences, it is also true that not only beliefs determine the use of technology or what teachers think about their use.

Then, Ertmer (2005) classified beliefs regarding (a) personal experiences, in which each individual conform their beliefs through personal experiences, and the change in these beliefs might depend on each personal practice. In addition, those beliefs are strengthened through social accord, and highly resilient to change. Some of those beliefs might include the identity of the individual, as well as other beliefs that are common with others. (b) Vicarious experiences, which are considered to be a tool to inform and motivate the teacher. It builds self-confidence and competency. These beliefs are constructed through direct understanding, but are not affected by external influences; (c) social-cultural influences, which involve personal experiences to build teachers practices and beliefs, as well as the environment where the teacher is located. All this factors would influence the perspective in which they perceive the world. Below is table 18 with a representation of this representation.

Table 18
Classification of teacher belief with the use of technology.

Beliefs about technology		
Personal experiences	Vicarious experiences	Social-cultural influences

Source: Ertmer (2005).

The classification proposed by Ertmer (2005) not only involved the term belief, but she also went further and investigated the beliefs when using technology. The author considered that these three strategies could influence change on teachers' perceptions and outcomes, when using technology to teach and learn. This categorization appeared to be simple but implied many characteristics in each category. In addition, the creation of those categories was based in the study of other authors' studies (Becker, 2000; Griffin & Ohlsson, 2001). Even though it is an interesting classification, it is believed that it does not support the nature of this specific research as precise as the categorization of conceptions by theoretical models. In addition, it refers more to beliefs than conceptions, even though this section took upon consideration beliefs as a part of a conception.

Bai and Ertmer (2008) classified beliefs about learning, teaching and the student, identifying three factors: (a) beliefs based on the student about the student, learning, and teaching. This first belief would be learner-centered and from a constructivist approach. In addition, it would include all the agents involved in the teaching process, the teaching and learning. (b) Non-learner beliefs about the learner, which would be non-learner-centered, more into a traditional approach, in which this non-student could be the teacher, and they could construct their beliefs based on what students are and perceive in education, and (c) beliefs based on the non-learner about learning and teaching. This last belief is again not centered on the student but in other agents that are not external to education, but not the principal agent in the learning process from a constructivist view.

In addition, this third belief might be categorized again from a traditional perspective since it is not student-centered. The authors based their instrument on the "Teacher Beliefs Survey" by McCombs and Whisler (1997), which included thirty-five items rating from one to four on a Likert scale. In an earlier study, the author also described two different obstacles that could affect the implementation of technology by the teachers. The first one could be (1) extrinsic to teachers, and would involve the time, support, and access to specific devices. The second was (2) intrinsic to teachers, and would include teachers beliefs about technology. In this second barrier, it is a more personal view about technology, and teachers play an important role on the use and implementation of it. In addition, personal experiences would be an important issue in order to use technology in the classroom. The representation of this classification is shown below on table 19.

Table 19
Classification of teachers' beliefs about teaching, learning, and learners.

Teachers beliefs about learning, teaching and learners		
Constructivist approach	**Traditional approach**	
Learner-centered beliefs about learners, learning, and teaching	Non learner-centered beliefs about learners	Non learner-centered beliefs about learning and teaching

Adapted from Bai and Ertmer (2008).

In the table above, there has been an added row in which it can be contemplated the two perspective of education: the ones that are learner centered and are more focused on a constructivist approach; and the ones that are nonlearner-centered, and are based on a more traditional approach. This classification included the learner, the teacher and the learning process, but from a different perspective that the ones analyzed before.

Then, the study conducted by Hermans, Tondeur, Van Braak and Valcke (2008) on the basis of Beijaard (1998), considered that teachers' beliefs could be considered as individual conceptions about different ways of teaching and learning. This categorization saves some similarities with the definition of conceptions that has been defined in the sections above. The authors also sustained the hypothesis that teachers' beliefs could be considered important factors that determine teacher's opinion on the adoption and implementation of technology in the classroom.

Their results showed a positive effect on the constructivist conceptions of the use of technology in the classroom. In the other hand, the more traditional conceptions have a negative effect in the use of technology in the classroom. This investigation was focused on the two main approaches that have been mentioned before, and the ones that also correlate with the approach of teachers' conceptions presented by Chan & Elliot (2004): the constructivist and the traditional approach. Even though their investigation was more related to teachers' use of technology in the classroom, it is believed that their contribution is of special interest because they considered beliefs and conceptions as one of the important issues to use technology in the classroom.

Furthermore, in another research conducted by Tondeur, Hermans, van Braak and Valcke (2008), the authors also established a categorization of teachers beliefs with the use of technology, based on Woolley and Benjamin (2004) approach, which determines two types of educational beliefs: (a) traditionalistic; and (b) progressive. The traditional teaching mainly focuses on traditional approaches to the curriculum and assessment. The progressive teaching embraces student-centered approaches to teaching and learning. This approach is also similar again to the approach of traditional and constructivist conceptions proposed by Chan and Elliot (2004). Below is table 20 with a representation of this classification.

Table 20
Classification of beliefs of teaching and learning with technology.

Beliefs of teaching and learning with technology	
Traditional approach	**Constructivist approach**
Traditionalistic beliefs	Progressive beliefs

Adapted from Tondeur et al. (2008).

This categorization is particularly interesting because they also believed that the use of technology could be categorized into a constructivist and a traditional approach. These two categories presented by these authors pointed that the traditional approach would be focused on the curriculum and outcomes from the students' performances; while the progressive approach would take into account the student as a main subject in the learning process, as well as the development of teaching and learning.

2.6 Final considerations and proposed classification

The analyses and review of the investigations presented above introduced different topics into this first chapter. The first one was the meaning of conceptions, where a general connotation of this concept resulted from the analysis of the literature. Second, an in depth analysis of the conceptions of teaching and learning emerged, based on the two main theoretical models: constructivism, and traditional. Third, a classification of conceptions of teaching and learning with technology was presented. Fourth, the concept of belief was also considered, and finally, the classification of beliefs with the use of technology was introduced.

The meaning of conception has been perceived of special interest due to the different meanings that authors have granted to this concept (Boulton-Lewis et al. 2001; Pratt, 1992). In addition, the term presented some similitudes with the term belief, which has had to be discussed in order to distinguish between both definitions. For some authors, the term conception and belief are closely connected, to the point that often, their meanings might merge, and there is not a distinction between both expressions (Beijaard, 1998; Hermans et al., 2008). For these authors, the word belief is seen as a conceptions, which it interconnects the term to the extent in which they cannot be excluded or detached. As a result, the final definition involves both concepts (Woolley et al., 2006).

The characterization of *conception* itself that has been considered more appropriate for this study is the one presented by Pratt (1992), which stated that each human being would build their own conceptions regarding their personal experiences. Even though that definition was from the beginning of the decade of the nineties, this fact has not private other contemporary authors to quote this definition in their studies about conceptions (Sang, Valcke, Van Braak, & Tondeur, 2009).

In the other hand, the topic of *conceptions of teaching and learning* has provided a vast number of literature and classifications. Even though some authors corresponded in the main categorization of conceptions applied to teaching and learning, a significant number of general classifications appeared. As an example, Säljö (1979) provided a classification based only on learning, and the levels of processing. Although the author did not included teaching, the meaning of conceptions was related to the definition provided by Pratt (1992). Even though their classification was further analyzed by other authors such as Dall'Alba and Beaty (1993), it only appeared to make emphasis on learning; so that, in this classification, the conception of teaching would be missed.

Another classification of this term was the consideration of teaching and learning. This type of classification included the conceptions of both activities in the educational process. Some of the significant authors that classified conceptions into these two main groups were Boulton-Lewis et al. (2001) and Prosser et al. (1994). In addition, Alger (2009) identified the conceptions into teaching and learning, but based on six metaphors that related to these two terms.

Even though the main categorization was equal, the proposal from each author was different. Boulton-Lewis et al. (2001) also studied teachers at a secondary level, but they oriented their research into obtaining information from a few number of educators and their perspectives, contrary to what it is expected in this study. In addition, this categorization kept close similarities with the classification proposed by Chan and Elliot (2004) about teaching and learning from a constructivist and a traditional approach.

Furthermore, other authors classified conceptions from a technological perspective. Levin and Wadmany (2006) proposed a classification in which they analyzed the beliefs of teachers about teaching, learning and technology in correlation with the teaching practices in the classroom. Their classification was related to the two main theories of education: the constructivist and the traditional approach and it included also technology. However, the investigation was oriented towards elementary education, and it implemented many instruments to gather data.

Finally, for most of the authors, the conceptions of teaching and learning were separated between the traditional and the constructivist approach. Two of the main authors that made emphasis about this taxonomy were Chan and Elliot (2004). Even though some of the studies that were analyzed did not specifically mentioned these two approaches, it was implied in the outcome of their studies, as well as in the definition of the terms (Alger, 2009; Tigchelaar, et al., 2014). This classification included a more general view of conceptions, but the instrument that they created could be implemented at any level, and it could be adapted to include technology.

Due to the characteristics of this investigation, the more accurate definition of conception of teaching and learning is the one established by Chan and Elliot (2004), that identified conceptions as “a set of beliefs that teachers have about their preferred practices of teaching and learning at the school, including the significance of teaching and learning, and the roles of educators and students” (p.819). This proposal projected to categorize teaching conceptions in two main groups: (a) constructivist conceptions, and (b) traditional conceptions. One of the main reasons to consider this categorization is the meaningful approach to the two main theoretical models in education. This view would give an understanding of the teachers’ perspectives when it refers to conceptions of teaching and learning.

Moreover, there are many authors that, to some extent, have focused their classification in these two main classifications (Boulton-Lewis et al., 2001; Cheng et al., 2009; Woolley et al., 2006). Even though there is theory with a mix of both approaches, it is interesting to have both sides well excluded from each other to delimitate the boundaries and the specific characteristics of each one. Having more categorizations would make the process of separating features more difficult, and it could challenge the classification of the questions in each group.

In addition, those authors did not made especial emphasis to the use of technology in their definition, but their conceptions could be implemented to teachers that use it in the classroom, as well as to teaching and learning. In addition, one of the advantages of their study is that the questionnaire was built and implemented in quantitative studies, as well as it was further used in other researches with significant outcomes that proved the research to be valid and reliable (Aypay, 2010; Cheng et al., 2009).

The questionnaire created by Chan and Elliot (2004) will be used in the present study, and it will maintain the same format and questions with no alteration of the content. It is believed that similar outcomes that those found in the authors' study will also result in the present research, leading to classify the teachers into two main categories: the constructivist and the traditional educators. In these two categories, it is believed that constructivist teachers will be more welcoming to the use of technology than traditional educators.

The method used by the authors to achieve this investigation consisted on a couple of questionnaires; one concerning to beliefs, and one about conceptions. In regarding of the results that the present investigation attempts to achieve, it is thought that the instrument related to conceptions is more appropriate than the one related to beliefs, since conceptions is the issue that is considered in this section and dissertation.

As any other research, the classification proposed by the authors also comprises some weaknesses and strengths that need to be presented when thinking about this study. First of all, the authors did not refer to history and science conceptions of teaching and learning with technology at a secondary school level. The research conducted by Chan and Elliot (2004) was administered to students of the Certificate in Education (CE) Course in a tertiary institution. In addition, neither of them was conducted taking into account technology. However, since the conceptions might be similar either using or not using technology, it has been considered of special relevance to keep the questions as they were stated in the original research. In addition, being implemented on secondary or elementary teachers does not change the format in which they should be presented.

Another weakness that the reader might find in this particular classification is the quantity of questions in each sections of the instrument. Teachers' constructivist approach holds twelve questions; while the traditional approach covers eighteen. Even though there is a significant difference on the total of questions in each section, it might not become a problem when implemented, since the number might not influence in the outcomes. In addition, each section is well delimited and does not influence or converge with the meaning of the other concept.

In the other hand, one of the strengths of the study conducted by Chan and Elliot (2004) is that they considered the two main theories in education: the constructivist and the traditional approaches. The study conducted by these authors basically implied and presented these two categorizations as the most important issues when taking into account the conceptions that teachers have about teaching and learning. Even though some authors did not specifically classified it at an equal manner, the classification has been existent in most of the literature that has been reviewed above.

Another strengthen is the methodology used to conduct the study. This research was part of a quantitative study that involved three hundred and eighty five teachers. Even though it was not applied to American teachers, the background of the participants was the same in relation to the ones expected to be reach in the United States. Moreover, they included thirty questions that could be implemented and used in the present study without altering them.

Another advantage of using this instrument is that it has been applied by other authors in similar researches such as the ones conducted by Aypay (2010), and Cheng et al. (2009). These authors also investigated about conceptions, and they decided to validate the scales for the sampled teachers. The results were that fit indexes and reliability alphas were obtained not only in one investigation, but in all of them. In addition, the overall reliability of the instrument was significantly high for all the authors.

And finally, the last strengthen is the similarities that this specific classification has with the conceptions of teaching and learning presented by Tondeur, et al. (2008). These authors presented a classification of teacher's beliefs with technology into a traditional and a progressive category, which can be identified to teachers' conceptions of teaching and learning by Chan and Elliot (2004). This similarity would allow to include technology into these categories.

In summary, this first review of the investigations about conceptions of teaching and learning has shown the relationship of this term with the two main theoretical models that has guided this research: constructivist and traditional. Furthermore, the lack of studies about the conceptions of teaching and learning with technology at a secondary level has made necessary to fulfill a research in which technology would be included, or at least, considered. In order to do so, the questionnaire created by Chan and Elliot (2004) will be used among secondary science and history teachers.

III. Teachers' conceptions of the nature of history and science

Based on the research conducted by Morrison (2009), Leaderman (2002), and Krubu (2012), it is significant to know the knowledge that teachers own about the topic in which they are instructing their students. Because of the different environment, characteristics, experiences and other circumstances regarding the educator, some teachers may not have a clear idea about the nature of the subject that they are teaching. In addition, the perception that they have about the same issue may differ.

In a study conducted by Abell and Smith (1994), they stated that in disciplines such history, the teacher's views of the subject itself would influence the way they teach; however, in science, teacher's views of the nature of the discipline might influence the conceptions that the students have about science. This section will center the attention on gathering data to analyze this aspect that affect the teacher's conceptions of the subject that they are teaching.

3.1 Teachers' conceptions of the nature of history

The first section of this chapter will be oriented into gathering data about teachers' conceptions of the nature of history. First of all, there will be a definition of the term history; then, some significant literature about the conceptions of the nature of history; and the final considerations and the proposed classification. Because of the nature of this topic, there is not a significant body of literature regarding conceptions of the nature of history.

3.1.1 Teachers' definition of history

After reviewing some articles regarding the conceptions of history by teachers, it was found that there were only a few authors that addressed the topic of teacher conceptions of the nature of history. In the paragraphs below, the reader will find a conceptions of teachers concerning the nature of history, as well as the conceptions of history itself; however, there are not a significant number of authors that emphasized this topic, and only one appeared to be significant.

The study conducted by Yilmaz (2006), gathered some information about the perspective of different teachers about history. Those educators referred to the nature of history as the epistemology of history or a way to perceive history and their values, beliefs, and historical knowledge. The educators described the discipline as: (a) interpretative, where it can be reflected the point of view, and it is based on evident interpretations by inferences, historical empathy, and creativity, (b) tentative or subject to change, where historical knowledge is not outright or permanent in that new evidence and ways of looking at the past, and advanced conceptual frameworks keep it changing, (c) subjective, where historical knowledge is loaded with theory, and it does affect the construction of knowledge in history, (d) empirically based, where he process of constructing historical knowledge involves ordering evidence about the past through different sources, (e) literary based, where different literature figures constructs the historical knowledge, and finally (f) socially and culturally embedded, where social and cultural environment affects the explanations of the teachers. A representation of this categories are shown below on table 21.

Table 21
Classification of the nature of history.

Interpretative	**Tentative**	**Subjective**	**Empirically based**	**Literary based**	**Socially and culturally embedded**
Reflection of the point of view	History is not outright and it changes over time.	Loaded with theory and subject to different interpretations.	Based on past events and evidence.	Literature figures helps to construct knowledge.	The environment might affect the teachers view.

Source: Yilmaz (2006)

The classification proposed by Yilmaz (2006) stated that the nature of history as a discipline was interpretative, tentative, subjective, empirically and literary based, and socially and culturally embedded. The author included many characteristics that helped to build the definition of this topic. From this perspective, history is not only a simple and singular topic, but it includes many characteristics that build the subject.

3.1.2 Teachers conceptions of the nature of history

After this brief introduction on the meaning of history by Yilmaz (2006), the following section will introduce different authors that provided a perspective of the conceptions of teachers on the nature of history. Even though history is one of the main subject in most of the school curriculums, there is only a few literature regarding this topic.

The first classification is the one provided by Goodman and Adler (1985), which conducted a study among elementary students and teachers, and they found five classes of conceptions of social studies. Those conceptions were: (a) social studies as a non-subject, in which social studies was not considered a major subject in the program because it was not included in the early experiences of the learners, only math and reading was considered important, (b) social studies as human relations, in which the subject was considered to teach students on how to build human relationships, rather than being a bridge to acquire knowledge on that specific matter, (c) social studies as citizenship, in which social studies was observed to teach learners on how to be indiscriminating and devoted to the political and economic institutions of the society to be considered a good citizen.

In addition, this perspective endorsed that being an American citizen would be the best; as well as comparing the USA nation to other nations in the world to understand that this specific society would be more advanced than others, (d) social studies as school knowledge, in which social studies was seen as the acquirement of knowledge based on textbooks, where students had a passive role in the learning process. They were confined to obtain information without questioning, or using other high order thinking skills, and finally (e) social studies as the great connection, in which the teacher was able to connect a social studies lesson with another subject such as math. As an example, students would be measuring map distances in the math class, and then linking it to a social studies lesson. All of those that held this perspective had a more independent perspective in which knowledge was integrated and provided from inside and outside the school. This classification is presented below on table 22.

Table 22
Classification of the conceptions of the nature of history.

Social studies as nonsubject	**Social studies as human relations**	**Social studies as citizenship**	**Social studies as school knowledge**	**Social studies as the Great Connection**
Social studies not being considered a major subject.	Social studies as teaching children techniques of human relations.	Social studies as teaching students the value of being a good citizen.	Social studies seen as textbook knowledge.	Social studies as integration of knowledge.

Source: Goodman and Adler (1985).

This classification from Goodman and Adler (1985), is interesting even though it dates from twenty years ago. It has four first categories in which social studies is barely considered part of the curriculum in elementary schools because it is scarcely seen in lower grades; in addition, the teacher has an active role while students are passive learners; however, the last perspective sees social studies as being integrative of other subjects and it can be acquired inside and outside the schools. This last perspective has a more constructivist approach while the others conserve a more traditional point of view.

In addition, this categorization considered social studies as the main classification instead of just history. As a matter of fact, history is part of the social studies discipline. This issue made this classification valuable, because it might refer not only to history, but also to other disciplines included into the social studies group, and that teachers teach as part of a whole.

Then, Evans (1988), investigated educators and students' conceptions of history in three studies. In the first study, he classified conceptions of history in: (a) social activist and reformer, were the main purpose of history was to find a solution to modern problems that society has to face, (b) the cosmic philosopher, were the main purpose of studying history was to help student construct a knowledge based for understanding the human beings, and (c) storyteller, were history was meant to understand modern issues in order to make proper decisions. This representations is shown below on table 23.

Table 23
Classification of the nature of history based on the orientation to teaching.

Social activist	Cosmic philosopher	storyteller
History to find a solution to modern	Help students construct knowledge.	Understand modern issues.

	problems.

Source: Evans (1988).

This first classification by Evans (1988), considered history as a problem-solving subjects to help resolve issues that might happen in the world, and that students might have to face in this modern society. In addition, it tried to give a wide understanding of the world around.

In a subsequent study, Evans (1989) identified five categories of teacher conceptions of history: (a) storytellers, where the knowledge of other times, people and so on were the most important aspect for studying history, (b) scientific historians, that focused on the acquisition of knowledge and understanding of historical processes to study history, and in the same way, to help students develop history skills, (c) relativist/reformers, where the relationship between past and present events were important to understand current issues, (d) cosmic philosophers, where theory was the most interesting issue about history, and lastly (e) eclectics, where they had a very practical orientation to make students become interested in history.

Table 24
Classification of conceptions of the nature of history.

Storytellers	**Scientific historian**	**Relativist/reformers**	**Cosmic philosophers**	**Eclectics**
Studying history to understand problems of other times.	Acquisition of knowledge and skills.	Relationship between past and present events.	Theory as the most interesting part about history.	Practical view to make students become interested in the subject.

Source: Evans (1989).

This second classification was also revisited in a following study by Evans (1990), in which he reviewed these five conceptions again. This classification gathered different aspects of history, and viewed the subject as an integration of different factors such as the past and present events; students learning about it; understanding problems, acquiring skills and learning theory. The theory would be the most traditional part of his proposal, in which students would be immerse and active while learning about the subject.

Another study conducted by Wineburg (1991), found three main conceptions of the nature of history: (a) history as a development of understanding, where history helps understand the issues that relate to the history subject, (b) history as entertainment or as a story to be brought to life, in which history is just a subject that explains things that happen in the world around us, and (c) history as a search for accuracy, in which history tries to be precise in the facts that happen around us. Table 25 presents this classification.

Table 25
Classification of the nature of history based on the orientation to teaching.

Construction of meaning	Entertainment	Search for accuracy
History helps to understand the issues that relate to the subject.	History explains things that happen in the world around us.	History tries to be precise in the facts that happen in this world.

Source: Wineburg (1991).

This author emphasized that teachers needed to have a solid background as well as an accurate understanding of the conceptual foundations of the subject in order to be able to teach it properly. Otherwise, it would distort the content and abridge it, so the learner would not be able to acquire accurate knowledge of the facts.

Based on previous literature, Patrick (1992) investigated the different means in which secondary history teachers viewed and approached the teaching of their disciplines. The author described three broad groups of history teachers, based on how they oriented the subject, and how they taught it: (a) the first group, was represented by history teachers who emphasized delivery of the content, and made emphasis on the presentation and technique to teach content. That group of educators perceived the students' relation to the subject matter as secure and without problems. (b) The second group was oriented on how to assist students in the understanding of history and historical explanations.

In addition, the relationship between students and history was seen as problematic in that they thought that learners needed the educator's help to acquire historical understandings as teachers had. Otherwise than the first group, they saw historical facts as intricate and challenging; and (c) the third group saw teaching history as a process of interacting with students to get them to develop their own interpretations from the outset. This classification is presented below on table 26.

Table 26
Classification of the nature of history based on the orientation to teaching.

Content of history	Help to understand history	Own interpretation of history
Emphasizing the content of history.	Help students understand history, points of view and explanations.	More sophisticated view in which students build they own understanding of the subject.

Source: Patrick (1992).

This classification intended to explain teachers' conceptions of history by describing their instructional practices in the classroom. In addition, the three categories ranged from more specific and teacher oriented, such as explaining history content; to a more sophisticated view in which students were able to build knowledge of the subject by understanding and learning about historical facts. As a matter of fact, it could be classified from a more traditional view to a more constructivist view of the subject in which the learner is involved in building knowledge.

Furthermore, Vinson (1998) found five conceptions of history: (a) history as a citizenship transmission, where the meaning of social studies is the acquirement of concepts from the American culture. Teachers that hold this perspective used two principal methods that were description and persuasion. Description would be information that is communicated directly without explanation, while persuasion would have multiple understandings and the teachers would try to only convey one. (b) History as a social science, in which the content is presented theoretically to understand social sciences. It suggests that the significance of phenomena that happens in the world are based on the fundamental systems. (c) History as a reflective inquiry, in which the main characteristic is problem solving in socio-political settings, (d) history as enlightened social criticism, in which social studies aims to provide students with skills to be able to criticize and revise the problem solving to transform to a better society, and (e) history as a means to foster personal development, in which students are responsible to pursue the content that is embedded in the environment. This approach believes that students should search on their own experiences and build a critique perspective to understand values. This classification is presented on table 27.

Table 27
Classification of conceptions of the nature of history.

Citizenship transmission	Social science	Reflective inquiry	Social criticism	Personal development
Acquisition of content.	Theoretical content to understand social sciences.	Problem solving in socio-political settings.	Provide skills to criticize problem solving.	Students are responsible of knowledge.

Source: Vinson (1998).

This classification consists of the five approaches described above that the author based on other authors theoretical frameworks. In addition, these five categories ranged from the more traditional ones, where the more important things is to learn content; to a more constructivist one, where the student develop skills to problem-solve issues, as well as he is responsible to acquire knowledge. A large amount of participants conceptions were characterized by a common-sense of the understanding of history, such as the study of past events, cultures, and so on.

In addition, there were two different views of conceptions of history equivalent to the classification of conceptions of teaching and learning. The first one was of those teachers that had a constructivist view, and they considered social studies as a construction of knowledge through personal experiences; in the other hand, the teachers that had a traditional approach considered knowledge a public issue instead of being personal to each individual. The teaching practices were content oriented, and focused on students achieving pre-structured knowledge.

Another study conducted by Virta (2001) in the basis of a work proposal from Jaeger and Davis (1996), observed how history teachers construed historical documents. After interviewing fifteen teachers, they found three main types of history teachers with three different approaches to history: a) history as a reconstruction, that can be understood as the constructivist approach in which students are able to build their own knowledge; b) history as entertainment and narrative, with no critical touch to the indication, and no effort at pursuing for the main ideas of the texts; and c) emphasis on the accuracy of information, where it implies exacts facts that happened in the world around us. Table 28 presents this classification.

Table 28
Classification of the nature of history based on the orientation to teaching.

History as a reconstruction	History as entertainment and narrative	Emphasis on the accuracy of information

Emphasizing the content of history.	Help students understand history, points of view and explanations.	More sophisticated view in which students build they own understanding of the subject.

Source: Jaeger and Davis (1996); Virta (2001).

This perspective contains a more constructivist approach in the basis of teaching and learning, and it implied different facts about history such as reconstructing the past, searching for accurate information or narrate events. In addition, those classifications depended on the orientation of the teacher, and the perspectives that the educator hold.

Finally, the study conducted by Yilmaz (2008), proposed a categorization of the conceptions of history as: (a) the conception of history as a story of mankind, where it describes history more universally as the total understandings of the people in the world or humankind, (b) conceptions of history as an enactment of the past in one's mind, where accentuates the connectivity of the past, present, and future. It makes emphasis on the retroactive rational to comprehend the previous facts, (c) change and struggle over time, where the past might produce a significant impact on the present, and there is an interaction among people and with the environment that are noticeable in building the conception of history as a study of change and struggle over time. This conception of history is culture oriented and characterized by a diverse perception, (d) history as an interpretation of the past, that takes into consideration the method in which historical accounts or historians construct explanations; that is, it considers the process and the outcome of historical endeavor, and (e) history as a nation's memory, where history is conceptualized in the form of chronicled events of the past. This classification is presented below on table 29.

Table 29
Classification of the conceptions of the nature of history.

Story of humankind	**Enactment of the past on one's mind**	**Change and struggle over time**	**Interpretation of the past**	**Nation's memory**
Defines history globally.	Connects past, present and future.	Past impacts in the present.	Historians construct explanations.	Recorded events of the past.

Source: Yilmaz (2008).

This classification is really clear and focused on different aspects of the discipline. It has a perspective on past events influencing the present as well as teachers perspectives might influence the method they use to teach their students. It is of special interest that this research dates from a more contemporary year that would approach better the teachers' perspective to our time.

After reviewing the classifications presented above, there will be a proposal of a categorizations of history teacher conceptions of history, based on the different literature that has been described above.

3.1.3 Final considerations and proposed classification

In this second section regarding the conceptions of history, two main topics have been presented. The first one was the definition of the discipline, or how some investigators viewed history as a subject in education. The second topic was a more in depth analysis of the conceptions of the nature of history by different authors that have contributed to build the base of this unit.

As it was observed in this section, it was difficult to find authors that defined the notion of history. As a matter of fact, only one author was found to be relevant to provide information about this topic (Yilmaz, 2006). In her classification of the term, she was able to gather some data on the perspective of the term by different educators. As a result, history was defined from the epistemology of history or how to perceive history and their values. Because of that, six different characteristics ensued when applied to education. Those characteristics included a social and cultural environments, as well as different facts that apply to the research of the past, and the explanation of events.

The analysis of the conception of the nature of history in education resulted in the appearance of different views and perspectives about this matter. However, all these standpoints could be included into a classification regarding personal experiences. As an example, Goodman and Adler (1985) classified the conceptions of the nature of history based on six complex perceptions. This classification was founded on examining elementary teachers perspectives towards a larger discipline called social studies, by exploring into their beliefs and actions. Evans (1989), in the other hand, found that teachers' conceptions occupied a significant role in shaping the transmitted curriculum. Then, Virta (2001) classified the conceptions of history as a construction of historical documents. And Yilmaz (2010) found that most of the participants classified history as objective knowledge.

All these classifications appeared through the responses of teachers to queries about the topic. In addition, most of the investigations were oriented to elementary or higher education. On occasions, there were some similarities in the studies that were presented. Some of those similarities were that most of the authors agreed on describing the conception of the nature of history as a study of the past, as well as the present. Moreover, it also included the study of humankind, the facts that occurred over time; and history also helped to construct meaning, to give some sense to the world in which human beings live. However, there is a lack of a specific study adapted to secondary teachers that might include all the characteristics presented above. From the studies that have been analyzed, some were dated from a couple of decades ago, and some information might be considered outdated; however, they conserved some basics in which this study is based. This statement might imply that further research is required to address this topic more correctly, and this present study has the intention of gathering some data for this purpose.

Subsequently to reviewing the literature stated above, it is believed that another proposal needs to be presented. This need appears with the demands to attain a different purpose such as gathering data from a significant number of teachers to have a more substantial overview of this matter. The final classification has emerged from the conjunction of two investigations offered by Wineburg, (1991); and Yilmaz, (2008).

From their contributions, four categories were built regarding the conception of the nature of history: (a) history as a construction of meaning, in which each individual has different approaches to history and it helps to understand different issues. (b) History as a story of human kind, which it defines history more globally at the total experiences of the world's people. (c) History as an interpretation of the past, which history helps to explain and build explanations, considering the process and the outcome of historical endeavor, and (d) history as a study of change and struggle over time, which is culture oriented and characterized by a multicultural perspective.

Based on the research that exists and has been analyzed, it is believed that those categories include the basics of the term history as a curriculum subject.

In addition, the combination of these two studies will help to achieve a major degree of significance and validity. Below is a table 30 with a proposal on the conceptions of history based on the studies of Wineburg (1991) and Yilmaz (2008) combined together.

Table 30
Classification of history conceptions based on the proposals by Wineburg (1991) and Yilmaz (2008).

Conceptions of history	Description
History as a construction of meaning.	Each teacher had very different historical understanding, interpretations, and conclusions in her or his evaluation of historical texts. History gives human beings an approach of the facts that have happened in life and helps them to understand the meaning of these issues.
History as a story of human kind.	It defines history more globally as the total experiences of the world's people or humankind.
History as an interpretation of the past.	The view of history as an interpretation of the past takes into account the way that historical accounts or historians construct explanations; that is, it considers the process and the outcome of historical endeavor.
History as a study of change and struggle over time.	Change in the past, impact of the past on the present, and interaction among people and with the environment are prominent themes in the conception of history as a study of change and struggle over time. This conception of history is culture oriented and characterized by a multicultural perspective.

Because of the lack of existence of queries regarding this issue, the questions were created based on the responses that teachers gave on the two studies that have been selected. Those answers were adapted to suit the questionnaire, and to be proper regarding the four main categories. In addition, those questions were tested among a certain amount of teachers to ensure that were reliable and valid to apply to a larger amount of educators.

In addition, this section is intended to show the strengths and weaknesses of the classification and proposal stated above for the conceptions of the nature of history. This section will focus on analyzing the benefits and possible difficulties that might results on the use of this classification.

One of the weaknesses of this classification is that it has never been implemented as a whole in a study previous to this one; as well as it has never been implemented into a quantitative study or a large sample. Both classification proposed by Wineburg (1991) and Yilmaz (2008) were part of a qualitative study with a few participants. However, it is believed that if the questions and classifications are first validated by history teachers, they will be applicable to a large number of participants. Even though there are some weaknesses that might affect the results, it is assumed that the section with the questions about the conceptions of history will contain the pertinent enquiries that will faithfully guide this investigation.

Finally, one of the strengths that might be observed is the adaptation of the questions and categories according to the aims of this study. After reviewing all the literature, it can be appreciated that there are some classification that might fit more accurately in the objectives that have been proposed. In addition, the questions presented were built according to history teacher responses to previous studies. Due to the positive responses and results, it has been considered to be part of the final questionnaire.

In summary, the study of some investigations regarding the conception of the nature of history has left behind an open path, that claimed for a new perspective and understanding of this concept. After analyzing the literature, it was revealed that not many studies focused on this issue, as well as they were mostly based on a qualitative perspective. As a result, a new categorization was created, which included many characteristics of other studies. The objective will be to present different categories of the conception of the nature of history among secondary social studies teachers that will participate.

3.2 Teaching conceptions of the nature of science

To the contrary of teacher's conceptions of the nature of history, there are a significant number of articles regarding teachers' conceptions of the nature of science. In the following paragraph, there will be a summary of the most important literature that gathers the main classifications towards this topic, as well as a definition of the NOS (Nature of Science).

3.2.1 Definition of the Nature of Science (NOS)

First of all, Craven (2002) conducted a study among teachers about the conceptions of science and its definition. The initial classification concluded with three conceptions of science: (a) science as a fact, in which the subject presents a series of statements that imply no elaboration or explanation and it characterized science as a whole. The second classification was (b) science as a method, where science was defined as a methodology that included tests and it could be comprehensively applied to different situations, and finally (c) science as questions, where science was defined as pursuing knowledge and creating questions to respond the possible answers that could appear.

After this first classification, and by the end of the school year, the students concluded on defining science as: (a) science as multiple methods, where science was described as a set of methods, and the community had the responsibility to create rules and principles. The set of methods were used to confirm or refuse new ideas that could appear, and (b) science as enquiry, in which science had the obligation of making and confirm ideas by questioning. In addition, science was considered to gather information through different mechanisms. This first classification resulted in two main characteristics of science that relate to a conceptual framework (a), and an empirical outcome (b).

Moreover, Abd-El-Khalick and Akerson (2009), in the basis of Lederman (1998), stated that most of the times, the nature of science referred to the knowledge and understanding of science, or to all the ethics and principles intrinsic to the development of scientific understanding. However, there is not a precise or common definition of this topic (NOS), even though there are certain aspects that might be significant to all individuals.

These two definitions of the nature of science provide different perspectives on this topic, and stated that NOS might have different significances depending on each individual and their background. It is also believed, that each individual will build their conceptual structures in contact with the environment.

After the identification of those two perspectives, it is believed that each individual builds their own concepts of science regarding their background, and the environment in which they live. In addition, science involves two main characteristics or parts: the first one is theory, or everything that relates to the study of the subject, as well as the understanding of its basics and principles; and the epistemological part, that it explores why things happen or develop in a certain way.

3.2.2 Teaching conceptions of the nature of science

On a first study, Brickhouse (1986) conducted an investigation among a few number of teachers to identify the conception of science, and the author found that teacher conceptions were related to two main topics: (a) scientific processes, in which the teachers that participated considered a relationship within the procedures and different philosophies of science; the second conception was (b) scientific progress, which considered science to be a development by the increase of facts rather than by variations in theory. This classification is presented below on table 31.

Table 31
Classification of the conceptions of the nature of science.

Scientific processes	Scientific progress
This perspective offered different perspectives in how educators taught their students.	This perspective considered science to progress by accumulation rather than by changes in theory, and putting this theory in new ways.

Source: Brickhouse (1986).

This categorization is one of the first classifications that could be found regarding the conceptions of the nature of science. Even though the classification offers two main categories, those are significantly general and they could include a great amount of results. In addition, the investigation was conducted among a minor number of teachers, and three decades ago. Even though it might be a pioneer research and it might help to understand the nature of science, it is believe that there are other investigations that will ensemble more properly into the present research.

Abell and Smith (1994) conducted a quantitative study among elementary teachers in order to find the conceptions of teachers about the discipline of science and science knowledge. In addition, the authors thought that the understanding of the nature of science by the teachers, would lead to science literacy by the students. Moreover, in the same study, they analyzed and compared the conceptions resulted from Bloom's study (1989) to their own results. Bloom's (1989) defined science into four groups: (a) science as a study of the world where it is studied what it is part of science such as laws governing the environment, searching for explanations, man's relationship and interaction with the environment and so on. (b) Science as a set of processes or the methods of science, where science is the act of investigating, exploration, employment of the scientific method, problem solving, observation and so on. (c) Science as a body of knowledge, where science is considered a system of knowledge, a set of facts, a discipline, a pursuit of knowledge and gaining or learning new knowledge, for example, and (d) science as a search for new development, where science is seen as a service to man, and it contain two topics: medicine and new technology.

Abell and Smith (1994) defined science into five groups that they arranged subsequently to the students answers. The first one was discovery, which could be inserted in Bloom's category called "process". This category defined science as a procedure of finding out what occurs in the environment around us; the second category was knowledge, which was a mix between Bloom's *study of the world* and *science as a body of knowledge*. This category was defined as the subject as an outcome, as well as a cluster of ideas to be analyzed. The third category was process, where science was considered to be *observing, testing, asking and hypothesizing*. This category is thoroughly similar to Bloom's *study of the worlds*. The fourth category was explanation, in which this category responds to discovery answers.

The participants thought that there is a reason for everything that happens in the world, and it is the job of the scientists to explain it to human beings. The last category was created by the authors according to the findings and responses of the participants, and it was named education, where the perception remained from the educator instilling science, and the learner acquiring knowledge from them. This view was different to the one of scientists practicing science being not related to education. Table 32 presents this classification.

Table 32
Classification of the conceptions of the nature of science.

Discovery	Knowledge	Process	Explanation	Education
Process of findings.	The subject is the outcome.	Method that involves different procedures.	There is a reason for everything that happens.	The educator instilling science instead of doing science.

Source: Abell and Smith (1994).

The classification proposed by Abell and Smith (1994) is based on Bloom's study (1989). The categories are build regarding the answers of the participants that they analyzed. Some of those categories have been also suggested by other authors, as well as they have been implied in some definitions of science. Even though the categorization infers in different matters concerning science, the study was built upon a qualitative research among a few participants.

Cruz, Martins and Cachapuz (1996), found five conceptions to the nature of science: (a) the purposes of science, where the purpose of science is to increase the scientific knowledge and the resolution of problems that human society raises, (b) process of creating science, even though there is not a unique method for science, there exist a vast extend of methods, and each scientist uses the one it is more appropriate for the ambit that they are studying, (c) the nature of the scientific knowledge, where the constructing of science is an intend to understand the worlds, (d) status of theory and scientific laws, where investigations have to be sustained by a theory framework, and it may include different laws, and (e) relationship between science and society, where the public opinion is built through mass media, that usually emphasize the negative results of the interaction. Below is this classification on table 33.

Table 33
Classification of the conceptions of the nature of science.

The purpose of science	Creating science	Nature of scientific knowledge	Status of theory and scientific laws	Relationship between science

				and society
Increase scientific knowledge.	Vas extend of method that are used differently depending on each individual.	Science to help understand the world in which we live.	Investigations should be sustained by a theoretical framework.	Public opinion is built through mass media and it might influence in the results.

Source: Cruz et al. (1996).

This classification was founded on another research and the questions were not predetermined. This is also an old study that found five different responses to the conception of science. However, for the purpose of this research, it is not considered of special interest, even though there are some sections that could be implemented.

At a prior study conducted by Akerson, Abd-El-Khalick and Lederman (2000), they studied certain science teachers at an elementary level trying to build a solid foundation and conceptions of the NOS to help them teach properly. On that study, they found seven aspects regarding the nature of science. Those aspects were similar to the ones that would be proposed in a posterior research by Abd-El-Khalick and Akerson (2009): (a) Science is empirical, which entails that all explanations should be supported by consistent empirical practices to support what it is explain. This special particularity is what differences science from other disciplines such as art. (b) Science is tentative, which it might imply that overtime it might change due to different circumstances. (c) Science is creative and imaginative, which means that science demands of creativity and imagination in order to build new statements. (d) Science is subjective (theory laden), in which the environment and many other external factors might influence in the methodologies teachers use to teach, as well as their perceptions of the concept. (e) Science is social and cultural, as it was stated in the item before, the conceptions that each individual might have regarding the topic might be influenced by the cultural and social environment in which they live. Different values, societies and perspectives, for example, might impact the outcome. (f) Science is observation versus influence, in which scientist will observe and predict how experiments might result, and sometimes, they will infer they are right, and (g) science is theories and laws, in which these two particular concepts need to be separated. Theories are explanations of phenomena that have been observed and studied, whereas scientific laws state, categorize or define relationships among such occurrences. This representation is presented below on table 34.

Table 34
Classification of the conceptions of the nature of science.

Empirical	Tentative	Creative and imaginative	Subjective (theory laden)	Social and cultural	Observation versus influence	Theories and laws
Theory complemented with practices.	It might change over time.	This two requisites to build new statements.	Environment might influence in results.	Influenced by social and cultural environment.	Observe and predict, sometimes they might be influenced.	Differentiation of the two concepts.

Source: Akerson et al. (2000).

This classification referred to many significant aspects of the NOS literature. As a matter of facts, it seems to provide a rich variety of conceptions to define the discipline that involves not only theory, but also empirical matters. However, one of the particularities is that it was implemented among elementary teachers, as well as it was a qualitative research. The classification is of special interest, and it should be taken into consideration due to the nature of the present study.

Karakas (2001) in the basis of the investigation conducted by Akerson et al. (2000), found the same conceptions of science: (a) scientific knowledge is tentative (subject to change), (b) empirically based (based on and/or derived from observations of the natural world), (c) subjective (theory-laden), (d) partly the product of human inference, (e) imagination, and creativity (involves the invention of explanation), and (f) socially and culturally embedded. Because the classification has also been explained above, there will not be another explanation of this classification.

The research conducted by Zeidler, Walker, Acket and Simmons (2001), found fourteen characteristics of the scientific enterprise. Most of the features that they introduced had similarities with the research stated above, especially the one conducted by Akerson et al. (2000). The first categorization was (a) scientific knowledge while durable has a tentative character, where it can be change overtime due to new findings, (b) scientific knowledge profoundly relies on observation, experimental evidence, rational arguments, and skepticism, that requires science as an epistemological discipline that needs a complementation between theory and experimentation, (c) there is no one way to do science in which there are more than just one valid path to discover or to apply scientific knowledge, (d) science is an attempt to explain natural phenomena, in which the discipline is often trying to pursue new singularities to discover to the world, (e) laws and theories serve different roles in science; therefore students should note that theories do not become laws even with additional evidence, (f) people from all cultures contribute to science, where science is open to different cultures all over the globe without discriminating, (g) new knowledge must be reported clearly and openly, in order to be tested and validated to show the truth, (h) scientists require accurate record keeping, peer review, and replicability, (i) observations are theory-laden and based on previous theories, (j) scientists are creative, which it means that they are always trying to find different and specific perspectives to show discoveries to human beings, (k) the history of science reveals both an evolutionary and revolutionary character, where science has also a determined involvement of facts that might affect the discoveries, (l) science is part of social and cultural traditions, which involves the socio cultural community, (m) science and technology impact each other, and they work together to a better outcome, and (n) scientific ideas are affected by their social and historical environment, where the environment might affect the outcomes of the research.

This classification entails different categories that have been presented above, and they added some new issues to complete the groups proposed before in different studies. Even though some of the categories are similar, or sound similar, they all have a nuance of difference.

Carvajal and Gómez (2002), conducted a qualitative study over science teachers that taught chemistry, physics and biology in secondary schools. In this study they found different conceptions that they classify in two dimensions: the epistemological dimension, and the learning dimension. In the (1) epistemological dimension, the reader can find the following conceptions: (a) Origen and development of scientific knowledge, which entails teachers from constructivist and traditional approach giving their opinions about this matter. The approaches that teachers have may differ over the process, and it seems that teacher did not have any conceptions that was tied to a philosophical position. (b) Methods of scientific research, where the teacher organizes different phenomena to conduct scientific methods. This section emphasizes the collection and analysis of data to find new issues. (c) The scientific community and the utility of the scientific work, were it is understood that science teachers have a poor understanding of themselves, and they see scientists as extraordinary human beings.

The dimension of (2) conceptions of learning science and representations of teaching has different conceptions too: (d) what is to learn science?, were the teachers show how to teach science and the objectives of teaching this discipline, (e) the role of the teacher, where the teacher thinks that his job is to teach and pass knowledge to the student, (f) role of the student, where depending on the approach (traditional or constructivism), the student has one role or another. In the traditional approach the student is learning and absorbing knowledge from the teacher, while in the constructivist approach the student is active and engaged in the process of building its own knowledge, (g) role of the previous knowledge, where the teacher needs to link together what the student already knows and what will be learned, (h) teaching and learning strategies, where the teacher uses a variety of strategies to teach the students, (i) evaluation of learning, where teachers need to create a good evaluation format to assess the student learnings, and finally (j) design of the experimental activity, where it implies the teacher planning all the activities to implement in the classroom. This classification is presented below on table 35.

Table 35
Classification of the conceptions of the nature of science.

Epistemological dimension	Learning dimension
(a) Origen and development of scientific knowledge. (b) Methods of scientific research. (c) The scientific community and the utility of the scientific work.	(d) What is to learn science? (e) The role of the teacher. (f) Role of the student. (g) Role of the previous knowledge. (h) Teaching and learning strategies. (i) Evaluation of learning (j) Design of the experimental activity.

Source: Carvajal and Gómez (2002).

This classification had two different perspectives: the practical perspective, in which science involves to prove and state what it is found; and the learning process, which includes the teacher, the learner, the content, what is learned and so forth. In addition, this classification was conducted among a sample of 66 teachers from different disciplines such as physics, biology and chemistry. The research also involved the different models in education such as the constructivist and traditional approaches. The questionnaire was of special interest because it was formulated in a close-question basis, in which teachers had to answer their degree of agreement with the statement presented.

In a qualitative study conducted by Abd-El-Khalick and Akerson (2009), they found five different aspects of the NOS. Those conceptions were similar to the ones proposed on a previous study (Akerson et al. 2000), but reduced to only five instead of seven categories. The conceptions were as follows: (a) science is empirical, which entails that science is a theoretical construct that can be proved through observation, experiments, tests and any other form of investigation, (b) scientific knowledge is both reliable and tentative, that means that is subject to change and can be proven wrong over time, (c) science is theory-driven, which entails that, even though scientists attempt for objectivity, their work is nonetheless affected by their theoretical commitments and personal histories, (d) that the inferential nature of scientific knowledge involves the need to appreciate the crucial distinction between inferences (scientific claims) and observations (the evidence that provides support for such claims), and finally (e) human creativity plays an important role in the development of scientific knowledge because it needs to explain the how, why or when something happened. This classification is presented on table 36.

Table 36
Classification of the conceptions of the nature of science.

Empirical	Tentative	Theory-driven	Inferential	Creative
Proved through observation.	Subject to change.	Work is objective but sometimes might become subjective.	There is a differentiations between inferences and observations.	The how, why or when is sometimes explained by creativity.

Source: Abd-El-Khalick and Akerson (2009).

Even though this second study kept some similarities with the prior one, the last study only proposed five conceptions of the NOS. In addition, the first three classifications remained equal from the first study, whereas the last two were modified regarding the nature of the participants and their answers. This second classification resulted on a more summarized conceptions of the nature of science.

Moreover, Buaraphan (2010), conducted a study among pre-service and in-service teachers in Thailand. In the study, the author found four main areas, and each area had different classifications on the conceptions of science. (1) Scientific knowledge, which included: (a) hypotheses, theories, and laws, which entailed that scientist believed the close relationship between this three factors to become a correct outcome. Each factor led to the following one. (b) Tentativeness of science, which had two groups: (I) the statics, that beliefs that science is a group of facts that could be explained, and (II) dynamic, which sees science as tentative, and believes that science is constantly evolving. (c) Cumulative knowledge, where some scientists believe that scientific knowledge is cumulative and the developments depends on the accumulation of evidence. (d) Scientific model, where individuals believe that the scientific model is a copy of the reality rather than an invention of the human kind.

(2) Scientific method, which includes (e) universal, step-wise method, that is perceived as something equal for everyone, (f) scientific experiment, where experiments are primordial to support validity of the scientific knowledge, (3) scientists' work might be (g) theory-laden observation and subjectivity, where this two topics are confronted in scientific endeavor, and (h) creativity and imagination in science, where the role of creativity plays and important role in building scientific knowledge. Finally, (4) scientific enterprise, which includes (i) social and cultural influences on science, where society might influence the scientific environment and the findings, and (j) interaction between science and technology, where technology plays an important role for the development of science. This classification is presented on table 37.

Table 37
Classification of the conceptions of the nature of science.

Scientific knowledge	Scientific method	Scientists' work	Scientific enterprise
(a) Hypotheses, theories and laws. (b) Tentativeness of science. (c) Cumulative knowledge. (d) Scientific model.	(e) Universal, step-wise method. (f) Scientific experiment.	(g) Theory-laden observation and subjectivity. (h) Creativity and imagination in science.	(i) Social and cultural influences on science. (j) Interaction between science and technology.

Source: Buaraphan (2010).

This classification has an especial factor added to the other researches and is that it included technology in the scientific enterprise view. In addition, it included many categories that might refer to different aspects of the conception of science. The study was implemented also to a large amount of pre-service and in-service teachers, and the questions were created inspired in the research conducted by McComas (1998). Even though the questionnaire was focused on the conceptions of science, it also implied and tried to demystify the myths regarding this discipline. This research is considered of special relevance even though it should be adapted to the teachers in the USA, and specifically to a particular group of teachers.

Akerson, Buzzelli and Eastwood (2012), conducted a qualitative study among science teachers, and they proposed seven conceptions of the nature of science. Those conceptions were equal to the previously proposed by Akerson et al. (2000). Most probably, the participation of one of the researchers of the first study in this particular one, as well as the similarities in both studies, has led to obtain the same categorizations. The seven classifications are as follows: (a) scientific knowledge is both reliable and tentative, and it can be changed with new evidence or reconceptualization of existing evidence, (b) no single scientific method exists, but there are various approaches to creating scientific knowledge, such as collecting evidence and testing claims, (c) creativity plays a role in the development of scientific knowledge through scientists interpolating data and giving meaning to data collected, (d) there is a relationship between theories and laws in that laws describe a phenomena and theories are scientific knowledge that seek to explain laws, (e) there is a relationship between observations and inferences with inferences being interpretations made of observations, (f) although science strives for objectivity there is an element of subjectivity in the development of scientific knowledge, and (g) social and cultural context plays a role in development of scientific knowledge, as the culture at large influences what is considered appropriate scientific investigations and knowledge.

Points (f) and (g) are predominantly interconnected to cultural values. In addition, cultural values may influence the other aspects of NOS that teachers are responsible to teach. Moreover, many aspects of the teaching values might influence the type of knowledge they generate from data they gather. This study will not include a table since it would be identical to the one stated above by Akerson et al. (2000).

Finally, the classification presented by Akerson et al. (2012) also presented some treats that could be considered to gather data from science teachers. However, the results have been obtained from a qualitative study, and from teachers answering to a specific dilemma. If those classifications were selected, the study should be adapted to find specific data to corroborate the results.

Due to the character of this research, we adopted one main dimension of the conceptions of science: the conceptual dimension. It has been decided to only use this dimension since science in secondary education is mostly theoretical, even though it includes some practical activities. In addition, the epistemological dimension is used more frequently at a university level, where research is involved to discover new findings or to prove findings. The conceptual dimension refers to concepts or mental conceptions about science that include a detailed definition of the topic. It also implies information about the concept measured that might include different values and categories.

3.2.3 Final considerations and proposed classification

This section about the conceptions of the nature of science will present an analysis of the definition of the Nature of Science (NOS), as well as the literature and classifications that have been gathered and analyzed in the theoretical framework. Then, there will be a review and consideration of the classification that has been selected, and finally the weaknesses and strengths that it presents.

In the first definition of the nature of science, or also called NOS, two studies were found significant defining this matter. Those definitions were proposed by Craven (2002); and Abd-El-Khalick and Akerson (2009) in the basis of Lederman (1998). These authors summarize that there is not an absolute definition about the nature of science, and that this definition is built among each individual according to their beliefs and the environment in which they live. However, in science, teachers' conceptions of the discipline may influence their pupils' conceptions, and it is essential to understand the subject that docents impart.

The conception of the nature of science has been classified by many authors according to different perspectives. However, there are two that repeat its pattern. The first one was presented by Brickhouse (1986), in which science was divided into scientific process, which established a relationship within the procedures and different philosophies of science, and scientific progress, which considered science to be a development by the increase of facts rather than by variations in theory. This classification saved close relationship with other investigations that proposed to separate science into the learning and the epistemological dimension (Carvajal & Gomez, 2002), and into theory and epistemology (Akerson, Abd-El-Khalick & Lederman, 2000). These two classifications saved close similarities because they proposed two main dimension that related to theory and practice.

Nevertheless, other authors classified science according to teachers' responses and perceptions of the discipline, and those classifications might include different categories. As an example, the investigation conducted by Abell and Smith (1994) classified science into five categories according to discovery, knowledge, process, explanation and education. These five categories were build conferring to elementary participant's responses to specific questions about science. The classification proposed by these authors is of especial interest because it is built on answers of actual teachers instead of only theory. In addition, all those categories could be included into a theoretical framework to describe the discipline at a secondary level.

After reviewing this two main classifications, the categorization that has been considered more significant is the one suggested by Abell and Smith (1994) that classified science into five main categories. In addition, the conceptual dimension has been selected because it plays a more significant role in secondary education, since it is at a university level that teachers and students start implementing more practice into their teaching and learning.

One of the reasons to select this classification is the orientation of the categories to the conceptual dimension instead of the epistemological dimension. Even though five groups were proposed, only four will be considered and included in the present study. Those conceptions are: (a) science as a discovery, in which science is mainly a process to find out what exists in the world, (b) science as knowledge, in which science is a product, a set of ideas to be studied, (c) science as a process, in which science is a process of exploration in which data are gathered to discover the truths about the world, and (d) science as explanation, in which it tries to explain the "how's" and "why's" of the world. The last conception about education was removed because it did not appear in Bloom's (1989) investigation, and it obtained the lowest outcome.

Most of the authors exposed in the literature analyzed pre-service teachers at an elementary level, as well as they conducted qualitative research gathering data from a minimal number of participants. The lack of quantitative studies, as well as the lack of studies in secondary education raised the need for a study with those characteristics. Because of that, the present research will emphasize the conceptions of science among science teachers, in secondary education.

Below is a representation of the proposal based on the research conducted by Abell and Smith (1994). The classification of each category and its definition will be presented below on table 38.

Table 38
Proposal for the classification of conceptions of the nature of science by Abell and Smith (1994).

Dimension and conceptions of science	Definition
Conceptual dimension Set of facts and concepts.	This dimension refers to concepts or mental conceptions about science that include a detailed definition of the topic. It also implies information about the concept measured that might include different values and categories.
Science as a discovery	Science mainly as a process of finding out what exists in the world.
Science as knowledge	Science as a product, as a set of ideas to be studied.
Science as a process	Science as a process of exploration in which data are gathered to discover the truths about the world.
Science as explanation	Science is about to explain the “hows” and “whys” of the world.

In order to introduce this topic into the questionnaire, some questions will be created in its respective sections. Those questions will be build based on the answers offered by the teachers that participated in their research. Those answers will be formulated into queries to prove if science teachers perceive those conceptions, and they will also be tested on a number of teacher to identify if it’s suitable to use.

The following fragment will introduce the strengths and weaknesses that should be considered. This section is specially intended to discuss the classification proposed by Abell and Smith (1994), and the different categories that have resulted from their classification.

As a weakness, there was not a questionnaire about the conceptions of science. Even though the teachers were conducted through an interview to give their opinions and arguments about the specific topic, the study was built over open-ended enquiries. When the questions for this research will be build, the answers from the teachers will be considered, but it will not copy or replicate any existent questionnaire that was built and validated before. However, the questions will be validated among science teacher to ensure its validity.

One of the strengths of the study conducted by these authors is that it focus on different dimensions of teaching and learning such as discovering, knowledge, process and explanation. Their classification does not include a large array of topics, but it included four categories that were well defined and delimited, with specific content. Each and every of those categories were obtained with the opinions of the teachers that participated, and it is believe that it might help in order to validate the results. Even though it could be more specific to an area in particular, it also gives a valid perspective and opinion about facts.

In summary, this chapter presented the definition of NOS as well as the conceptions of the nature of science by different authors. After this analysis, a classification was selected to be part of the questionnaire, and to build the enquiries that would be part of the final instrument. That classification referred to the four groups of conceptions that were: discovery, knowledge, process and explanation, and all the questions will be presented in a further section. Finally, a representation of the most significant weaknesses and strengths was presented to help understand its selection.

IV. Feelings and emotions with the use of technology

It is well known by literature that the feelings and emotions that teachers experience when they use technology may influence the integration of technology in the classroom (Agyei and Voogt, 2011; Bullock, 2004). In addition, this subject influence teachers' perceptions, and the manner they teach their students. Because of the close relationship between teachers' use of technology, and the effect that they have in peoples' responses, this section will gather some information on the feelings and emotions that teachers feel when they use technology in the classroom.

After reviewing some literature about this topic, it was observed the existence of a large amount of studies regarding feelings, emotions, and attitudes; however, and due to the nature of this research, this section will gather information about feelings and emotions in general, even though some studies might be the result of the study of those three topics together. In addition, it is significant to consider that the three terms mentioned above save a close relationship and meaning within each other, and all professionals might experience any of them at a certain point of their professional careers.

4.1 Definition of feelings and emotions in teaching

It is considered that the feelings and emotions that teachers have towards technology are the main predictor of the usage of such technologies in educational sceneries (Albirini, 2006; Almusalam, 2001). Hence, feelings and emotions develop a major role in shaping peoples' responses to different circumstances, as well as it also preserves a direct and close correlation with individuals' behavior (Fuson, 1942).

Through time, different scientist have defined this terms in a vast variety of meanings (Albirini, 2004; Allport, 1935; Damasio, 1994; Kiridis, Drossos & Tsakiridou, 2006). However, all of them mentioned at some point the relationship with behavior, and the predisposition to act in a specific manner, in a specific circumstance.

Because of the close relationship between terms, it is significant to differentiate between emotions, attitudes and feelings to be able to differentiate them in this study. Damasio (1994) defined emotion as a mental response to external stimuli, while feelings were the reaction to a specific emotion. Other researchers defined attitude as being related to the positive and negative response among specific conditions (Harrison & Rainer, 1992; Albirini, 2004, Kiridis et al., 2006).

After this brief summary of the three terms, and due to the nature of this research, the next section will continue gathering data on the terms feelings and emotions with the use of technology, and will focus on the classification of them in two main groups: positive and negative.

4.2 Classification of feelings and emotions in teaching, with the use of technology

This section will introduce different classifications of feelings and emotions that have been found on literature. Even though this section will only refer to this term, some of the classifications were part of a larger study that included attitudes. It is for this reason that this section will only present in its tables the classification that have some relationship with the first two terms, and predominantly, with the use of technology.

First of all, Damasio (1994) differentiated between two types of emotions. The primary emotions would be basic and universal such as (a) fear, the condition of being afraid, (b) anger, displeasure or belligerence, (c) disgust, to cause loathing, (d) sadness, unhappiness or grief, and (e) happiness, pleasure and the act of being happy. Secondary emotions would be (f) cultural and created in relation to personal experiences attributed to a specific community and its attributes.

Those could be based in social conditions and to human practices. The classification will be presented below on table 39.

Table 39
Classification of emotions in two types.

Primary emotions					Secondary emotions
Negative				positive	
Fear	Anger	Disgust	Sadness	happiness	Cultural and created through personal experiences.

Adapted from: Damasio (1994).

This classification considered five types of primary emotions that could be included into a positive and a negative range as presented on the table above. In this classification there exist a larger number of negative emotions over only one positive emotions. The secondary emotions would appear in relationship of the environment and personal experiences. This classification is significant for the appearance of five specific emotions that could be identified with the use of technology.

Robertson, Calder, Fung, Jones and O'shea (1995) directed a study among secondary school teachers in England to find the attitudes and feelings that teachers hold against computers. One of the results that they found were that the attitude that educators felt about computers was influenced by the genre of the person. Males were usually more open-minded to the use of computers and technology than females. In their research, they found different sub-scales to the feelings of teaching with technology: (a) computer anxiety, which is based on basically negative arguments about how educators feel about computers, (b) computer confidence, that includes items related to positive outcomes on how proficient the individual is likely to work with technology, and (c) enjoyment, that is the amount of apparent pleasure individuals get or feel when they are going to use a computer. The representation of this classification is presented below on table 40.

Table 40
Classification of feelings and emotions with technology.

Negative	Positive	
Anxiety	Confidence	Enjoyment
Feeling of discomfort.	Trust in one-self.	Apparent pleasure.

Adapted from Robertson et al. (1995).

This classification implied not only feelings and emotions, but also attitudes towards the use of technology, however, only the feelings were presented. Some of the classifications regarding feelings could be considered in the present study such as anxiety, confidence, and enjoyment. In addition, confidence and enjoyment could be considered positive; while anxiety could be considered a negative matter.

The study conducted by Clark (2000) focused on teacher views of technology. The author reported different attitudes that teachers hold about technology, and it correlated with the use that teachers do of it. One of the findings based on the research conducted by Bosch and Cardinale (1993), and Topp, Mortensen and Grandgenett (1995), was that teachers that taught for a long time were more reticent and found more difficult to implement technology, because they were used to another procedures and educational practices. In the other hand, the young generations were more adventurous to try and use technology in the classroom with success.

Among the feelings and emotions that teachers experienced, Clark (2000) found that it could be classified into two categories: negative and positive. Two of the feelings that the author found were (a) comfortable, where the teacher had a positive attitude and felt prepared to implement technology, and (b) anxiety, where this feeling prevented teachers from using any technologic device. After analyzing these two factors, it can be categorized as positive when it relates to comfortability; and negative, when they referred to anxiety. Table 41 represents this classification.

Table 41
Classifications of attitudes and feelings with the use of technology.

Positive	**Negative**
Comfortable	**Anxiety**
Positive attitude and feelings with the use of technology.	Feeling that prevented teachers from using technology.

Source: Clark (2000).

This classification concluded with two main categories that were the positive and the negative feelings and emotions. Those two classification could be used in this study as a main classification of feelings. In addition, “anxiety” would correspond to the feeling of stress and fear when teachers have to manipulate technology, while comfortability could refer to a positive outcome.

In addition, van Braak (2001) conducted a study about teachers’ attitudes about the use of technology in the classroom. In his study he found that computer experience is extremely related to computer attitudes. Those teachers that seemed to have experience and used technology on a daily basis, had more satisfaction and positive feelings about the use of computers.

Some of the feelings and emotions that he found among teacher were: (a) technophobia, where teachers do not like or fear the use of computers because they have poor usage of this devices, (b) anxiety, which is influenced by the gender of the person that uses the computer. They found that men experienced less anxiety over the use of computers (Robertson et al., 1995), (c) computer liking, that is when the teacher has previous experience and feels low anxiety when using computers, (d) motivation, when teachers experience that computers are a learning tool that helps students to be focused and motivate to the tasks performed in the classroom, (e) fear, when the use of computers frightens the person that is using them because they do not know how to perform properly. This categorization is presented below on table 42.

Table 42
Classifications of feelings and emotions with the use of technology.

Positive		**Negative**		
Computer liking	**Motivation**	**Fear**	**Technophobia**	**Anxiety**
Previous experience and low anxiety.	Technology as a learning tool.	Frightening.	Not like or fear of technology.	Influenced by the gender.

Adapted from van Braak (2001).

This study is of special interest because it considered different feelings and emotions as presented above. In addition, there was a differentiations between positive and negative outcomes, relating technology to these two large groups. The main categorization and some of these feelings and emotions could be adapted in the present research to be part of the questionnaire.

Furthermore, Hogarty, Lang and Kromrey (2003) directed a quantitative study among two thousand one hundred and fifty six teachers, where the most predominant genre was females. In their study, they investigated about computer use, and which factors affected their implementation. One of the topics that they reviewed was the attitudes of teachers towards technology, and they found different feelings and emotions that teachers experienced when using technologic devices.

Some of the feelings and emotions were: (a) tension, an emotional strain, (b) pressure, a compelling influence. As it can be appreciated, this two feelings would fit into a more general category of feelings called negative. Both feelings suggest a desire to stop using technology because it is not giving the teachers any help or facilitation in its implementation.

In the other hand, they also found feelings and emotions of (c) confidence, when they felt assertion, and (d) comfort, when they felt relief and pleasure. This two categories would be part of the positive feelings and emotions that give the opportunity to teachers to feel realized and willing to implement technology in the classroom. Below is a representation of these categories on table 43.

Table 43
Classifications of feelings and emotions with the use of technology.

Positive		**Negative**	
Confidence	**Comfort**	**Tension**	**pressure**
Feeling of assertion.	Feel of relief and pleasure.	Emotional strain.	Compelling influence.

Adapted from Hogarty et al. (2003).

This classification made special emphasis to different feelings and emotions, being classified into positive and negative categories. This study is also significant recognizing different types of affection that might appear with the use of technology. The feelings and emotions that have been proposed will be considered for the questionnaire of the present investigation.

Shapka and Ferrari (2003), conducted a study over fifty-six students from teacher-education courses in Canada. In their study they included three variables from the study conducted by, even though only two of them referred to feelings and emotions. Those items were: (a) computer confidence, in which they felt confident when implementing technology, and (b) computer anxiety, where technology develops a feelings of distress and discomfort. This classification is presented on table 44.

Table 44
Classification of feelings and emotions with the use of technology.

Positive	Negative
Confidence	**Anxiety**
Assured	Distress and discomfort

Adapted from Robertson, et al. (1995); Shapka and Ferrari (2003).

This classification presented two aspects that could be both included into feelings and emotions. Confidence could be considered as positive, and it could denote a positive outcome when in contact with technology; while anxiety could be considered as negative, and it might have a negative impact on teacher responses when in contact with technologic devices.

Galanouli, Murphy and Gardner (2004) conducted a study among primary and secondary school teachers in the United Kingdom. In their study, they classified teachers' attitudes regarding the interaction between educators and technology. In addition, they classified different feelings and emotions that correlated with the attitudes that teachers have when using technology. The two main categories for attitudes were (1) positive and (2) negative. Positive attitudes would be the predisposition of teachers to use and implement technology in the classroom, while the negative attitudes would be the desire of not using technology when in educational practices.

Furthermore, they analyzed the feelings that those teachers experienced, and among the positive feelings they found (a) confidence, where the teacher feels assertion on what he or she is doing; while in the negative attitudes they found: (b) inadequacy, that produce them to worry unnecessarily, (c) frustration, when technology does not work in the way it should be, (d) stress, where the teacher feels overwhelmed because of the use of technology, and (e) confusion, when the teacher does not know how to work with an issue or how to implement technology properly. Below is table 45 with a representation of this classification.

Table 45
Classifications of attitudes, feelings and emotions with the use of technology.

Positive	Negative

Predisposition to use and implement technology	Desire to not use technology			
Confidence	**Inadequacy**	**Frustration**	**Stress**	**confusion**
Feeling of assertion.	Worry unnecessarily.	Technology does not work properly.	Overwhelming.	Not knowledge about technology.

Source: Galanouli et al. (2004).

Even though in their study they made more emphasis on the negative feelings and emotions that resulted from implementing technology devices, they also recalled on the confidence that teachers felt when using it. This classification is significant because it recognized the two main categories of attitudes feelings and emotions that would be negative and positive, which is the aim of the present study. In addition, some of the feelings and emotions that they specified may be also considered in the present study to be included in the questionnaire.

Another study led by van Braak, Tondeur and Valcke (2004), found different feelings regarding the use of computers. In their study, the principal purpose was to discover the uses of technology over teachers; however, part of their research found attitudes regarding this use. Those attitudes were: (a) computer liking, in which teachers enjoy the use of computers, (b) computer anxiety, in which they develop a feeling of fear and frustration, and (c) computer confidence, in which they felt assurance in the use of computers. Table 46 present a representation of this classification.

Table 46
Classification of feelings and emotions with technology.

Negative	Positive	
Computer anxiety	**Computer confidence**	**Computer liking**
Fear and frustration.	Assurance in the use of computers.	Enjoyment in the use of computers.

Adapted from van Braak et al. (2004).

These three categories may be related to the ones proposed by Robertson et al. (1995); and they also reflect some feelings as a result of the use of technology in the classroom. Those feelings also refer to positive and negative outcome of technology implementation. Even though they considered these three categories as attitudes, the term can also be classified as feelings and emotions.

Also, the categorization proposed by Sooknanan, Melkote and Skinner (2002), considered the attitudes toward the use of computers. In their classification, they considered attitudes the positive or negative inclination to use and implement technology in the classroom. Among the attitudes that they proposed, it was found the following feeling and emotion: (a) fear of computers, in which technology becomes an undesirable tool that teachers do not want to use in the classroom. Below is table 47 with a representation of this type of affection.

Table 47
Classifications of attitudes and feelings with the use of technology.

Negative
fear
Technology becomes an undesirable tool that teachers do not want to use in the classroom.

Adapted from Sooknanan et al. (2002).

This classification only proposed one feeling and was negative. After reviewing some literature it seems that most of the feelings that repeated in many categorization are negative feelings such as anxiety and fear. Even though there is only one classification that referred to feeling and emotions, fear might be considered since it repeats a significant number of times among other investigations.

In addition, van Braak and Goeman (2003), conducted a quantitative research over three hundred and eighty one teachers in Belgium to achieve a better view of teachers' attitudes among the use of computers. From their research, they found two types of classification. The first one referred to perceived computer attitudes; and the second one to computer attitudes. In the first group, they oriented their classification into attitudes that will not be described below; however, in the second category, seven items were found and some of them referred to feelings and emotions. Because of the nature of this research, only feelings and emotions will be presented.

Among those types of affection they found: (a) computers make me nervous, (b) I like working with computers, (c) computers don't frighten me, and (d) I am afraid to break something. As it may be observed in this second categorization, there are some feelings and emotions produced by the use of technology such as nervousness, liking or fear. Items (c) and (d) could be mixed together since it refers to the same, but as a positive or a negative statement. This classification will be presented on table 48.

Table 48
Classification of feelings and emotions with technology.

Positive	Negative	
like	**Fear**	**nervous**
Desire to work with computers.	Panic of computers.	Discomfort when using computers.

Adapted from van Braak and Goeman (2003).

This classification presented three different feelings and emotions among the attitudes that teachers experienced when using technology. From those feelings there were found more negative than positive outcomes. This categorization will be considered because it included feelings that could be included into a positive and a negative classification, and it also repeats feelings that have already appeared in other investigations.

Albirini (2006) studied the attitudes of high school teachers with the use of technology in Syria's schools. In his study, the author tried to measure three domains: the affective, the cognitive, and the behavioral. Because of the matter of this research, this section will analyze the affective domain because it is more related to the objectives that are stated. They classified six items in the affective domain; however, only the five that referred to feelings and emotions will be presented: (a) fear, where computers bring to a state of fright about using them; (b) uncomfortable, where computers makes teachers feel unsafe and not contented about using them; (c) happiness, where the use of computers is a satisfaction; (d) repulsion, where talking about computers generates a state of unhappiness and discomfort; and (e) dislike, where teachers do not like to use computers in the classroom. This classification is presented below on table 49.

Table 49
Classifications of attitudes with the use of technology.

Negative				Positive
Fear	**Uncomfortable**	**Repulsion**	**Dislike**	**Happiness**
Computers fright teachers.	Feeling of being unsafe.	Discomfort.	Teachers don't like the use of computers.	Satisfaction by using computers.

Adapted from Albirini (2006).

This classification included four negative and one positive feeling and emotion. From the categories stated above, happiness may be considered as a positive outcome; while fear, uncomfortable and repulsion may be considered as negative. Those four feelings could be included in the present study because they are part of the affective area. In addition, this study demonstrated again that it seems to be a predominance of negative feelings among the use of technology.

Furthermore, a study conducted by Chen and Chang (2006) among early childhood teachers also analyzed teachers' attitudes with the use of computers. The classification that they suggested included parts of the affective domain, and they found eight items. From those items, six referred to feelings and emotions, even though three of them were similar: (a) confident when using computer in the classroom, (b) comfortable using internet, (c) comfortable teaching computers to children, (d) comfortable teaching computers to colleagues, (e) comfortable teaching computers to parents, and (f) fear computer may take over some parts of my job. From this classification, it can be observed that three feelings and emotions appeared such as confidence, comfortability or fear. Below is this representation on table 50.

Table 50
Classifications of attitudes and feelings with the use of technology.

Positive		**Negative**
Confident	Comfortable	Fear

Source: Chen and Chang (2006).

This classification comprises three main feelings and emotions that could be considered in the present research. Those feelings and emotions are confidence and comfortable as positive; and fear, as a negative. In this classification there was a predominance of positive feelings over negative and they presented three types of comfortability even though the table 50 only categorized one.

Luan (2007), developed a scale to measure technology attitudes toward the use of computers. His quantitative study was implemented among eight hundred and seventeen teachers in Malaysia. The scale about attitudes included items related to feelings and emotions that were: (a) anxiousness when learning about technology, (b) confusion when using computers, (c) sickness, because it produces headaches to the users, (d) discomfort, because it is hard to use it and not mastered yet, (e) confidence, when it is technology training before its implementation, and (f) nervousness, of thinking about computers. This representations is presented below on table 51.

Table 51
Classification of feelings and emotions with the use of technology.

		Negative			**Positive**
Anxiousness	**Confusion**	**Sickness**	**Discomfort**	**Nervousness**	**Confidence**
Anxiety when learning with technology.	Confusion when using technology.	Technology produces headaches.	Hard to use and master.	Nervousness when thinking about computers.	When training is received.

Adapted from Luan (2007).

The classification proposed above presented six feelings and emotions that could be considered in the present study. One of those feelings denoted some positivity such as confidence; however, the rest of the feelings could only be classified as negative including: anxiousness, confusion, sickness, discomfort and nervousness. All the feelings presented above might be considered for review to be implemented in the current investigation.

The research conducted by Roussos (2007), developed an attitude scale for Greek population that contained thirty items with three subscales such as affection, confidence and cognitive. In addition, the author also explored the differences between males and females. Regarding to the affective subscale, eight items were found regarding feelings and emotions: (a) fear, when it comes to use a computer, (b) fool, that makes individuals hesitate when using computers, (c) frighten, when it is time to use computers, (d) comfortability, when computers bring easiness to work, (e) hostility, when it comes to use a computer, (f) sinking, that it makes teacher feel dizzy and scared of using technology, (g) boredom, the feeling of monotony when using technology, (h) joy, that makes feel happy and please for the use of technology. Below is a representation of this categorization on table 52.

Table 52
Classification of attitudes and feelings with the use of technology.

			Negative			**Positive**	
Fear	**Fool**	**Frighten**	**Hostility**	**Sinking**	**Boredom**	**Joy**	**Comfortability**

When it comes to use a computer.	It makes individuals hesitate to use them.	When it is time to use computers.	When using computers.	It makes teachers feel dizzy and scared.	Monotony when using technology.	Makes feel happy and please.	Computers bring easiness to work.

Adapted from Roussos (2007).

The categories presented above referred to feelings and emotions that teachers experience when they use technology. Some of the positives feelings were joy, and comfortability while the negative feelings were fear, fright, fool, hostility, sinking and boredom. Some of the feelings presented above might be considered for the present study.

Al-Zaidiyeen, Lai Mei and Fook (2010), conducted a study to investigate the attitudes of teachers that use technology for educational purposes. In the study, they stated that teachers' attitudes towards the use of technology were highly important in order to implement it into the classroom practices. The study that they conducted about attitudes included the same items than the research directed by Albirini (2006), it is for this reason, that this section will not include a table. Some of the types of affection that appeared on the table that they created included feelings and emotions, and others just included a positive or negative reactions toward a specific situation that would fit more properly into the group of attitudes. In the discussion, they found that the overall outcome with the use of technology was positive, and most of the teachers were able to implement technology in their classrooms. Referring again to the study conducted by Albirini (2006), some of the items that they included and that referred to the feelings and emotions might be included into two sub-groups: positive, and negative.

Agvei and Voogt (2011) conducted a study among sixty mathematic teachers with a high predominance of men, on a high school in Ghana. In this study, the authors tried to find teachers' attitudes toward the use of computers for teaching practices. In addition, they used a questionnaire that was previously developed and implemented by Knezek and Christensen (1998) in their study; The attitudes were categorized in six sub-scales and two of them included feelings and emotions such as (a) enjoyment, which means the comfort that the individuals experience when they use technology, (b) anxiety, that is the fear to use and talk about computers; The rest of the categories only referred to attitudes. This classification is presented below on table 53.

Table 53
Classifications of feelings and emotions with the use of technology.

Positive	**negative**
Enjoyment	**Anxiety**
Comfort when using technology.	Fear to use and talk about computers.

Adapted from Agyei and Voogt (2011).

As it can be observed from the above classification, the feelings and emotions that were presented referred to the use of technology. Also, it appeared to be more oriented on the reaction of teachers, than on their emotional experiences; in addition, the vision of feelings towards the use of technology scarce. As an example, the two first classifications could be sub-classified into positive and negative feelings, since enjoyment might be considered positive; as well as anxiety might be considered negative. But there is not the appearance of any other feeling and emotion in their classification.

Leng (2011) conducted a study about teachers' attitudes towards the use of technology, following a scale already created by Gressard and Loyd's (1986). In this scale, Leng adapted the questions and created some others that adapted to his research type. Leng (2011) classified the attitudes in four general categories and three of them referred to feelings and emotions such as: (a) anxiety, when teachers feel the sensation of discomfort, (b) confidence, when teachers feel they know what they are doing ad their self-stem is high, and (c) liking, in which teachers love implementing technology.

These three categories could be included into a positive and negative scale. Contrary to other categorizations that have been analyzed before, in Leng's (2011) study, only one is included in the negative feelings while the other two would be part of positive feelings. In addition, in his categorization they separated male and female since the perceptions they have about technology differ depending on the genre. This classification is presented below on table 54.

Table 54
Classification of teacher's feelings and emotions with the use of technology.

Positive	**Negative**

Confidence	Liking	Anxiety
Feeling of assertion.	They enjoy working with technology	Compelling influence.

Adapted from Leng (2011).

This classification may be classified into different feelings and emotions types being those either negative or positive. A difference with the other classifications is that they encountered more positive than negative results. As a matter of fact, only anxiety could be considered as a negative outcome of the use of technology. Some of their feelings might be taken into account when creating the questionnaire. Also, this classification established the same feelings and emotions that the classification presented by Yildrin (2000), which presented three types of computer attitudes and feelings such as anxiety, confidence, and liking.

Another study led by Peinado, Bolívar and Briceño (2011), gathered information among middle school teachers' attitude with the use of computers. In their study they used a sample of ninety three teachers from two different institutions in Venezuela. In addition, they used the questionnaire already created by Knezek and Christensen (1996) about teachers' attitudes towards computers.

From this questionnaire, they created sub-scales that referred to feelings and emotions that included: (a) joy/utility, that is the perception that teachers have about the safeness, joy and motivation to learn through computers, as well as the facility and utility that technology represent in the educational practices, and (b) frustration, anxiety, that are feelings that create fear, dependence, tension, frustration and so on, when teachers are working with a computer. In addition, teachers have a perception of technology as a non-useful tool. This classification is presented below on table 55.

Table 55
Classification of teacher's computer feelings and emotions.

Positive	Negative
Joy/utility	**Frustration, anxiety**
Safeness, joy and motivation.	Feelings of fear, dependence, frustration, and so on.

Adapted from Peinado et al. (2011).

The classification presented above involves teacher feelings and emotions, as well as uses of technology. The classification relates the use of technology to the feelings and emotions that might emerge from using it. In this study, the authors found that a large amount of teachers expressed feelings of anxiety and frustration over other emotions. These findings would led to teachers more reticent to use technology in the classroom due to the sensations that they experienced when using them. Some of the categories presented are of special interest such as joy, frustration and anxiety, because they are particularly related to the affection outcome.

4.3 Final considerations and proposed classification

The section above have analyzed and described the diverse classification of emotions and feelings offered by different authors (Albirini, 2006; Leng, 2011), from the perspective of the use of technology in the classroom (Agvei & Voogt, 2011). In addition, the subsequent paragraphs will present the main categorization of this topic, the classification that has considered for the present investigation, and the weaknesses and strengths that it presents.

The review of the literature regarding emotions and feelings revealed a vast amount of investigations regarding these topics. Sometimes, these two concepts were stated apart into its own category, and other times they were incorporated into the vast concept of attitude. When it referred to the term attitude, they were included into the affective domain of feelings and emotions. In addition, from an early moment in which technology was introduced in education, researchers started wondering about the outcomes that this implementation could cause among professionals, as well as their outcomes amid students.

After evaluating the literature on this topic, it was observed that feelings and emotions were classified into two main groups. The first one was the classification into primary emotions, which are basic and universal, and secondary emotions, which are more complex (Damasio, 1994). The classification proposed by Damasio (1994) also involved positive and negative feelings into the first group. However, for most of the authors, the feelings and emotions were separated into positive and negative, as a main classification (Agyei & Voogt, 2001; Chen & Chang, 2006; van

Braak, 2001). In addition, the authors tried to describe more specifically the types of feelings that could be included on each of those classifications.

The present study will focus on the reactions that technology produces to human beings. Because of the amount of categorizations regarding human affection, it was decided to classify feeling and emotions in a main categorization that included: (I) the positive feelings and emotions, and (II) the negative feelings and emotions. In addition, there are two sub-scales for the positive feelings, and two more for the negative feelings. The positive feelings include: (1) enjoyment that consist of four main feelings and emotions that are: (a) happy, (b) fulfilled, (c) glad, and (d) complete. And (2) Excitement includes: (e) energetic, (f) enthusiastic, (g) pleased, and (h) optimistic.

In the other hand, the negative feelings and emotions comprise: (3) fear, that includes: (i) anxiety, (j) nervousness, (k) panic, and (l) tension. And lastly, (4) anger, which includes: (m) irritation, (n) upset, (o) madness, and (p) furious. The table 56 below includes a classification and a more visual categorization of these feelings and emotions. Some of them have been acquired from previous research such as the one conducted by Agyei and Voogt (2011); however, there are many classification that have been a contribution from other investigations (Albirini, 2006; Clark, 2000; Shapka & Ferrari, 2003; van Braak and Goeman, 2003).

Table 56
Classification of teachers' feelings and emotions with the use of technology in the classroom.

Feelings and emotions Principal category	Sub-categories	Contributions of each paper
Positive		Positive feelings are those that evoke a state of general wellness in teaching with technology, and they arouse the desire to implement technology.
Enjoyment		The pleasure someone experiences when using and interacting with technology.
	Happy	Feeling or showing pleasure or contentment.
	Fulfill	Satisfied because of fully developing one's abilities or character.

	Glad	Delight.
	Complete	Make something whole or perfect.
	Motivated	Reason for people's actions, desires and needs.
Excitement		Elevation in energy level above an arbitrary baseline energy state when using and talking about technology.
	Energetic	Showing or involving great activity or vitality.
	Enthusiastic	Having or showing intense and eager enjoyment, interest, or approval.
	Optimistic	Hopeful and confident about the future.
	Pleased	Feeling or showing pleasure and satisfaction over a situation.
	Confident	Positive attitude in how well to do something.
Negative		Negative feelings are those that raise states of general discontent, which are powerful factors to stop implementing information and communication technologies and that can, in extreme cases, lead to depression.
Fear		Behavior that leads to escape or avoid using technology. Fear to use and talk about technology.
	Anxiety	A feeling of worry, nervousness, or unease, typically about an imminent event or something with an uncertain outcome.
	Tension	Mental or emotional strain.
	Nervousness	Easily agitated or alarmed; tending to be anxious; highly strung.
	Fright	Sudden uncontrollable fear or anxiety, often causing wildly unthinking behavior.
	Embarrassed	Feelings ashamed and self-conscious.
Anger		Offended, wronged, or denied and a tendency to react through retaliation against technology.

	Irritation	The state of feeling annoyed, impatient, or angry
	Upset	A state of being unhappy, disappointed, or worried
	Madness	The state of being mentally ill, esp. severely.
	Furious	Extremely angry
	Frustrated	Feeling of anger and disappointment.

Adapted from Agyei and Voogt (2011); Galanouli et al. (2004); Hogarty et al. (2003); van Braak et al. (2004).

After classifying the feelings and emotions into different categories and sub-categories, it is believed that a more in depth analysis of its strengths and weaknesses is necessary to further understand this classification. In addition, an overall understanding of its particularities will help to determine if the classification is suitable for this investigation.

This classification faces the weakness of trying this new categorization, involving not only the feelings and emotions stated in other researches, but also a different perspective. Overall, most of the feelings and emotions have been mentioned before in the different body of literature, but there is still a small percentage of feelings that have been included in this new classification because it was considered a good contribution to the investigation. In addition, most of the proposals only presented between three and six feelings and emotions, and it is believed that the inclusion or a larger number of feelings will help to define with more accuracy the feelings and emotions that teachers perceive.

One of the strengths is that most of the authors recognized the existence of two main categories into feelings. Those categories referred to the positive feelings and emotions, and the other one referred to negative feelings and emotions. Most of the authors, even though not all of them stated this main categorization, implied the existence of some feelings that made teachers feel comfortable and wealthy around technology, while other feelings made them feel discomfort and the desire to not use technologic devices. The use of this classification in other studies is a strength and a base point to start the sub category that has been presented above.

Another strengths is that most of the feelings considered on this study have been mentioned, at some point, in the other authors' studies, which means that the researches they conducted proved the existence of those feelings among teachers that used technology in their classrooms.

In summary, the body of literature of this section is extensive because it included many studies and classifications since technology became a reality in education; however, it is believed that those classifications were of special interest for the foundation of the present study. This sections delimited the main categorization of feelings and emotions, and it also mentioned attitudes when the affection domain was classified into this topic. Subsequently, there was the creation of a new classification of teachers' feelings and emotions, and finally a review of the weaknesses and strengths that might imply this categorization.

V. Use of technology

From the time when technology started being implemented in the classroom in the middle of the decade of the 90s, (Sigalés, Mominó, Meneses, & Badia, 2009), in which the use of the Internet became widely available and began to introduce technology into school education, that the problematic of its implementation and its didactics has been studied. Because of this, there has been an increase of investigations in this specific area.

It is with the implementation of technology, that there have been developed two significant positions: teachers that have been more reticent and distant to the incorporation of technology, and those teachers in favor of its use in the classroom. It is because of this matter that the purpose of this section is to also identify the uses that teacher ensure of technology in the classroom, with a specific educational objective.

In addition, it is considered technology integration when technology is used in education to nurture teaching and learning processes (Vanderlinde, Aesaert & van Braak, 2014). Below the reader will find some literature on the use of technology in the classroom, the uses of technology by history and science teachers, and its classifications.

5.1 Teachers and learners' use of technology in the classroom

This section will gather some information about significant uses of technology amongst elementary, secondary and pre-service teachers in different parts of the globe. Most of these categorizations do not refer to specific areas, but they can be applied to different subjects and environments. In addition, some authors have similar views about the uses of technology even though the name of the categorization might differ.

Drenoyianni and Selwood (1998), conducted a study on UK primary school teachers' use of technology in the classroom. Among the teachers that they interviewed, there were three aspects of the use of technology that were identified. The first one was the use of a word processor, in which this view changed from the understanding of a word processor as a learning tool (Dun & Ridgway, 1991; MacArthur & Malouf, 1991), to a word processor as a tool to facilitate the learning practices such as substituting paper and pencil for a digital device. In this situation, technology did not have a learning function but an assisting function. In the other hand, there were some teachers that demonstrated a good practice; those teachers were the ones using a word processor as a support for drafting and redrafting pieces of writing.

The second use of technology among the teachers interviewed was the use of graphics packages and software, concerned with information handling, such as databases. The use of database was allowing to simplify the finding of information and the arranging of that. However, as the same stated above, there was a misunderstanding between the teacher use for learning purposes or just as a tool. And finally, the third use was technology as multimedia encyclopedia, were technology was a source to find information that the students could need in their classrooms. This classification will be shown on table 57.

Table 57
Classification of teachers' use of technology.

Word processor	Graphic packages and software	Multimedia encyclopedia
Tool to facilitate learning	Simplify the finding of information	Source to find information

Source: Drenoyianni and Selwood (1998).

In this investigation, the use of technology could be misinterpreted from a learning tool to just a tool to complete some work. The conclusion on this investigation was that teachers needed training in order to implement technology appropriately in the classroom. This conclusion could refer to the use of technology as a tool instead of a mean to learn. In the last years, some arguments have arose about using technology not only for learning but also as a substitution to the regular means such as a book (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur & Sendurur, 2012). This classification made emphasis to the importance of preparing teachers in order to give significance to the use of technology.

In the study conducted by Desjardins, Lacasse and Bélair (2001), they tried to describe the competencies that would lead to the use of technology in the classroom by teachers. The study was conducted among nineteen teachers that taught French, and the responses showed four types of competency: (a) technical, (b) informational, (c) social and (c) epistemological. In the (a) technical competency, the teachers were supposed to install and use a computer and its peripherals, without help, as well as be efficient in the operation of technology.

This kind of competency would show the teacher as able to resolve its own problems, when technology would become an issue, and it implied software and hardware technology. The second competency, (b) informational, implied to make use of semantic networks to prepare for keyword searching. This type of competency was defined as the range of theoretical and procedural knowledge usually built while searching for specific information using different resources and searching engines.

The third group was (c) social, and involved to describe the ethical, cultural, and societal issues related to the use of technology. This kind of competencies allowed human beings to interact with other individuals or groups through technology, and it also allowed individuals to establish relationships by this mean. The last competency was (d) the epistemological, where technology was a way to support compilation, organization, analysis and synthesis of information. In this group, computers would be a manner to resolve problems that could appear during the instructional time. Below is a classification of this categories on table 58.

Table 58
Classification of competencies that lead to the use of technology.

Technical	Informational	Social	Epistemological
Learn how to use technology efficiently.	Theoretical and procedural knowledge built to search information.	Ethical, cultural and social issues related to the use of technology.	Technology as a tool to support learning.

Source: Desjardins et al. (2001).

These authors classified the use of technology into four main categories that not only implied technology as a tool to learn, but also included the factor of *technical,* which meant the proficiency of teachers on learning to resolve their own technology problems. In addition, the classification went further and included other variables such as the social environment as well as the cultural and ethical issues that might result from the implementation of technology.

In the study conducted by Baylor and Ritchie (2002), they designated the use of technology according to nine other components which were considered separately one from the other. The components were: (a) technology to prepare for or during classroom instruction, where teachers were using technology to create the lessons, to implement the lessons or to assign homework, for example, (b) technology for subject-matter, where technology was the main vehicle on the introduction of a specific topic, (c) technology for higher order thinking skills (HOTS), where technology was aligned with Bloom's taxonomy in the fulfilling of a higher level of knowledge ability, (d) technology for literacy, where it would be a resource to develop literacy, (e) technology to respond questions by students, where it would be a tool to answer questions that has been assigned, (f) technology to create by students, where it would help students develop creative activities, (g) technology to interact with others, where it is a tool to favor the relationship within the educational community, (h) technology for a constructivist purpose, where it would help to build constructivist lessons to be implemented in the classroom, and (i) use of technology by teachers, where teachers would be in charge of developing lessons, and using technology to fulfill their duties. This classification is presented below on table 59.

Table 59
Classification of uses of technology according to nine components.

Prepare for instruction	**Subject-matter**	**Higher order thinking skills**
Use of technology to create lessons, assign homework, and so on.	To introduce new topics.	Technology aligned with Bloom's taxonomy.
Literacy	**Questioning**	**To create by students**
Resource to develop literacy.	Technology as a tool to answer questions.	Students develop learning activities.
Interact with others	**Constructivist purpose**	**Use of technology by teachers**
To stablish relationship in the educational community.	To build constructivist lessons.	To develop lessons.

Source: Baylor and Ritchie (2002).

An interesting fact about this study is the use of technology to achieve higher order thinking skills regarding the ones proposed in the Bloom's taxonomy. This is of special interest because it implied a constructivist perspective in which students are the center of the learning process. In addition, the nine categories gathered information on many activities related to the teaching process. It is believed that this categorization is of special interest and it might be consider for further use.

In a first study conducted by van Braak, Tondeur and Valcke (2004), they found two different uses of computers in the classroom: (a) class use of computers, where computers were a tool for presentations, for encouraging students to develop skills, for instructing students in the possibilities of technology and so forth, and (b) supportive use of computers, where technology was a tool to support the teaching practices such as preparing worksheets, administration documents, looking for information, lesson preparation and so on. Below is the classification presented on table 60.

Table 60
Classification of Uses of computers in the classroom.

Class use of computers	**Supportive use of computers**
Computers as a tool for presentations, encouraging students, developing skills, and so on.	Technology as a tool to support teaching practices.

Source: van Braak et al. (2004).

In this classification, the first category implied computers as a tool that is part of the learning process; meanwhile, in the second category, technology is considered a tool to help develop the correct and appropriate material for teaching. One of the things that needs to be taken into account is that the first classification specifically inferred the use of computers while the second one referred to technology in general. It is also believed that the term technology implies more than only computers, and that it has to be considered when applying to education.

Moreover, another study conducted by McCormick (2004), exposed the challenges of technology. In his study, he identified different collaboration types with the use of technology. Some of those uses were: (a) to design projects, where technology is an indispensable tool to design projects and activities with other peers, (b) to share understandings, where technology is a useful tool to share what has been learned and findings with other students, (c) to remotely collaborate, where individuals are able to work together due to the existence of new technology resources, (d) to peer collaboration, where students can collaborate using different technological tools, and finally (e) shared thinking, where individuals are able to share and combine ideas easily with the use of different technology resources. This classification is presented below on table 61.

Table 61
Classification of learner's type of collaboration with the use of technology.

Design projects	Share understanding	Remotely collaborate	Peer collaboration	Shared thinking
To design activities with peers.	To share learning with other students.	Work together no matter distance or time.	Collaborate using different resources.	Share and combine ideas.

Source: McCormick (2004).

The classification proposed by McCormick (2004) was student oriented and found different practices of technology when used by students. This classification also related to other studies that were presented in this section, and they included the same categories. The only feature that showed some differences between this study and the others is that this particular research centered all its uses on the learner.

In a further study, Tondeur, van Braak and Valcke (2006), tried to find the different sorts of educational computers' use that teachers perform in the classroom. The study was conducted over three hundred and fifty two primary school teachers and they found three aspects of computer use over elementary school teachers. These three features were divided in two groups: the first one that implied two items was focused in the (1) educational uses of computers, while the second one was meant to (2) teach basic computer skills to the students.

The first group included: (a) the use of computers as an information tool, where computers act as a tool to gather information, to present topics and so on, (b) the use of computer as a learning tool, which included the use of computers to do future research on specific topics, and the use of computers to practice knowledge or skills. The second group included: (c) the learning basic computer skills, which identified computers as a device to teach students the primary computer abilities, such as using the keyboard or the mouse, and basics of the functioning of the hardware. This classification is introduced below on table 62.

Table 62
Classification of computers' use in the classroom.

Educational uses of computers		**Teach basic computer skills**
Computers as an informational tool	**Computers as a learning tool**	**Learning basic computer skills**
Tool to gather information and present topics.	Computers to do further research and to practice knowledge skills.	Computers to teach students primary computer abilities.

Source: Tondeur et al. (2006).

This classification hold special interest on gathering information regarding the use of computers. As it was stated above, it is considered that technology involves not only computer, but the use of a larger number of devices, and software. Nevertheless, and due to the nature of this research, some of the categories proposed by these authors might be considered and further analyzed, to include in the present questionnaire.

In addition, another study conducted by Tondeur, van Keer, van Braak and Valcke (2007) found eight uses of technology among teachers: (a) encouraging pupils to train skills, where students would be able to develop additional skills through the use of technology, (b) using the computer for differentiation, where each students would be able to learn at its own pace and needs, (c) encouraging collaborative learning, where technology would be a tool to interact with other students, (d) asking pupils to do assignments on the computers, where computers are tools that facilitate the learning process and help the students to develop assignments, (e) encouraging pupils to search for information on the Internet, where this system would be a resource such as an encyclopedia to find information that is needed in the lesson, (f) using the computer as a tool for demonstration, where technology can help create demonstration to show to other students and the teacher, (g) using the computer as a tool for instruction, where technology is an instrument for teaching, and (h) teaching about the possibilities of computers, where technology shows its own advantages and limitations. This classification is presented on table 63.

Table 63
Classification of uses of technology among teachers.

Encouraging to train skills	**Differentiation**	**Collaborative learning**	**Assignments**
Developing skills to use technology.	Learn at its own pace.	Tool to interact.	Facilitate learning and develop assignments.
Search information	**Demonstration**	**Instruction**	**Computers**
Resource to find information.	Tool to create demonstrations.	Instrument for teaching.	Advantages and limitations.

Source: Tondeur et al. (2007).

This study showed eight types of use of technology for teaching and learning practices, and included different software and hardware as well as training. The classification is more complex than the first one that the authors presented in a previous study and it also included more uses. This classification will be considered since it is believe to be of special interest for its vast presentation of uses, as well as the type of classification. In addition, this categorization presented technology as a tool to differentiate instructions, which would allow all students to learn at its own pace.

In addition, Haydn and Barton (2007), led a study among high school teachers on the use that they did of technology. The results were that teachers used technology for: (a) digital video editing, when they had to work with cameras and other devices; (b) video conferencing, such as Skype, that helped them to communicate no matter the location; and (c) web design, that would help them develop web pages for instruction. In addition, teachers were positive that the more they used it, the more confident they would become, and the more proficient that technology would result in the classroom. This classification is presented below on table 64.

Table 64
Classification of uses of technology by high school teachers.

Digital video editing	**Video conferencing**	**Web design**
To work with cameras and other devices.	To help with communicating cross boundaries.	To develop material for instruction.

Source: Haydn and Barton (2007).

The authors proposed a classification based on three types of technology use that made special emphasis to video and web design, but did not mention specific uses in the classroom. Even though the uses could be at home while students work independently, these uses could also be implemented in the school as a part of a project. This classification of the uses will be considered for the present research.

Coll, Mauri and Onrubia (2008) conducted a study where they focused on the real and intended use of technology in formal instructive contexts. The authors classified the uses of technology as: (a) technology as a mediator instrument between students and content, or learning tasks. This use implies the activity that students develop around the content and tasks that are being taught and learned, (b) use of technology as an instrument to represent and communicate significates about the content or teaching and learning tasks for the teacher and/or the students. In these situations, professors and students use it as a support to present and communicate with others. (c) Use of technology as a tool to track learning and the activity of professors and students around the content and learning and teaching tasks. In this situation, technology helps teachers to track, regulate and control the processes and difficulties that students have in the realization of tasks in the learning of the content. And finally (d) uses of technology as a configuration tool around learning environments and workings spaces for teachers and students. Technology is a resource to generate teaching environments that cannot exist without them. Below is a representation of this categorization on table 65.

Table 65
Classification of the real and intended uses of technology.

Mediator instrument between student and content	**Instrument to represent and communicate significates**	**Tool to track learning**	**Configuration tool**
Activity that students develop around the content and tasks that are being taught and learned.	Professors and students use technology as a support to present and communicate with others.	Technology help teachers to track, regulate and control the processes and difficulties that students have in the realization of tasks in the learning of the content.	Technology is a resource to generate teaching environments that cannot exist without them.

Source: Coll et al. (2008).

In the four items of this classification, the authors established a relationship between four elements: the content, the teacher, the students, and the context. In addition, the authors considered these four elements as the main characteristics around the educational environment which would help to create a proper learning background.

Another research conducted by Tondeur, Hermans, van Braak and Valcke (2008) found the same categories that were conducted in a previous research (Tondeur et al., 2006): (a) the use of computers as an information tool, where computers acted as a tool to gather information, to present topics and so on; (b) the use of computer as a learning tool, that included the use of computers to do future research on specific topics and the use of computers to practice knowledge or skills and (c) the learning basic computer skills, that recognized computers as a tool to teach students basic computers skills such as using the keyboard or the mouse, and basics of the functioning of the hardware. This classification is presented on table 66.

Table 66
Classification of the use of computers.

Information tool	Learning tool	Learning basic computer skills
Computers as a tool to gather information.	Computers to do research on specific topics and to practice knowledge and skills.	Computers as a tool to teach students basic computer skills.

Source: Tondeur et al. (2008).

The authors proposed another classification similar to the one proposed on a previous study by Tondeur et al. (2006). In this classification they found the same categories and considered computers as the main technology used for education. Again, the categorization is considered of special interest and it will be taken into account for a future proposal; however, it has to be reflected not only computers as a main technology resource in education, but a vaster array of technology.

A study conducted by Padilla, Garrido and del Aguila (2008), among student-teachers at a university in South Spain, found different uses of technology in the classroom. Those uses were: (a) a word processor, to create word documents with information or worksheets, (b) spreadsheets, to gather data and create graphics, (c) presentations software, were technology is a tool to be able to present information in the classroom, (d) data management software, to collect information and be able to process emails and personal information easier, (e) e-mail software, to be able to communicate with others no matter place or time, (f) internet browser, to find information to use in tasks and assignments, (g) search engines, to also find information and browse different webpages, (h) instant messaging, to communicate with others that are not in the same place.

In addition, (i) chat, to communicate with people to exchange ideas and knowledge, (j) web forums, to post ideas online about some interesting topics suggested by the teacher, (k) e-mail lists, to be able to send email to others, and communicate with people, (l) P2P networks, were a game technology is used to establish communications with other people, (m) IP telephony, that uses IP addresses to communicate everywhere in the world, (n) mobile phones, to establish calls and talks with other people that is not in the same place at a specific time, (o) SMS, to send messages to others, and (p) mobile phones to access internet, where the latest generation of cell phones allow to access internet from a small device. This classification was specifically referring to uses that those teachers made of technology, some of this technology can be used in the classroom to fulfill activities and tasks that the teacher assign to the pupils. Below is a classification of this categories on table 67.

Table 67
Classification of uses of technology by student-teachers.

Word processor	**Spreadsheet**	**Presentation**	**Data management**
Word documents.	Gather data and graphics.	Present information.	Manage data.
Email	**Internet**	**Search engines**	**Instant messaging**
Communicate with others.	Find information to use on tasks and assignments.	To find information.	To communicate with others.
Chat	**Web forums**	**Email lists**	**P2P network**
To communicate with people and exchange ideas.	To post online.	To be able to send emails and communicate with others.	Game technology to stablish interaction.
IP telephony	**Mobile phones**	**SMS**	**Mobile phones to access internet**
Use IP to communicate with others.	To stablish calls and communication.	Send messages to others.	Latest generation of cell phones allow to access Internet.

Source: Padilla et al. (2008).

This classification included the appearance of different resources to use technology in education. In addition, it mentioned most of the devices used at a school environment, and the purpose of its use. This classification is of special interest because it included many devices and software that are currently in place in many institutions. This research categorization will be taken into account in order to build the present study.

Then, Brand-Gruwel, Wopereis and Walraven (2009), classified 5 types of informational use, depending on the solving information problems when using Internet. All these five classifications were interrelated and based on three main skills that were: reading, evaluating, and computer skills. The classification that they proposed was: (a) define an information problem, which will be mainly due at the beginning of the process, when the problem arise. This skill will be important to identify the needs and real problems that will be faced, (b) search information, which will imply the finding of important sources on Internet. This skill will be important because the source of the information might affect the results, (c) scan information, which will imply to scan and analyze all the information that has been found in the previous stage.

This phase will be important to discard some information that will not be useful, as well as to find information that is reliable and valid, (d) process information, that will consist on a deep processing of the information to gain understanding. For this skill, it will be important to analyze, select and structure information. In order to select information, it will be taken into account the judging of useful and quality information, and finally (e) organize and present information, that can be compared to the synthesis, where all the information will be gathered together and the problem will be resolved. Table 68 shows a representation of this classification.

Table 68
Classification of uses of technology depending on the solving information problems when using Internet.

Define an information problem	**Search information**	**Scan information**	**Process information**	**Organize and present information**
Due at the beginning of the process.	Find important information.	Scan and analyze all the information that is found on Internet.	Deep processing of the information to gain understanding.	Synthesis and gather information together to present.

Source: Brand-Gruwel, Wopereis & Walraven (2009).

The classification proposed by these authors it mainly involved the use of Internet and the different phases of its use. Some consideration would be Internet as a technology use to fulfill educational practices; however, Internet is not the only technology resource that should be considered in the present study. As observed in other researches, there are some authors that base their investigations in a specific type of technology. However, it is believed that more resources and devices should be considered when analyzing this matter.

Chen (2010) conducted a quantitative investigation among pre-service teachers and the use that those educators did of technology. The author specifically proposed the use of technology to support student-centered learning from a constructivist perspective. Chen (2010) found that the use of technology could be for: (a) information and data, where teachers provided opportunities for students to use technology to gather information and/or collect data regarding class assignments, (b) project, where teachers provided opportunities for students to use technology to conduct in-depth projects, and (c) presentation, where teachers provided opportunities for students to communicate their ideas by means of classroom presentations. Below is a representation of this classification on table 69.

Table 69
Classification of uses to support student-centered learning.

Information and data	Project	Presentation
Technology to gather information and collect data regarding class assignments.	Technology to conduct in-depth projects.	Technology to communicate ideas by means of classroom presentations.

Source: Chen (2010).

This classification was oriented in areas such as training, value, efficacy and context too, but the author also thought that all these factors were the ones that influenced teachers to use technology. This classification was also oriented on a constructivist approach, and emphasized the student as the center of the educational core. This presentation is of special interest for its contribution as a constructivist view emphasizing the role of the student as a main participant in the teaching process; and technology a tool to achieve the objectives.

Then, Losada, Correa and Carrera (2010) found four uses and competencies when it comes to the use of technology. The first one is (a) to understand the function of both a personal computer and an IT network with the aim of applying them to an improvement in teaching practice, then, (b) to search and find information by the way of websites using a browser and search engines to organize and transmit the information through desktop office suites, understanding their basic characteristics and limitations.

In addition, (c) to use collaborative tools (chat, forums, blogs, etc...) that allowed an integration in hands-on learning in Primary Education with the aim of opening the channels of learning to more modern and dynamic environments, and (d) to build multimedia and interactive and non-interactive web tools, to support the teaching-learning process provided in Primary Education, using audiovisuals and understanding their basic characteristics and limitations. As they specified, these core competencies were comprised of the following elements: (1) Information Systems; (2) Information Processing; (3) Collaborative Tools, and (4) Multimedia and Web Tools. This classification is presented below on table 70.

Table 70
Classification of uses and competencies with the use of technology.

Understanding	**To search and find information**	**Collaborative tool**	**Built tools to support teaching and learning**
Understanding technology to improve teaching practices.	Technology to find reliable sources.	Technology as a tool to collaborate.	Technology to support teaching and learning.

Source: Losada et al. (2010).

These authors proposed a classification that was based on the use of technology to support and improve teaching and learning practices. This classification is of special interest for its implementation as a tool to support and improve teaching practices. Sometimes, technology is used as a mere tool to fulfill a task, but it does not have any educational meaning; however, this classification proposed to use technology to help build better educational practices.

Morris (2010) conducted a one-on-one qualitative study to track teachers' competencies on the use of technology. They found that teachers used it for: (a) instant messaging, such as a way to communicate with the students on an asynchronous environment, (b) wikis, that would be used as a tool to create lessons, post information, and keep interactions with the students and within the students, (c) blogs, that would allow to increase the communication skill, (d) online discussions, where students would be able to interact and post their arguments to be evaluated by their peers and teachers, and (e) to introduce plenary sections of a lesson, where teachers might do a use of technology as a complementary tool to present the different topics to the students. This classification will be exposed below on table 71.

Table 71
Classification of the use of technology and the competencies of teachers.

Instant messaging	Wikis	Blogs	Online discussion	Plenary sections of a lesson
To communicate with students.	To create lessons.	Increase communication skills.	Interact and post arguments.	Complementary tool.

Source: Morris (2010).

Morris presented a classification based on five categories of teacher use. In these categories they made special emphasis on communication tools such as messaging, wikis, blogs and online discussions. Finally, they add a different tool to complement the first four. The uses are interesting and will be considered in the present study.

Gotkas and Demirel (2012), conducted a qualitative and quantitative study amid Turkish teachers focusing on one of the uses of technology: the blogs. They considered the blogs as a tool where students should control their own learning and the way they used it in education. In addition, the blog might be set as instructional activities, and it also leads to the use of other software such as word processor, excel or power point presentations. This one classification is presented below on table 72.

Table 72
Classification of the use of technology in blogs.

Blogs
Use of the blogs as a tool to learn and contribute to instructional activities as well as other software.

Source: Gotkas and Demirel (2012).

This classification only proposed one category for technology use that were the blogs. Blogs might be considered a collaborative or a communication tool used by either teachers or students in the classroom or even outside. Blogs are becoming more popular in education and being used by a large array of educators in their practices.

Meneses, Fàbregues, Rodríguez-Gómez and Ion (2012) directed a study among elementary and secondary school teachers in Spain that well implemented technology in their classrooms. The study was divided into two areas of usage of technology: The first one: (a) supportive use, which meant the use of technology to prepare activities that would be implemented in the classroom. This might imply the search of information online (Orr, 2006); or the preparedness of worksheets for students (van Braak et al. 2004), the second area was: (b) the management use, which implied the responsibilities that teachers needed to fulfill in order to develop organization within the institution (Meneses & Mominó, 2012). This category might include the performance of administrative and management tasks (McCannon & Crews, 2000), the communication with other experts and professionals (Law, Pelgrum & Plomp, 2008), and interacting with parents and pupils (Ward & Parr, 2010). This classification is represented below on table 73.

Table 73
Classification of the use of technology as supportive or in management.

Supportive use	**Management use**
Use of technology to prepare activities.	Responsibilities that teaches need to fulfill to develop decent practices.

Source: Meneses et al. (2012).

The categorization presented by these authors was focused on the proper implementation of technology in the classroom by the teacher. It is of special interest the elements that they considered in each group, as well as they did not describe a specific technology device such as computers, but they considered a more significant number of devices and resources. In addition, those authors considered the use of technology as a mean to implement decent educational practices.

In addition, Vanderlinde, Aesaert and van Braak (2014) conducted a quantitative study within Belgian teachers to find the use that teachers perform with technology in the classroom. In this study, they found thirteen uses that are related to institutionalize technology. They considered institutionalized technology when it has been fully implemented on behalf of teaching and learning.

The uses were: (a) technology to learn basic information and communication skills, where technology is a device to learn about the functioning of different technology resources, (b) use of educational software and instructional computer programs to learn, where there are specific software created to learn a specific topic, (c) use of the computer machine and other technologic peripheral equipment, where it is used for different learning tasks, (d) use of technology in a safe manner, where it is learned how to use it in a way that does not damage student learnings, (e) use of educational software and instructional computer programs to make exercises, where technology is a mean to make class assignments and tasks, (f) use of technology for remedial assignments, where it is a way to catch up on assignments.

In addition, (g) use of technology to look up and select information, where the students are able to browse internet and find different information using tools such as yahoo, google and so on, (h) use of technology during classical instruction, where technology is a tool for the teacher to complement the teaching practice, (i) use of technology to store information, where technology is used to save information that has been created for different class assignments, (j) use of educational software and instructional computer programs among those students that has special needs, where technology is implemented to those students that require special attention to help them develop the proper knowledge to keep up the demands of the class;

And (k) use of digital databases to look up for information, where different databases such as Wikipedia, google Earth or google books are used to find information, (l) use of technology to save and to share files with each other, where technology is a mean to share documents with other peers or with the teacher, and finally (m) use of simulation software, whiteboards, beamers to exemplify and/or explain complex matters, where technology is used as a support to the learning processes in order to make the teaching practices more prolific. Below is a representation of this categorization on table 74.

Table 74
Classification of use of technology in the classroom.

Basic technology skills	Educational software	Technology and peripheral equipment	Technology for safety	Software to perform exercises
Technology to learn about the functioning of different devices.	Software created to learn specific knowledge.	Technology used for different learning tasks.	Learnt to use technology securely.	Make class assignments and tasks.
Remedial assignments	**Select information**	**Technology in classical instruction**	**To store information**	**Special needs**

To fulfill assignments.	Browse internet and select reliable information.	Complement teaching practices.	Save information for later use.	For students that need special attention.
Search information	**Save and share information**	**Simulation software**		
To find information.	To save and share information.	To exemplify and explain complex matter.		

Source: Vanderlinde et al. (2014).

This study added a new aspect to the uses of technology because the investigation was conducted among the fully implementation of technology for teaching and learning. In other studies, some of the authors showed different uses that teachers ensured of technology, but it did not necessarily included technology as a part of the curriculum. This study had this special factor in which technology considered learning, the curriculum, the learner, and the teacher; becoming a complete sequence and practice, with the implementation of technology.

Finally, the research conducted by Badia, Meneses and Garcia (2014) identified the uses that teachers and students made of technology as a teaching and learning tool in fully implemented technology classrooms. Those uses were: (a) teachers' educational use of content technologies, that implies technology to deliver content; (b) teachers' educational use of interaction technologies: where technology is used to transfer and lead students through the teaching process; (c) students' educational use of content technologies: where technology is used to develop content; and (d) students' educational use of interaction technologies: where technology is used as a tool to cooperate and work together with others. This classification is presented on table 75.

Table 75
Classification of teachers' uses of technology as a teaching and learning tool.

Teacher use of content technology	Teacher use of interaction technology	Student use of content technology	Student use of interaction technology
Technology used by the teacher to deliver content.	Transfer and lead student through the teaching process.	Technology is used by the student to develop content.	Technology is used as a tool to cooperate and work with others.

Source: Badia et al. (2014).

The classification proposed by Badia et al. (2014) emphasized two agents in the use of technology that were the teacher and the student. From this first classification, the main use would be to present and deliver content, as well as to interact. Both activities would be performed by the educator and the learner, and they would be involved in the use of technology.

5.2 Secondary science and history teachers' use of technology

This section will gather some of the literature regarding science and history secondary school teachers' use of technology. If it is well known by the literature stated above that many authors researched about this topic, there are only a few that went deeper to find the uses of technology in a specific area such as history or science. Below are some authors that investigated on this issue, and their classifications.

Based on previous research, Angeli (2005), categorized teachers' use of technology in the science class by competencies. By technology competencies they referred to the teacher's ability to manage information and technology to create a better learning environment for students. That way, the learner would be able to achieve their goals at the school. In addition, certain aspects were considered. Those aspects referred not only to technology, but also to teachers' capabilities to use technology in different manners. As an example, teachers could use technology to emphasize social aspects, such as cultural facts that happen around them.

This research classified teachers competencies in five categories: (a) selection of appropriate science topics to be taught with technology, this category implied the use of technology to teach science, even though sometimes it meant to just show a picture with the use of digital media, (b) the use of appropriate technology-supported representations to transform science content, where technology was a method to support the teaching practices, (c) the use of technology to support teaching strategies, where technology is used to sustain the strategies that teachers use in the classroom when they teach, (d) the integration of computer activities with appropriate pedagogy in classroom instruction, when the teacher creates technology based activities to support instruction, and (e) the total technology competency, where teachers could present their lessons technology-infused in the classroom. Below is table 76 with this classification.

Table 76
Classification of science teachers' use of technology by competencies.

Selection of appropriate science topics	Appropriate technology-supported presentations	Support teaching strategies	Integration of computer activities	Total technology competency
Use of technology to teach science.	Technology as a method to support teaching practices.	Technology used to sustain strategies.	Teacher creates activities with technology to support instruction.	Present lessons integrating technology in the classroom.

Source: Angeli (2005).

This classification selected five types of competencies to be used in the classroom with technology. Those competencies emphasized the melting of technology into instruction, as well as into teaching and learning activities. Most of the categories exposed the figure of the teacher, but not the student; however, the student is implied in the act of learning. Even though this category was built regarding the use of technology in the classroom, it more accurately referred to teacher competencies as stated above.

Another research conducted by Law (2009) provided an approach of the uses of technology by mathematics and science teachers. In addition, in the same study, they organized these uses from the most frequently adopted to the less, separating both disciplines. This section will focus on science teachers, and the technology uses will be ordered from the most frequently used to the less frequently used.

(a) Technology for exercises to practice skills/procedures, where technology is a tool to practice abilities that have been learned in the lesson; (b) technology for teacher lectures, where technology is a meant to give some talks; (c) technology for looking up ideas and info, where technology is a resource to find information that must be required in the discipline; (d) technology for lab experiments with clear instructions and well defined outcomes, where technology is a source to find the information that is needed to fulfill a project.

Then, (e) technology for short-task projects, where technology is used to help resolve tasks, (f) technology for processing and analyzing data, where technology is a tool to study the results of an investigation, (g) technology for product creation, where technology is a tool to create the result of a practice, (h) technology for studying natural phenomena through simulations, where technology is a tool to create simulations to understand phenomena better, (i) technology for discovering math principles and concepts, where technology is a tool to find and resolve math problems.

And (j) technology for scientific investigations, where technology is a tool to help investigate, (k) technology for self-accessed courses and learning activities, where technology is a tool to plan and achieve courses demanding at the student own time, (l) technology for extended projects, where technology is a tool to resolve extended projects, and (m) technology for field study activities, where technology is a resource to study certain aspects of science. Below is table 77 with a representation of this classification.

Table 77
Classification of the uses of technology by science and mathematics teachers.

Technology for exercises to practice skills/procedures	**Technology for teacher lectures**	**Technology for looking up ideas and info**	**Technology for lab experiments**
Technology is a tool to practice abilities that have been learned in the lesson.	Technology is a meant to give some talks.	Technology is a resource to find information that must be required in the discipline.	Technology is a source to find the information that is needed to fulfill a project.
Technology for short-task projects	**Technology for processing and analyzing data**	**Technology for product creation**	**Technology for studying natural phenomena through simulations**
Technology is used to help resolve tasks.	Technology is a tool to study the results of an investigation.	Technology is a tool to create the result of a practice.	Technology is a tool to create simulations to understand phenomena better.
Technology for discovering math principles and concepts	**Technology for scientific investigations**	**Technology for self-accessed courses and learning activities**	**Technology for extended projects**
Technology is a tool to find and resolve math problems.	Technology is a tool to help investigate.	Technology is a tool to plan and achieve courses demanding at the student own time.	Technology is a tool to resolve extended projects.
Technology for field study activities			
Technology is a resource to study certain aspects of science.			

Source: Law (2009).

In this investigation, the authors found thirteen uses that resulted from science and math teachers' use of technology. This uses were related to class activities, as well as teaching, and presenting information. Some of this uses could not be used by all sort of teachers because they were oriented to the science discipline.

As it has been observed, there are not many literature regarding particular branches of education. Most of the researches focused their investigation on a particular level of education instead. However, it is significant to consider some of the investigation that referred to science and teachers, and the types of classification that they proposed.

5.3 Final consideration and proposed classification

This section about uses of technology and its uses by science and history teachers has revealed the presence of a significant number of authors that have considered this topic (Haydn & Barton, 2007; Tondeur et al., 2008); however, most of the literature referred to elementary or secondary education, but it did not presented a distinction between groups of teachers, or the level in which they were teaching.

After reviewing the literature, it is observed that there are three main classification on the use of technology in the classroom. The first one is the use of technology by teachers (Drenoyianni & Selwood, 1998; Tondeur et al., 2007; van Braak, 2004). This classification made special emphasis to the use of technology by educator in the classroom, and in some situations it also included the competencies that they have in order to implement it (Desjarding et al., 2001; Tondeur et al., 2007). In this type of classifications the main agent involved was the teacher and its practices.

The second group was oriented on the use of technology by teachers and students. (Badia, 2014; Tondeur et al., 2006). In this situation, the use of technology was analyze from the teacher and the student perspective. This second group has the teachers as an element in common with the first group, and it also contributed with the student. Some of the classifications also involved the competency with the use of technology to identify if it increased its uses (Tondeur et al., 2008).

For the authors, technology might be used for teachers or students, and it might imply many different meanings: one might be the use of technology as a tool to perform different activities in the classroom (Law, 2009), it also might be a mean to achieve and fulfill certain activities (Morris, 2010), a tool to resolve problems when related to internet (Brand-Gruwel et al., 2009), and so forth.

The third group involved four elements that were the content, the teacher, the student and the context (Coll et al., 2008) these four elements were considered as the main characteristics around the educational environment which would help to create a proper learning background, so that, technology could become a reality. This classification also has several elements in common with the first and the second groups such as the teacher and the student.

From these three classification, it was found that most of the authors selected a certain type of technology such as Internet or a computer, and based their classification among those devices or resources. This type of classification does not make it less valid, but it referred to only one specific category. As a matter of fact, the results would not be able to generalize into the uses of technology, but only on the specific kind. One of the advantages of this type of classification is that it gives a more accurate outcome on a particular area, for example: internet; however, it does not give an overall of the uses among different types of resources.

In addition, some of the authors included the reason why technology was used (Angeli, 2005), while other authors included which mean was used, in order to implement technology (Padilla et al., 2008). Both categories were of special interest and should be taken into consideration. The first category, which included what is the use of those resources and devices, gives an overall perspective to the application of such technology. In the other hand, the type of technology assists to understand which is more popular among teachers, as well as which ones are used the most.

Another distinction that has to be considered is the use of technology by teachers or by students. As it can be assumed, both agents are different, as well as their needs. In this situation, it is significant to understand if both agents involved in the educational process include a similar type of technology, or if they used different types, for similar purposes. This case refers to the use of a word processor to write an essay; while teachers might use a different type of resource for the same purpose.

Furthermore, when technology is included into the work environment, the teacher is the agent that will decide the device, the software and the resources that will be available for the learner depending on the school properties. Though outside of the school environment, the student will be the agent in charge of choosing the type of technology that will better suit its needs.

For the nature of this research, it is believed that schools in Utah offer a vast array of technology to be used in the classroom (Gray, Thomas and Lewis, 2010); however, there might be some district that might not dispose of sufficient means to implement technology in their schools. The economical budget, as well as the involvement of the different professionals, are the factors that might impact the most in the implementation of technology.

In summary, this first review of the uses of technology has shown the appearance of many studies regarding this topic, as well as the different perspective that professionals gave to its use at an elementary, secondary and university level. However, it is important to recognize that most of the articles presented in this section referred to elementary and secondary education.

It is also important to mention that it has been difficult to find studies that related to the uses of technology at a secondary level, and especially studies that related to the discipline of history and science. Only two of the articles presented were related to the scientific discipline (Angeli, 2005; Law, 2009). Unfortunately, there was not the possibility to find studies that focused on history teachers.

As a result of this analysis, a new classification has emerged which will include the type of uses of technology, as well as the frequency of use in which teachers implement it in the classroom. The classification will consider the teacher and the student from the educator perspective, and it will also include the curriculum that is taught in Utah.

After reviewing the literature stated above, it was significant to categorize the use of technology among the different beings implied in the teaching and learning processes. It is for this reason that this classification will be centered on the learner and on the teacher. It is considered (1) learner use when the students are the main individual involved in its use, such as creating activities, resolving problems, building new tasks and so on; otherwise, it is considered (2) teacher use, when the teacher is the person involved in using technology to the purpose of fulfilling different activities.

Because of the different nature of history and science, it was essential to find different types of uses for both disciplines. One of the main reasons is the different practices that each type of teacher might implement to teach their subject. As a matter of fact, history teachers might use technology for a certain purpose, while science teachers might use technology with a different determination. Even though most of the questions might be similar, there are certain items that should be adapted according to each discipline.

As a first categorization, the use of technology will be sub-categorized in two main groups: (1) learner use, that implies the use of technology by students; and (2) teacher use, that implies the use of technology by teachers. In addition to this first categorization, the learner use will be divided in three other groups: (a) technology as a curricular tool, where technology is used to learn the standards of the subject, (b) technology as an informational tool, where technology is a tool to search, find, scan, analyze and synthesize information (Brand-Gruwel et al., 2009; Tondeur et al., 2008), and (c) technology as a collaborative or interactive tool, where technology is used for educational interaction and collaboration between teacher and students, or between students (McCormick, 2004).

The second group, that is focused on the teacher, has four components: (d) technology as an instructional-learning tool, where technology is a didactical resource to teach the curriculum (Tondeur et al., 2008), (e) technology as a design tool, where technology is a tool to plan engaging lessons in the classroom (Tondeur et al., 2008), (f) technology as a collaborative-Interactive tool, where technology is a tool to communicate and interact with students, parents and other professionals, and (g) technology as an assessment tool, where technology is a tool to evaluate the students' learnings and knowledge (Tondeur et al., 2008). Below is a table 78 that summarizes the different categorizations and its definition.

Table 78
Classification of the use of technology by students and teachers.

Uses of technology	Definition
	Learner use
Curriculum tool	Technology is used to learn the standards and objectives of the subject.
Informational tool	To research and process information. Using technology to search, select, scan, analyze and synthesize information. The emphasis is on the interaction between pupils and the subject-domain content: researching and processing information and communication.
Collaborative tool	Demonstrate the need of examining computer use from a multi-faceted, rather than a singular, perspective.
	Teacher use
Instructional-learning tool	Technology as a didactical resource to teach the curriculum.
Design tool	Technology as a tool to plan engaging lessons in the classroom.
Collaborative-Interaction tool	Technology is a tool to communicate and interact with students, parents and other professionals.
Assessment tool	Technology as a tool to evaluate the students' learnings and knowledge.

Adapted from: Brand-Gruwel et al. (2009); McCormick, (2004); Tondeur et al. (2008).

The uses classification will include a certain amount of items that will be parallel for both disciplines, except for the first category, on the learners' use, that will include specific items related to each subject. History will be included in the social studies curriculum, and it will include five main areas: (a) Utah history, (b) United States history, (c) geography, (d) world civilizations, and (e) government and citizenship. In the other hand, science will include only four items that will be: (c) earth science, (b) biology, (c) physics, and (d) chemistry. Those item have been chosen after reviewing the Utah core curriculum in each area of learning.

The classification of science and history teachers' use of technology has been built through the participation of many authors' investigations. Because there was not a specific investigation that fulfilled the needs of this research, a necessity for a special classification arose. Furthermore, the unification of many classifications resulted in the categorization presented above for the present study.

One of the weaknesses that appeared with this classifications is that it raised the doubt of implementing a classification that was never tested before in any other study. Even though most of the categories were already created, they were never placed together for gathering data in secondary science and history teachers, and there is no identification of the possible outcome that might appear. Though, in this situation, it is believed that the present classification will fulfill the purpose for which it is created because it has been analyzed and created according to the curriculum in Utah.

In the other hand, one of the first strengths is that a significant number of literature was reviewed to build the fundamentals of this issue. The overall view of the different classifications offered an enhanced perspective on what it could be more accurate in this study. In addition, the use of different classification permitted to build a system of categories that complemented each other. As a result, a new classification emerged, and that classification was considered to be more accurate for the sample that was aimed in this study.

Another strength is that most of the studies that have been considered for this research are from a current period of time, and not obsolete. This statement implies that the classification is more reliable, as well as adapted to the type of technology that is currently present in classrooms. In addition, the uses that teachers might ensure in their schoolrooms might be similar to the ones that appeared in the literature.

In summary, a vast amount of literature have been analyzed regarding the topic of uses of technology; however, only a few authors analyzed it from the perspective of teachers' discipline.

In addition, and because of the nature of this research, another classification has been built that presented different weaknesses and strengths, but it is assumed that the present categorization will be suitable, and the categories will correspond to the demands of teachers in Utah.

EMPIRICAL FRAMEWORK

VI. Research design

This page initiates the empirical framework of the present study. This section starts with the chapter about research design, where it states the phases that have been taken in order to fulfill the investigation exposed in the theoretical framework. First of all, there will be a presentation of the research aims and objectives that were the foundation of this investigation, then the context of study in Utah, and the participants, then the data collection and the procedure to collect data, the survey instrument and measures, and finally the data analysis. Following this section there will be an explanation of the findings that were achieved with the information gathered from teachers in Utah, and to finalize, there will be a section with the conclusions, the limitations, and the educational implications of the study. The last section will contain the bibliography and annexes.

6.1 Research aim and objectives

This research was intended to gather significant information about secondary history and science teachers that impart their knowledge in Utah. In addition, there were three aspects that were taken into consideration: the conceptions of teaching and learning; the conceptions of educators about the subject they teach; and the feelings that they experience when using technology in the classroom. Moreover, there was an intention to gather data on the use of technology by teachers and students.

Furthermore, this investigation proposed three main objectives that were: (1) to identify and describe the main characteristics of science and history teachers from Utah that participated in the study, (2) to establish the relationship between competency with the use of technology, conceptions of teaching and learning, conceptions of the subject they teach, feelings and emotions with the use of technology, and uses of technology in the classroom, and finally, (3) to identify the profile of science and history teachers according to all the variables that appeared in the investigation.

The first objective that was established in this investigation was to identify and describe secondary science and history educators that teach at a secondary level in Utah, and that have participated in this investigation. In order to fulfill this objective, there were some variables that were taken into consideration. Those variables were: the gender, age, the highest university degree, the type of school, and the quantity of years that they were teaching as a full time job teacher.

In addition, there was also an aim to identify and describe the competencies with technology of these two particular groups of teachers. To gather this information, there were some variables to reflect such as: the types of technology they use and the level of proficiency; the training they received, the training received during the last five years; the usefulness of the training; and the time when they were able to implement it in their classrooms.

Moreover, the conceptions of teaching and learning were also identified and described through the analysis of the teachers' approach to education. In order to accomplish this purpose, the teachers were asked questions about two theories of education: the constructivist, and the traditional. Depending on the positioning of the teacher answering those questions, they would be considered into one or another type of teacher.

In order to identify and describe the conceptions of the teachers about the subject they teach, the educators were asked questions about their own discipline. Science and history were different due to the nature of their subject, and each subject consisted on queries about their respective fields of study.

Then, there was an intention to understand the feelings and emotions of teachers when they performed with technology in their classrooms. Those feelings were divided into two groups and several sub-categories to help understand the types of affection that educators experience due to the use of technology.

And the last part of the first objective was to identify and describe teachers and students use of technology in their classroom. This objective was achieved through the analysis of the use of technology applied to the curriculum in Utah, and also through the analysis of some of the most significant tools that educators and learners might use in the educational process. In this situation, both disciplines entailed similar tools, but the part of the curriculum was different due to the dissimilarities between science and history.

The second objective was to establish a relationship within the different variables considered in this investigation. This relationship is intended to gather information between competencies with the use of technology, conceptions of teaching and learning, conceptions of educators in the subject they teach, feelings and emotions, and uses of technology. This relationships might show a correlation between two or more variables, being direct or inverse according to the outcomes.

And finally, the last objective was to identify the profile of secondary science and history teachers from Utah that have participated in this research, that have used technology in the classroom, as well as to compare the outcomes of both disciplines. Through the results of the cluster analysis, there will be the appearance of teachers' identity for each discipline. This identity will allow to differentiate and compare each cluster of teachers, as well as to compare the type of teachers in each subject.

6.2 Context of the study

6.2.1 Education in Utah/districts

Two of the main subjects that are taught in secondary education are history and science, and these two disciplines are divergent from each other due to their nature. Science belongs to the natural sciences branch, while history refers to social studies. One of the reasons why these two disciplines were selected is because of the opposite features of each one. Science is generally a system of knowledge that tries to cover the truth to different facts as well as general laws that are obtained through a scientific method (Abd-El-Khalick & Akerson, 2009). However, history is the study of chronological events affecting different nations or institutions and it includes an explanation of their causes and consequences (Yilmaz, 2008). As a result of the differences between both disciplines, it is thought that history and science teachers will differ in their way of teaching, thinking, feeling, and implementing technology in the classroom.

Education in Utah is separated between elementary education (K to 5 or 6); and secondary education: middle or junior high (5-8); and high schools (9-12). Because of the sample that had been aimed, and the information that wanted to be collected, this investigation reached a sample of secondary teachers ranging from 8th to 12th grade, and mainly from the grades 9th to 12th, were the subjects became more specific. The primary focus was on high school teachers, even though there were some teachers selected that not only taught in high school, but also in middle and junior highs. These set of teachers taught social studies and sciences disciplines.

The state of Utah has an overall of forty-one public districts in total through the whole state, and each district has different number of schools under their domain. The number of schools may depend on aspects such as the area where it is situated, the population, and the extent of the state. However, for this specific research, only teachers from forty of these forty-one areas were approached. In addition, each district has different types of schools such as public, charter and private. From this pool, only public and charter schools have been contacted, which the majority of their participants being from the public area.

6.2.2 Curriculum in Utah for teaching history and science in secondary education

In middle, junior high and high schools, the curriculum is separated in different subjects. Science has four main branches of study that are: biology, earth sciences, physics and chemistry; in the other side, history comprises: Utah studies, United States history I and II; geography, world civilizations and United States government & citizenship. In lower grades, these subjects are studied in a more general manner; while becoming more specific with an increase in grade.

6.2.3 Technology access in Utah

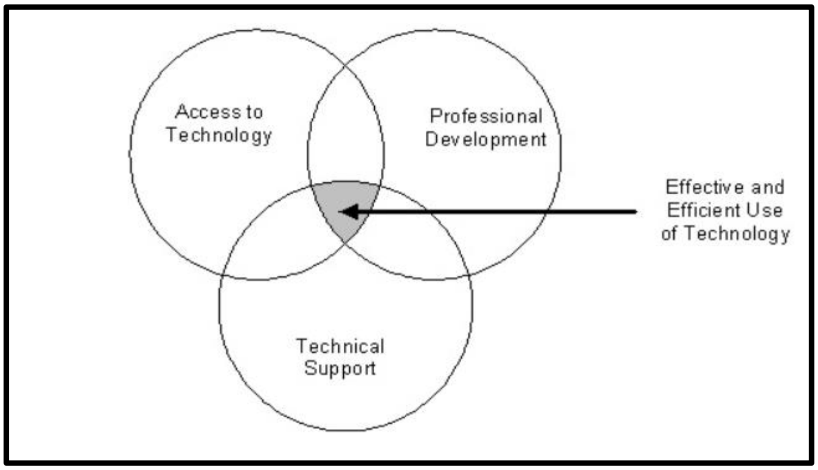
Even though the United States is well recognized for implementing technology in the classroom, as well as having a large amount of technology resources (IES, 2009), there are still some areas in the state of Utah that do not count with as many resources to use in the classroom as other places. Some of the questions that were in the questionnaire have led to this conclusion because some of the teachers stated (and even wrote) that they were unable to access technology in their classrooms.

In Utah, each school district has the responsibility of deciding how much money they want to invest into technology to achieve the educational objectives, and how fast they want to install the technology infrastructures. Every school district has also a Board with a specific number of members that will establish authority to set educational policies. Districts can also differ in their funding competences to provide with technology programs. In 1991, all districts profited from the legislative funding under the Educational Technology Initiative; however, that funding vanished and state budgets became really tight in the last few years, raising some concerns about how to update obsolete devices and software.

Even though the purpose was to keep technology in their full potential, it finally became an issue due to the lack of economic support, and not only with devices, but also with professional development opportunities and technical support. Moreover, the amount, age, accessibility and use of technology differs greatly, by district and school.

In a research study conducted in Utah, the main characteristics to the implementation of technology were: (a) access to technology; (b) professional development; and (c) technical support. Schaff, Stahla, Minchey and Gibson (2005). Those three main aspects would determine the effective and efficient use of technology by educators and students at the schools. The figure below provides a diagram sowing the correlation between these three factors.

Figure 1. Factors influencing the effective and efficient use of technology in Utah.



Source: Schaff, Stahla, Minchey and Gibson, (2005).

If it is important to have technology to implement curriculum among students, it is also important to know how to make this devices and software work. There are many professionals that have the opportunity to use a computer in the classroom, but they do not know the functioning of that device, and so, they do not use it. Because of that, professional development has to be available for all teachers in order to implement technology successfully in the classroom. In addition, there are many problems that appear when using it, some might be software related, and some other might be about the hardware. In order to fulfill the needs of educators and to support them in their educational practices, it is important to have a group of professionals, highly qualified, to be able to resolve all sort of problems as the ones stated above.

One of the main entities in Utah regarding educational technology is the UEN (Utah Educational Network). The UEN was established around twenty years ago by the Utah State Legislature to manage telecommunications technology for public and higher education. Even though the first name was SETOC (State Educational Telecom Operations Center), it become UEN in 1989. The UEN, then, serves education all over Utah.

Table 79
UEN services from K-12 education.

UEN serves:	And it's:	In support of their mission to:
Utah Public K-12 Education	612.551 students 32.376 educators 1.044 schools	• Assure literacy and numeracy for all Utah children • Provide high quality instruction for all Utah children

	(USOE fingertip facts 2013-2014)	• Establish curriculum with high standards and relevance for all Utah children. • Require effective assessment to inform high quality instruction and accountability. (Promises to Keep 2009)

Source: UEN.com.

Below is table 80 with a representation of all the districts and the level of network infrastructure.

Table 80
Level of network infrastructure.

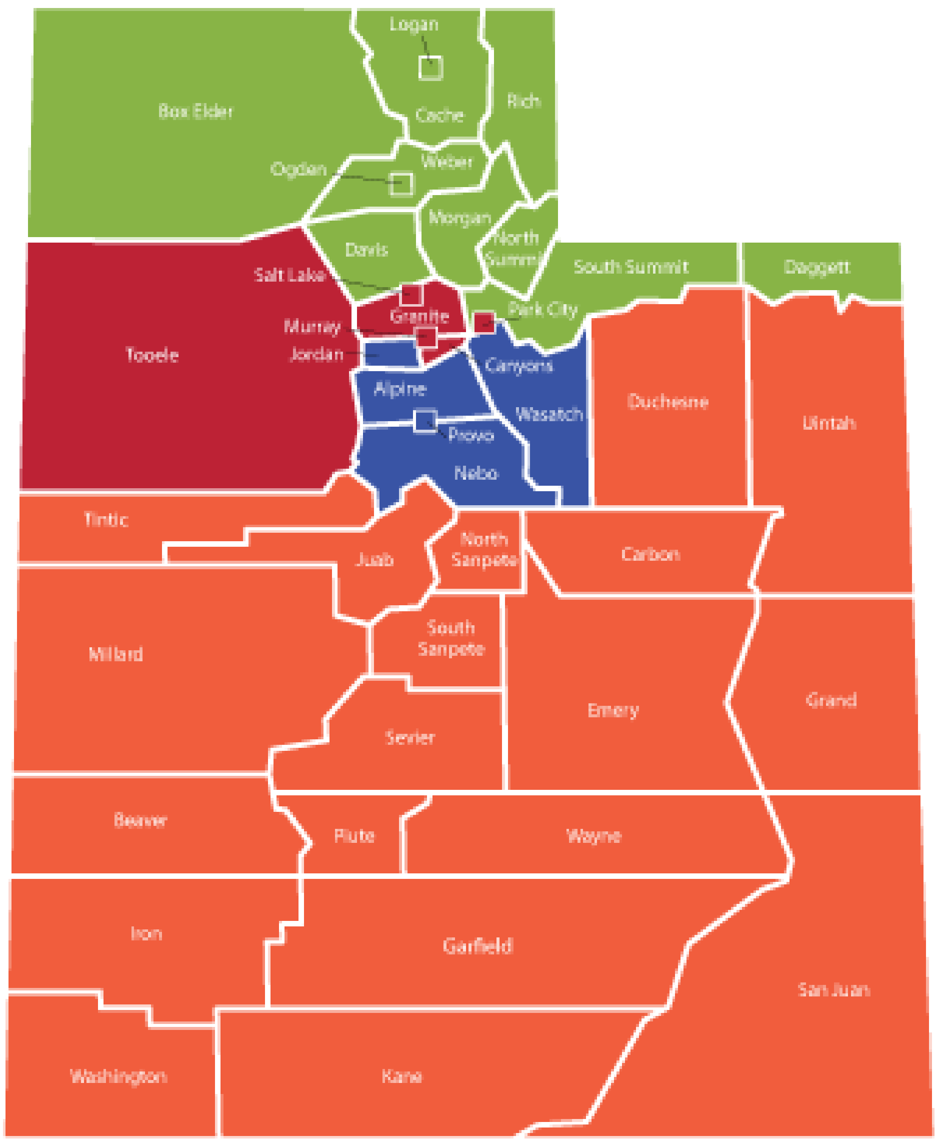
Level of network infrastructure	Districts
High technology infrastructure	Alpine School District
	Beaver School District
	Box Elder School District
	Cache School District
	Canyons School District
	Davis School District
	Granite School District
	Iron School District
	Jordan School District
	Juab School District
	Logan City School District
	Morgan School District
	Murray School District
	Nebo School District
	Ogden City School District
	Provo City School District
	Salt Lake School District
	Sevier School District
	Tooele School District
	Washington School District
	Weber School District
Good Technology infrastructure	Carbon School District
	Duchesne School District
	Emery School District
	Garfield School District
	Grand School District
	Millard School District
	Kane School District
	N.Sanpete School District
	NorthSummit School District
	Park City School District
	Piute School District
	Rich School District
	South Sanpete School District
	South Summit School District
	Tintic School District
	Uintah School District

	Wasatch School District Wayne School District
Poor technology infrastructure	Daggett School District San Juan School District

Source: UEN.com

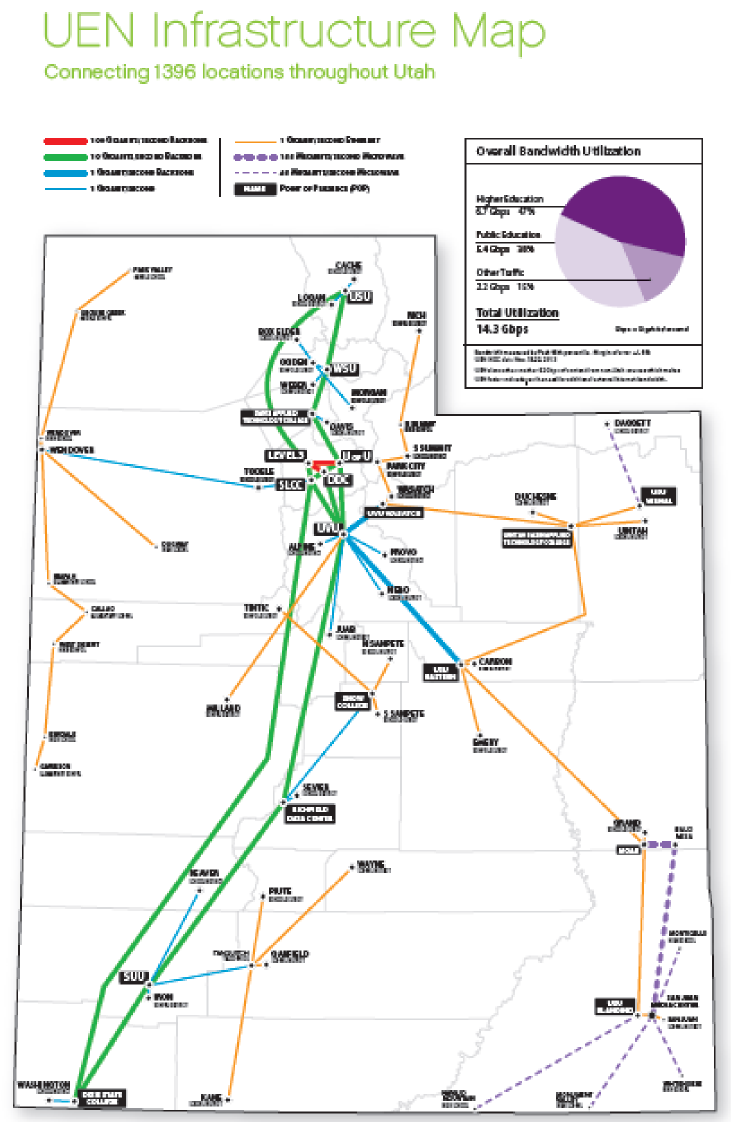
The districts presented above are distributed as follow in Utah:

Figure 2. Distribution of the districts in Utah.



Below is a map of the UEN network. In the map, it can be appreciated the Internet speed and usage throughout Utah. In addition, it can be observed that the north-central part of the state is not only the best communicated, but also is the best connected to the network. Moreover, there are three location that are highlighted as the main sources of this map: the University of Utah, where the UEN was founded and it has its headquarters; the Level 3, and the DDC. In addition, a table has been created to show the Districts that are enrolled in a better network infrastructure. And the technologic infrastructure is also presented on the figure 3 below.

Figure 3. Representation of UEN Infrastructure Map in Utah.



Source: UEN.com

After analyzing the graphic, there is a correlation of the districts that dispose of more technology and the ones that are situated in a better network. In a study conducted in 2009 in Utah regarding technology (NCES, 2009), the percentage of secondary school teachers using computers in the classroom ascended to 95%. In addition, there were a ratio of student to computer of 5.2 and a 94% of computers had access to Internet.

6.3 Data collection and procedure

In order to interpret this research, a quantitative approach was used with the objective of gathering data, to attain the purpose of this investigation. The decision to use this methodology began with the willing to obtain a relationship between variables to construct statistical models in an attempt to explain what was observed more objectively, from a large group of teachers about a specific subject matter.

Once the questionnaires for teachers of both disciplines were created, the following stage took place, and it started the plan to implement the instrument. After analyzing all the options, and even though many possibilities were considered such as an email or an online questionnaire, it was believed that the easiest way for the teachers to get the information and reply to it, was by regular mail.

On a previous pilot study, a significant amount of teachers from Utah were contacted through their emails to ask if they would be able to participate as a sample on this research. Even though the expectations were big on the quantity of responses, only a minimal 1% replied to that method willing to participate. As a result, it was considered that regular mail would be more beneficial to reach most of the sample that this study aimed for. In addition, teachers would have a physical questionnaire that they would be able to respond to at any time, and convenience.

Before sending all the information, an email was sent to the USOE (Utah State Office of Education) to ask permission to contact science and social studies teachers, as well as the information and how to approach them. The USOE responded that teacher information is considered public, and thus teachers could be contacted directly through the school. Emails were not facilitated, but an excel spreadsheet with the names of the teacher, the subject they teach, the school, the district, addresses of their school and phone number of the school was provided. After gathering all the data about teachers, the next step was to send out all the questionnaires.

Between November 26th and December 19th, of 2014, six-hundred teachers were contacted to gather information about their identity and uses of technology in the classroom. After the questionnaire was created, three-hundred copies of each questionnaires were made. The total amount of copies was equivalent to one thousand and eight-hundred pages of paper with questions in both sides, so each teacher received three pages doubles-sided with questions, but only five of those sides had the questions.

After the questionnaires were printed, they were put into an envelope with another self-addressed envelope and a stamp in it. In addition, the envelope contained a note with a presentation of the researcher, the reason to conduct the study, the instructions on how to fill out the document, and all the material needed to return the questionnaire at no-cost for the participant. The questionnaires were collected from November 26th until February 5th, when the ratio of responses went down, and there were no other questionnaires sent back to the researcher. At that point, the collection of data was concluded.

The data presented in findings is the result of the collection of questionnaires among six-hundred secondary teachers from social studies and sciences branches. Even though a large amount was contacted, only two hundred and sixteen professionals were able to respond and send the questionnaire back to the researcher.

6.4 Participants

An explanatory factorial analysis was applied to this research. This study counted on an intentional sample of 216 teachers from secondary education in Utah. From this amount, 50% were science teachers and the other 50% social studies teachers that teach history in the classroom. A total of 108 teachers from each discipline replied to the questionnaires and sent them back to the researcher.

From this 216 teachers, a total of 103 participants were males, and the other 109 were females. Four of the participants decided to not state their gender. After analyzing the data, it can be observed that more females participated in this study, a total of 51.4%; however, the total amount is really close between both genders since males scored 48.6%. This characteristic might imply that at a secondary level, there are similar quantity of male and females.

The average age of science teachers was 50.36 years with a standard deviation of 8.22; while the average age for history teachers was at 49.58 years with a standard deviation of 7.95. Even though the average age is higher in science teachers, the difference is not even a year apart. In addition, it can also be observed that most of the teachers that participated were at an overall of 49 or 50 years of age. The mean indicates that all the professionals involved in this study might not be new to education since they are mostly adults getting to their seniority.

In relation to the argument stated above, another question regarding years teaching was asked in the questionnaire. As a results, science teachers had an average of 21.09 years teaching with a standard deviation of 7.5 years; while history teachers had an average of 22.20 years teaching with a standard deviation of 9.12 years. Most of the teachers in this study had many years of experience as educators.

Another significant information was the university degree achieved by the teacher. From the sample that participated in this study, 91 held a bachelors (43.3%); 113 a masters (53.8%); and 6 a PhD (2.9%). It is significant to highlight that more than half of the secondary teachers achieved a master’s degree. Or went further in education. Even though the PhD ratio is still low, more than 50% of educators pursued another degree in education to complement their knowledge and formation.

Although the questionnaire tried to reach teachers from all types of schools, only public and charter educators participated in this study. After analyzing the results, it can be observed that there is a larger amount of educators working in the public scene instead of in charter schools. One of the reasons could be the large amount of public institutions in the state, while charter and private schools are minimal. Looking at the table, it can be observed that 203 (96.2%) of the participants are in the public sector, against the 8 (3.8%) that work in the charter area.

From all the sample, 210 educators stated their training. From that amount, 193 (91.9%) did receive training; 17 (7.9%) did not; and 6 (2.8%) teachers missed the question. This means that most of the science and history educators in Utah have been trained on how to use technology in the classroom. Even though it is not the 100%, it is a large percentage of teachers that have participated in technology formation.

In addition, there is an overall of 179 (85.2%) of the teachers that received training in the last five years, while the other 31 (14.8%) did not. Even though there was a 2.8% of the sample that missed the question (6 participants), it is still a large amount that were into training for education in the last five years. This might be because of the resources that the district has, the level of involvement from the teachers, and the integration of technology in the curriculum. In addition, it seems that districts and technology departments do a great effort to continue the formation with technology after the first training to keep implementing and growing in the mastering of teaching with it.

Even though most of the teachers received training, 206 (95.3%) compared to the 10 (4.7%) that did not; most of them received only a one day training 102 (47.4%), focusing on the basics to use the technology resources. The basic training that would imply a course that could be extended to a week had also a large amount of teachers 59 (27.4%); but the advanced and expert trainings that would take more time and probably monetary involvement were minimal, being at 17 (7.9%) and 27 (12.6%). In consideration of the importance of training to the implementation of technology, it is significant that most of the teachers received some sort of instruction, even though it might have not been an extended course.

Another characteristic that has to be taken into account is the usefulness of the training. Most of the training was in short periods (a day or a week), as characterized above, but that does not mean that the training was poor, as a matter of facts, there were educators that considered the training especially useful. Educators were asked to answer on a rate from “I did not receive any training” to “a little useful” and “completely useful”. From the total, 10 teachers did not receive any training (4.7%); 24 (11.3%) considered that it was not that much useful; 56 (26.4%) considered it a little useful; 85 (40.1%) somewhat useful; and finally 37 (17.5%) considered the training completely useful. Only a 16% would be in the two first classifications where technology training would not be as important or useful for those educators. The rest of the participants (84%) would consider it important and valuable. This outcome might imply that teachers are certainly positive about the training they are receiving in their institutions, and it might be considered a valuable resource for teaching proficiently.

Another issue was the effectivity of the training received, and when it started being useful. After analyzing these results, it might be observed that most of the teachers perceived that the training was useful from the first day they attended the workshop 97 (46.2%); in addition, the amount of teachers that did not receive training or that never were able to use anything they learned were 29 educators (13.8%). Even though it is not a large percentage, it is still over 10% of the total, which might imply the restructuring of the training to make it valuable and useful for a larger amount of teachers. The rest of the teachers, 181 (86.2%) considered their training really useful from the beginning and after the first weeks or months. This is a positive factor that might imply that training is overall really useful, and teachers are able to apply what they learn ipso facto.

Two tables with the districts, the schools the quantity of teachers from each discipline, and how many teachers were contacted in each location will be presented in the annex, section IV.

6.5 Survey instrument and measures

To gather data about teachers’ identity and the use of technology in the classroom, two questionnaires with close-ended questions were created. Those questions were primarily in the form of a 5-point Likert scale, and implemented among six-hundred social studies and science teachers from Utah. However, only 36% of this sample participated and sent the questionnaire back. The questionnaires included a number of items that were previously used in other studies (Sigalés, Mominó, Meneses & Badia, 2009), as well as some parts of the questionnaire such as the conceptions of teaching and learning, that were taken literally from a questionnaire that was previously used in other studies (Aypay, 2010; Chan & Elliot, 2004; Cheng et al., 2009).

The form had mainly the same questions in each document, except for the conceptions of teaching and learning history and science, and the uses of technology. Those sections were adapted to each discipline. The total amount of questions in each document was one hundred and twenty five for each history teacher; and one hundred and twenty two for each science teacher. In addition, the queries were separated by topics, and teachers were asked to answer as accurate as they could to what was asked. Even though each section contained a separation on the document, there were no invitation to think about the nature of the questions such as if it was a constructivist or a traditional type of query.

The following sections will include a more in depth analysis of the characteristics of each of the blocks in the questionnaire.

6.5.1 Socio-professional information

This section was the first one of the questionnaire, and it was the same for both history and science professionals. The socio-professional information had three sections to offer an overall explanation of the teacher that was participating in the sample. The majority of the questions on this section were based on a research conducted by Sigalés, Mominó, Meneses & Badia (2009). The decision to use that questionnaire among others arose from the nature of the objectives that this study aimed for. Even though most of the questions were similar to the ones from that research, there were some items that were adapted or created, to obtain a specific response that would help in the understanding of the sample.

In the first section, teachers were asked to provide their age, gender, highest university degree, year when they started teaching, and type of school where they were working at. Those questions were answered according to a number choice such as 1, 2 or 3; in the other hand, the age and year in which they started teaching was answered by the educator according to their specific characteristics.

The second section was regarding teachers' competency using specific technology or software, and it was divided into four parts. The first part consisted on five items that referred to basic technology tools. The second part comprised five items about software use. The third part consisted of four items about specific software to teach, and the fourth part included only one item that was the level of expertise designing activities in virtual learning environments. The section together consisted of a total of fifteen questions in the form of a Likert scale with five possible options: 1, no competency; 2, some competency; 3, average competency; 4, good competency; and 5, very good competency, for the first fourteen items. The last item comprised a different Likert scale with the following options: 1, extremely poor; 2, below average; 3, average; 4, above average; and 5, excellent.

The first and second section of "basic technology tools" and "software use" was founded on the investigation conducted by Sigalés et al. (2008). In their investigation, they studied the integration of Internet into Spanish education. The study was conducted among elementary and secondary teacher and used a significant number of participants. In their questionnaire, they included different items regarding the competency of teachers using different tools and software, and they made special emphasis to Internet. Some of the main areas that they investigated were: "knowledge and experience with technology and Internet", "use of technology at the school and outside the school", "technology in the classroom", "use of technology when not working in the classroom". Even though most of the items in this first two section derived from these sections of the questionnaire, other items were added in order to make the competency with technology more general instead of focusing on just one area such as Internet. In addition, they proposed a Likert scale with four options and this investigation proposed five.

The third and fourth sections “specific software to teach”, and “the level of expertise designing activities in virtual learning environments” also used some items on the questionnaire created by Sigales et al. (2008), but it also founded its items in the research conducted by Vargas, Chumpitaz, Suárez and Badia (2014). These authors focused on the relationship beween competency with technology and its uses. In their investigation, they classified competencies into: basic competency, pedagogical competency, and complex technologic competency. Even though the classification in this investigation was not equal, some of the queries were suitable on this investigation.

The last section was about the educational training that those professionals received concerning technology, and it included five queries. The two first questions were used to know if they received training, and were answered using a 1, yes; or a 2, no. The following question regarding the perception of the training received was responded using a 5-point Likert scale being 1, I didn’t receive any training; 2, minimum training; 3, basic training; 4, advanced training; and 5, experts training. The next question was regarding the usefulness of the training and was also responded by a 5-point Likert scale with 1, I didn’t receive any training; 2, not that much useful; 3, a little useful; 4, somewhat useful; and 5, completely useful. The last question asked when the training started being useful for them, and was also responded with a 5-point Likert scale being 1, I didn’t receive any training; 2, never; 3, after a few months; 4, after a week; and 5, from the first day I attended the training.

6.5.2 Conceptions of teaching and learning

The second part of this questionnaire was the conceptions of teaching and learning. In this section, an existing instrument was used, which was developed and tested to investigate teachers’ conceptions of teaching and learning (Chan & Elliot, 2004). This block included thirty questions referring to the two main theories in education: the constructivist and the traditional approaches. The constructivist approach consisted of twelve questions while the traditional approach consisted of the remaining eighteen. All the questions were answered using a 5-point Likert scale being 1, completely disagree; 2, disagree; 3, neutral; 4, agree; and 5, completely agree. The origin of this questionnaire is from the research conducted by Chan and Elliot, (2004), even though it was further used in other researches such as Aypay, (2010); and Cheng et al., (2009).

6.5.3 Conceptions of teaching and learning history and science

The questions regarding conceptions of teaching and learning history and science were different for both disciplines. For this reason, each questionnaire included their own questions regarding the nature of the subject.

The science section consisted of eighteen questions based on a conceptual dimension, and it was divided in four blocks. The first one referred to "science as a discovery", and it mainly considered science as a procedure of finding out what exists in the world. This section included five questions. The second one was "science as knowledge", where science is seen as a product, a set of thoughts to be studied. It also included five questions; the third one was "science as a process"; where science is considered a process of examination in which information are collected to discover the certainties about the world. It included four questions; and the last one was "science as explanation", where science is near to explicate the "hows" and "whys" of the world. It also included four questions.

Those categories were extracted from the research conducted by Abell and Smith, (1994). Originally, the research conducted by those authors obtained five blocks, even though it was considered more relevant to only include the most significant four in this research. In addition, the questions were formed based on the answers of the teachers, and how they perceived science. All the questions were built on a 5-point Likert scale from 1, completely disagree; 2, disagree; 3, neutral; 4, agree, and 5, completely agree.

In the other hand, the history section consisted of twenty questions divided in four blocks. The first one was "history as a construction of meaning" that included the first five questions. Those questions were built based on the research conducted by Wineburg, (1991); then "history as a story of human kind", that block also had five questions; the third one was "history as an interpretation of the past", which also had five questions and the last one was "history as a study of change and struggle over time" that also included five questions. This last three blocks were based on the research conducted by Yilmaz (2008). All these questions were built on a 5-point Likert scale being 1, completely disagree; 2, disagree; 3, neutral; 4, agree, and 5, completely agree. The questions were created based on those researches, and adapted to the present study. After the creation of the question, ten history educators volunteer to validate the questions.

6.5.4 Feelings about the use of technology in the classroom.

The questions about feelings and emotions using technology were the same in both questionnaires. It consisted of twenty short questions that asked the respondent what were their feelings when using technology in the classroom. This block had two significant divisions. The first one was into positive feelings that included enjoyment and excitement, with each containing five items; and the second division was negative feelings, which included fear and anger, and contained five items in each section too. In order to make it visual, this section was distributed in two columns to make it easier to fill out. The column on the left was the positive feelings; and the column on the right involved the negative feelings. All the items were answered on a 5-point Likert scale being 1, completely disagree; 2, disagree; 3, neutral; 4, agree; and 5, completely agree.

The categorization of the feelings was based on the research conducted by Agye and Voogt (2011), which separated feelings into two big groups: positive and negative. After doing an extended research on feelings, the two sub-divisions in each section was created, including some of the most important feelings that appeared on those researches (Albirini, 2006; Teo, 2008; and van Braak et al., 2003).

6.5.5 Use of technology

Finally, there was the section about uses of technology. This section was also different depending on the subject that the teacher taught. However, the two main categories that were the uses of technology by the student or by the teacher were equal. The difference between both questionnaires and the amount of queries depended mainly on the curriculum taught in Utah about those disciplines. Below will be an explanation of the characteristics of each section.

The science questionnaire consisted of twenty-nine questions regarding the uses of technology by this specific group of teachers while the history questionnaire contained thirty. The questions were divided into two main groups: the use of technology by the students, and the use of technology by the teacher. The student use had also three categories that included “technology as a curricular tool”, which included four questions in the science questionnaire, and five in the history one. This part was based on the Utah curriculum at a secondary level, and this is the reason why there is a diversification in the amount of questions.

The second category was “technology as an information tool”, which included five questions; and finally “technology as a collaborative and interactive tool”, which included also five queries. The second group that involved the teacher had four sub-categories. The first one was “technology as an instructional-teaching tool”, which included four questions; “technology as a design tool”, which also included four questions; “technology as a collaborative-interaction tool”, which included three questions; and finally “technology as an assessment tool” that also had four questions. All the questions were based on a 5-point Likert scale being 1, never; 2, almost never; 3, occasionally/sometimes; 4, almost every time; and 5, every time.

The main sections of this block were based on the study conducted by Tondeur et al. (2008). In addition, the curricular tool section was extracted from the UEN.org webpage where the Utah curriculum was stablished. After evaluating the different proposals from the theoretical framework, the items on the questionnaire were built. Some of the items were originally used by other studies conducted by Kent and Facer (2004) or Pelgrum (2001). However, the items were changed and adapted to the nature of the present investigation.

6.6 Data analyses

Once the data was gathered and prepared, quantitative responses were analyzed using the SPSS software 21. First, there was a descriptive and factorial analysis to evaluate and describe the different factors and its outcomes. Then a correlation analysis was conducted to establish the degree to which two variables are related. Third, a multiple regression analysis was performed to identify the relationship between different variables. And finally, a cluster analysis was completed to identify aspects with similar characteristics that could be included in the same group.

As a first step of the data analysis, descriptive data was analyzed on the eight socio-professional variables included in this study. The first group that referred to the "participants" included descriptive information such as: age, years teaching, gender, area in which they teach, university degree and type of school. In addition it also included an analysis of the technology training, training received in the last five years, the quality of the training, usefulness of it, and when it started to be useful in the classroom.

Next, seven exploratory factor analyses was carried out to reduce items variability to a multidimensional semantic space representing teachers' meanings. All scales were formulated adding the raw scores and dividing them by the number of items included in each factor. A non-orthogonal solution with oblique rotation (Oblimin with Kaiser normalization) were calculated for all variables, in order to examine potential correlations between factors. As they were significantly correlated (i.e., $r > 0.22$, corresponding to more than 5% of variance explained), there was the final rotated solution.

The first analysis on "teachers' competency" was achieved, and two scales were formulated (see Table 81). Second, an analysis of "conceptions of teaching and learning" was formulated through the two dimensions offered by Chan and Elliot (2004). The "constructivist approach" resulted in two scales (see Table 83) while the "traditional approach" resulted in three (see Table 85). "Conceptions of the nature of history" concluded in three scales (see Table 87), and "conceptions of the nature of science" also concluded in three (see Table 89). Finally, feelings were divided into two groups. "Positive feelings", which resulted in one scale (see Table 91), and "negative feelings", which resulted in two scales (see Table 93).

The variable of the "use of technology" was not included in the factorial analysis because it was aimed for an explicative analysis of the uses, resulting from a conceptual proposal with already built categories. It is for this reason that only a descriptive analysis was performed to find reliability and alphas.

The variables of “competency with technology”, “constructivist approach”, “traditional approach”, “conceptions of the nature of history”, “conceptions of the nature of science”, “positive feelings and emotions”, “negative feelings and emotions” and “use of technology” were summarized to describe the quantity, media and standard deviation, as well as the Cronbach alphas.

In the second step of the data analysis, the relationship between variables was explored using three Pearson’s correlation analyses. These analyses were conducted to analyze how some variables were correlated, and the strength of this correlation. The first analysis included both types of teachers (N=216), and the variables that it included were: “teacher competencies”, “teachers’ conceptions of teaching and learning”, “feelings and emotions”, and the “use of technology”. The second analysis was among history teachers (N=108) and it included: “teacher competencies”, “teachers’ conceptions of teaching and learning”, “feelings and emotions”, “teachers’ conceptions of the nature of history” and the “use of technology”. The third analysis was on science teachers (N=108) and it included “teacher competencies”, “teachers’ conceptions of teaching and learning”, “feelings and emotions”, “teachers’ conceptions of the nature of science” and the “use of technology”.

In addition, 27 multiple regression analyses (MRA) were conducted, using the Enter method. This method intended to estimate the relationship between science and history teachers and students’ use of technology, according to all the variables involved. In addition, this technique helped to predict the most significant practices by teachers and students in the classroom, when technology is involved at different levels.

The first block included five MRA analyses within the use of technology by science and history teachers (N=216), and it involved five types of uses: “all uses”, “as an instructional tool”, “as a design tool”, as a collaboration tool” and “as an assessment tool”. These five types were analyzed with the following variables: “teacher competency”, “competency with tools”, "competency with instruction", "facilitation of understanding", "development of understanding", "teacher-centered", "teacher management", "teacher as a provider of knowledge", "positive feelings", "fear", and "anger".

The second block included five MRA analyses regarding the use of technology by history teachers (N=108), and it included the same types of use: "all uses", "as an instructional tool", "as a design tool", as a collaboration tool" and "as an assessment tool". These five types were analyzed with the following variables: "teacher competency", "competency with tools", "competency with instruction", "facilitation of understanding", "development of understanding", "teacher-centered", "teacher management", "teacher as a provider of knowledge", "history as a construction of meaning", "history as a differentiated understanding", "history as a definition of facts", "positive feelings", "fear", and "anger".

The third block also included five MRA analyses referred to science teachers' uses of technology (N=108) and it included the same types of use: "all uses", "as an instructional tool", "as a design tool", as a collaboration tool" and "as an assessment tool". These five types were analyzed with the following variables: "teacher competency", "competency with tools", "competency with instruction", "facilitation of understanding", "development of understanding", "teacher-centered", "teacher management", "teacher as a provider of knowledge", "science as a process", "science as discovery", "science as knowledge", "positive feelings", "fear", and "anger".

In the other hand, the fourth block consisted of four MRA analyses that referred to students' use of technology. It involved science and history teachers (N=216), and it included four types of use: "all uses", "as a curriculum tool", "as an informational tool", and "as a collaboration tool". These four types of use were analyzed with the following variables: "teacher competency", "competency with tools", "competency with instruction", "facilitation of understanding", "development of understanding", "teacher-centered", "teacher management", "teacher as a provider of knowledge", "positive feelings", "fear", and "anger".

The fifth block consisted of four MRA analyses that involved the uses of technology by history students (N=108), and it included the same type of use: “all uses”, “as a curriculum tool”, “as an information tool”, and “as a collaboration tool”. However, the variables analyzed were slightly different including the conceptions of the nature of history: “teacher competency”, “competency with tools”, “competency with instruction”, “facilitation of understanding”, “development of understanding”, “teacher-centered”, “teacher management”, “teacher as a provider of knowledge”, “history as a construction of meaning”, “history as a differentiated understanding”, “history as a definition of facts”, “positive feelings”, “fear”, and “anger”.

Finally, the sixth block comprised four MRA analyses that included the uses of technology by science students (N=108), and it included four types of use: “all uses”, “as a curriculum tool”, “as an information tool”, and “as a collaboration tool”. Although the variables were: “teacher competency”, “competency with tools”, “competency with instruction”, “facilitation of understanding”, “development of understanding”, “teacher-centered”, “teacher management”, “teacher as a provider of knowledge”, “science as a process”, “science as discovery”, “science as knowledge”, “positive feelings”, “fear”, and “anger”.

Finally, two cluster analyses with the WARD method were conducted, where objects within a data set were classified into groups or clusters according to selected variables, to explore the profile of science and history teachers. The cluster analysis permitted to minimize the differences within the agents involved in the same cluster; as well as it maximized the differences between the agents involved in different clusters. All teachers were included in this analysis (N=216), even though they were separated according to their discipline.

The first analysis was performed among history teachers (N=108), and included the following variables: “teacher competency”, “constructivist approach”, “traditional approach”, “conceptions of the nature of history”, “positive and negative feelings and emotions”, “students’ use” and “teachers’ use” of technology.

The second analysis comprised science teachers (N=108) and included the following variables: “teacher competency”, “constructivist approach”, “traditional approach”, “conceptions of the nature of science”, “positive and negative feelings and emotions”, “students’ use” and “teachers’ use” of technology.

In addition, four independent sample t-tests were conducted to compare if the constructivist and the traditional pattern of teachers were significantly different from each other, as well as if it was possible to establish inferences about the population in which data was collected.

The first t-test comprised two analyses including constructivist (N=39) and traditional (N=34) history teachers. It also included the following variables for both groups of educators: “teacher competency”, “competency with tools”, “competency with instruction”, “constructivist approach”, “facilitation of understanding”, “development of understanding”, “teacher-centered”, “teacher management”, “teacher as a provider of knowledge”, “history as a construction of meaning”, “history as a differentiated understanding”, “history as a definition of facts”, “positive feelings”, “negative feelings”, “fear”, “anger”, “teacher use as an instructional tool”, “teacher us as a design tool”, “teacher use as a collaboration tool”, “teacher use as an assessment tool”, “student use as a curriculum tool”, “student use as an information tool”, and “student use as a collaboration tool”.

The second t-test also involved two analyses including constructivist (N=38) and traditional (N=37) science teachers. In addition, it included the following variables for both groups of educators: “teacher competency”, “competency with tools”, “competency with instruction”, “constructivist approach”, “facilitation of understanding”, “development of understanding”, “teacher-centered”, “teacher management”, “teacher as a provider of knowledge”, “science as a process”, “science as discovery”, “science as knowledge”, “positive feelings”, “negative feelings”, “fear”, “anger”, “teacher use as an instructional tool”, “teacher us as a design tool”, “teacher use as a collaboration tool”, “teacher use as an assessment tool”, “student use as a curriculum tool”, “student use as an information tool”, and “student use as a collaboration tool”.

VII. Findings

This section will start with a descriptive and factorial analysis of the variables involved in this study: competency with technology; conceptions of teaching and learning; conceptions of the nature of history; conceptions of the nature of science; feelings with the use of technology, and use of technology by learners and teachers; then there will be an analysis of the correlations, the multiple regressions, and finally the cluster analysis.

7.1 Descriptive and factorial analysis

7.1.1 Descriptive and factorial analysis of secondary science and history teachers' competency with the use of technology in the classroom.

An exploratory factor analysis was conducted to identify secondary science and history teachers' competency using technology in the classroom. The principal component analysis revealed a multidimensional structure composed of two factors (KMO = 0.883 and a significant Batlett's test, $p < 0.001$), which explains an acceptable total variance of 70.80%.

The results are presented below. The application of the exploratory factorial analysis revealed a factorial structure composed of two factors affecting the competency of the teachers in technology-rich classrooms, which are presented on Table 81.

Table 81
Mean, standard deviation, explained variance and Cronbach's alpha of the two factors identified.

Factor	Mean (SD)	Explained variance	Cronbach's alpha
1. Competency with tools	4.35 (.82)	55.11%	.859
2. Competency with instruction	2.84 (1.33)	15.68%	.889
Total	3.56 (.82)	70.80%	.890

The factor that explains the highest variance is "competency with tools" ($M = 4.35$, $SD = .82$) which has a high 55.113% of the total variance; in the other side, "competency with instruction" (M = 2.84, SD = 1.33) are the second factor explaining the use of technology in the classroom. Each factor showed a satisfactory rate of reliability, with Cronbach's alpha in .859 and .889.

Below is Table 82 to present the overall factorial table obtained, which enables to characterize the specific content of each of the two factors

Table 82
Rotated component matrix (factor loading) and descriptive statistics for the items related to teachers' competency. (N=216)

Items	Mean	SD	Competency with tools	Competency with instruction
CO1. Competency using a word processor	4.43	.78	.890	.444
CO2. Competency using a computer or laptop	4.33	.77	.857	.516
CO3. Competency using email and personal information management.	4.44	.76	.826	.436
CO4. Competency using a slide show presentation.	4.19	.97	.810	.455
CO5. Competency developing learning activities.	2.71	1.42	.382	.869
CO6. Competency establishing collaboration.	2.78	1.39	.494	.860
CO7. Competency assessing students and knowledge.	3.42	1.19	.478	.831
CO8. Competency presenting content.	3.16	1.49	.474	.826
CO9. Competency designing activities in virtual learning environments.	2.61	1.12	.463	.785
Total	3.56	.82		

The first factor that was called *competency with tools,* comprises four items. In addition, this factor covers two aspects that are: (1) competency using certain technology tools, such as a computer or a laptop (CO2); and (2) competency using software, such as a word processor (CO1); an email and personal information management (CO3); and a slide show presentation (CO4).

The second factor, which was called *competency with instruction* included five items. This factor entails the use of software to give instruction. It also included two factors that were (1) the level of competency using specific software for education, such as the use of programs to present content (CO8); to assess students and knowledge (CO7); to develop learning activities (CO5); and to establish collaboration (CO6). In the other hand, the second factor was (2) the level of expertise developing activities in virtual learning environments (CO9).

7.1.2 Descriptive and factorial analysis of teachers' conceptions of teaching and learning.

The second component that was analyzed was teachers' conceptions of teaching and learning. For this component, there were two analysis: one related to the constructivist approach, and another one related to the traditional approach. A descriptive and factorial analysis was also conducted to determine teachers' conceptions, and the results will be presented below.

7.1.2.1 Descriptive and factorial analysis of secondary teachers' conceptions of teaching and learning from a constructivist approach.

The first constituent analyzed was teachers' conceptions with a constructivist approach. The principal component analysis revealed a multidimensional structure composed of two factors related to constructivism (KMO = .814 and a significant Batlett's test, $p < .001$), which explains an acceptable total variance of 56.23%. The results are presented below on Table 83.

Table 83
Mean, standard deviation, explained variance and Cronbach's alpha of the two factors identified.

Factor	Mean (SD)	Explained variance	Cronbach's alpha
1. Facilitation of understanding	4.36 (.47)	39.17%	.700
2. Development of understanding	3.97 (.60)	17.06%	.743
Total	4.17 (.45)	56.23%	.767

The factor that explains the highest variance is "facilitation of understanding" (M = 4.36, SD = .47) which has a 39.17% of the total variance; in the other side, "development of understanding" (M = 3.97, SD = .60) are the second factor explaining the constructivist approach. Each factor showed a moderate rate of reliability, with Cronbach's alpha in .700 and .743. Only these two factors appeared to be significant in teachers' conceptions of teaching and learning from a constructivist approach.

Below is the Table 84 to present the overall factorial table obtained, which enables to characterize the specific content of each of the two factors.

Table 84
Rotated component matrix (factor loading) and descriptive statistics for the items related to teachers' conceptions of teaching and learning from a constructivist approach (N=203)

Items	Mean	SD	Development of understanding	Facilitation of understanding
CAC1. Instruction should be flexible enough to accommodate individual differences among students.	4.48	.60	.790	.222
CAC2. Every child is unique or special and deserves an education tailored to his or her particular needs.	3.92	.82	.759	.372
CAC3. Different objectives and expectation in learning should be applied to different students.	4.23	.63	.746	.222
CAC4. The focus of teaching is to help students construct knowledge from their learning experience instead of knowledge communication.	4.02	.82	.728	.277
CAC5. It is important that a teacher understands the feelings of the students.	3.72	.89	.216	.752
CAC6. Learning means students have ample opportunities to explore, discuss and express their ideas.	4.49	.57	.459	.746
CAC7. Good teachers always encourage students to think for answers themselves.	4.20	.66	.290	.731
CAC8. Good teachers always make their students feel important.	4.28	.77	.173	.695
Total	4.17	.45		

The first factor that was designated as *development of understanding*, comprises four items related to the students acquiring knowledge based on their personal characteristics. These factors referred to different issues such as: instruction should be flexible to accommodate individual needs (CAC1); the uniqueness of each student (CAC2); the objectives should be applied different to each individual CAC3); and teaching should focus on helping students construct knowledge from their learning and experiences (CAC4). This first factor emphasized on each student as a unique individual in the learning process, as well as it considered that their needs are important to acquire knowledge.

The second factor, which was called *facilitation of understanding* also included four aspects. This factor entails that teachers understand the feelings of students (CAC5); learning involves the student as an active agents (CAC6); teachers always encourage students to think by themselves (CAC7); and finally teachers make their students feel important (CAC8). All these items are related to the student as an important individual involved in the teaching process, and teachers should consider all the factors when teaching them.

7.1.2.2 Descriptive and factorial analysis of secondary teachers' conceptions of teaching and learning from a traditional approach.

An exploratory factor analysis was also conducted on the conceptions of teaching and learning from a traditional perspective. The principal component analysis revealed a multidimensional structure composed of three factors related to the traditional approach (KMO = .841 and a significant Batlett's test, $p < .001$), which explains an acceptable total variance of 51.15%. The results are presented below in Table 85.

Table 85
Mean, standard deviation, explained variance and Cronbach's alpha of the three factors identified.

Factor	Mean (SD)	Explained variance	Cronbach's alpha
1. Teacher-centered instruction	2.32 (.60)	33.03%	.797
2. Teacher management	2.19 (.51)	9.98%	.702
3. Teacher as a provider of content	2.41 (.58)	8.14%	.700
Total	2.32 (.49)	51.15%	.831

The factor that explains the highest variance is "teacher-centered instruction" (M = 2.32, SD = .60) which has a 33.03% of the total variance; the second factor was "teacher management" (M = 2.19, SD = .51) with a 9.98%; and finally, the last component explaining the traditional approach was "teacher as a provider of knowledge" (M = 2.41, SD = .58) with an 8.14%. Each factor showed a moderate rate of reliability, with Cronbach's alpha in .797, for the first factor; .702, for the second factor; and .700, for the third factor. This three factors are the ones that appeared to be significant in teachers' conceptions of teaching and learning from a traditional perspective.

Below is the Table 86 to present the overall factorial table obtained, which enables to characterize the specific content of each of the two factors.

Table 86
Rotated component matrix (factor loading) and descriptive statistics for the items related to teachers' conceptions of teaching and learning from a traditional approach (N=200)

Items	Mean	SD	Teacher-centered instruction	Teacher management	Teacher as a provider of knowledge
TAC1. A teacher's major ask is to give students knowledge/information, assign them drill and practice, and test their recall.	2.75	.98	.699	-.023	-.119
TAC2.During the lesson, it is important to keep students confined to the textbooks and the desks.	1.81	.74	.665	.150	-.310
TAC3. Learning occurs primarily from drilling and practice.	2.14	.80	.635	.338	-.367
TAC4. Teaching is simply telling, presenting or explaining the subject matter.	1.91	.63	.560	.515	-.140
TAC5. Learning means remembering what the teacher has taught.	2.47	.92	.530	.482	-.483
TAC6. No learning can take place unless students are controlled.	2.50	1.04	.139	.684	-.342
TAC7. Teachers should have control over what students do all the time.	2.20	.89	.047	.672	-.251
TAC8. I have really learned something when I can remember it later.	3.16	1.13	.011	.634	-.373
TAC9. Students have to be called on all the time to keep them under control.	2.02	.68	.413	.629	-.080
TAC10. Good students keep quiet and follow teacher's instruction in class.	2.64	1.01	.423	.550	-.485
TAC11. Teaching is to provide students with accurate and complete knowledge rather than encourage them to discover it.	2.16	.81	.243	.262	-.865
TAC12. A teacher's task is to correct learning misconceptions of students right away instead of verify them for themselves.	2.38	.80	.161	.382	-.735
TAC13. The traditional/lecture method for teaching is best because it covers more information/knowledge	2.26	.83	.466	.297	-.724
TAC14. Good teaching occurs when there is mostly teacher talk in the classroom.	2.07	.73	.500	.341	-.539
Total	2.32	.49			

The conceptions of teaching and learning with a traditional approach consisted of three factors. The first factor was called *teacher-centered instruction* and it included six aspects. The first item was related to teachers giving students information and assigning them drill and practice to further test their recall (TAC1); the second item consisted of teachers keeping students confined into their textbooks and desks (TAC2); then teaching occurs only from drill and practice (TAC3); teaching as telling, presenting or explaining the subject matter (TAC4); learning as remembering what the teacher taught (TAC 5); and finally the last item that teaching only occurs when there is mostly teacher talk in the classroom (TAC14). This first factor entails the teacher as the center of the instruction, ensuring that the students is on their seat fulfilling the tasks that are required by the educator. It entails that the only option for the students to learn is doing what the teacher assigns.

The second feature, which was named *teacher management* was teaching as simply telling, presenting or explaining the subject matter; then learning cannot take place unless students are controlled (TAC6); teachers should have control over what students do all the time (TAC7); students learn something when they can remember it later (TAC8); students have to be called to keep them under control (TAC9); and finally the last one where good students follow teachers instruction and keep quiet (TAC10). Most of these items refer to the teacher having the students under control during instructional practices in the classroom.

The third aspect named as *teacher as a provider of content*, and consisted of six items. Learning as a process of remembering what the teacher taught (TAC5); good students are the ones that keep quiet and follow teacher’s instruction in the classroom (TAC10); teaching is to provide students with accurate and complete knowledge rather than encourage them to discover it (TAC11); teachers have to correct misconceptions at the precise moment instead of letting the students verify it for themselves (TAC12); the traditional method as the more efficient because it covers more information or knowledge (TAC13); and the best practices of teaching occur when there is mostly teacher talk in the classroom (TAC14). This third factor entails the teacher as a provider of content, but it does not necessarily have to become knowledge.

7.1.3 Descriptive and factorial analysis of teachers' conceptions of the nature of history.

Application of exploratory factorial analysis was also conducted on the conceptions of the nature of the subject that educators teach. The principal component analysis revealed a multidimensional structure composed of three factors (KMO = .700 and a significant Batlett's test, $p < .001$), which explains a significant total variance of 75.84%. The results are presented below on Table 87.

Table 87
Mean, standard deviation, explained variance and Cronbach's alpha of the three factors identified.

Factor	Mean (SD)	Explained variance	Cronbach's alpha
1. History as a construction of meaning.	4.46 (.53)	41.87%	.830
2. History as a differentiated understanding.	4.02 (.77)	18.93%	.879
3. History as a definition of facts.	3.98 (.69)	15.05%	.744
Total	4.15 (.49)	75.84%	.789

The factor that explains the highest variance is "history as a construction of meaning" (M = 4.46, SD = .53) which has a 41.87% of the total variance; the second factor was "history as a differentiated understanding" (M = 4.02, SD = .77) with an 18.93%; and finally, the last component explaining conceptions of history was "history as a definition of facts" (M = 3.98, SD = .69) with a 15.05% of the total variance. Each factor showed a moderate rate of reliability, with Cronbach's alpha in .830, for the first factor; .879, for the second factor; and .744, for the third factor. This three factors are the ones that appeared to be significant in teachers' conceptions of the nature of history.

Below is the Table 88 to present the overall factorial table obtained, which enables to characterize the specific content of each of the three factors.

Table 88
Rotated component matrix (factor loading) and descriptive statistics for the items related to teachers' conceptions of the nature of history (N=000)

Items	Mean	SD	History as a construction of meaning	History as a differentiated understanding	History as a definition of facts
CNH1.History builds understanding of different societies.	4.35	.63	.882	.161	.320

CNH2. Through history, we can have a better approach to facts that happened around us.	4.39	.60	.882	.302	.360
CNH3. Through the study of the past, history helps to understand the present.	4.62	.59	.818	.088	.395
CNH4. Every individual has different conclusions to the same historical fact.	3.97	.83	.191	.937	.223
CNH5. Every individual has different approaches (attitudes) to the same historical fact.	4.06	.81	.237	.932	.245
CNH6. History defines about the different societies.	4.05	.80	.338	.206	.860
CNH7. History defines good and bad events that have happened over time.	3.96	.89	.281	.335	.831
CNH8. History helps human beings to build a line with facts that happened in the past in chronological order.	3.93	.83	.406	.025	.748
Total	4.15	.49			

The conceptions of the nature of history consisted of three factors. The first factor was named *history as a construction of meaning* and it consisted of three items. The first one stated that history helps to understand different societies (CNH1); there is a better approach to understand facts through history (CNH2); and we can understand the present through the study of the past (CNH3).

The second factor was designated as *history as a differentiated understanding*, and consisted of two items. The first one was that every individual has different conclusions to the same historical fact (CNH4); and the second item that entailed that every individual had different approaches to the same historical fact (CNH5). Even though the close proximity between this two items, they still comprise a different in the analysis of the approaches or conclusions.

The last factor, which was called *history as a definition of facts*, entailed also three items. The first item considered that history is able to define about different societies (CNH6); the second one considered that history might be able to define good and bad events that have happened over time (CNH7); and the last one that entailed that history help human beings to build chronologies about facts that happened in the world in order (CNH8).

7.1.4 Descriptive and factorial analysis of teachers conceptions of the nature of science

Application of exploratory factorial analysis was also conducted on the conceptions of the nature of science. The principal component analysis revealed a multidimensional structure composed of three factors (KMO = .812 and a significant Batlett's test, p < .001), which explains an acceptable total variance of 64.32%. The results are presented below in Table 89.

Table 89
Mean, standard deviation, explained variance and Cronbach's alpha of the three factors identified.

Factor	Mean (SD)	Explained variance	Cronbach's alpha
1. Science as a process	4.32 (.46)	39.51%	.779
2. Science as discovery	3.70 (.87)	15.64%	.804
3. Science as knowledge	3.80 (.75)	9.18%	.700
Total	3.93 (.56)	64.32%	.832

The factor that explains the highest variance is "science as a process" (M = 4.32, SD = .46) which has a 39.51% of the total variance; the second factor was "science as discovery" (M = 3.70, SD = .87) with a 15.64%; and finally, the last component explaining conceptions of science was "science as knowledge" (M = 3.80, SD = .75) with a 9.18% of the total variance. Each factor showed a moderate rate of reliability, with Cronbach's alpha in .779, for the first factor; 0.804, for the second factor; and 0.700, for the third factor. This three factors are the ones that appeared to be significant in teachers' conceptions of the nature of science.

Below is Table 90, to present the overall factorial table obtained, which enables to characterize the specific content of each of the three factors.

Table 90
Rotated component matrix (factor loading) and descriptive statistics for the items related to teachers' conceptions of the nature of science (N=108)

Items	Mean	SD	Science as a process	Science as a discovery	Science as knowledge
CNS1. Science is studying and exploring the causes and effects of certain phenomena. Example: why there are three states of matter.	4.40	.51	.847	.231	-.224
CNS2. Science is finding reasons to why things happen in the world.	4.35	.63	.785	.266	-.258

CNS3. Science is about discovering things, or making educated guesses about the how's and whys of the world.	4.33	.63	.761	.351	-.253
CNS4. Science is the study of how things work in the world around us.	4.32	.65	.647	.165	-.350
CNS5. Science is about investigating different things and questioning everything.	4.24	.74	.637	.209	-.537
CNS6. Science is the search for the whole truth about everything.	3.25	1.28	.175	.824	-.405
CNS7. Science looks for answer to big truths.	3.78	1.03	.328	.823	-.397
CNS8. Science is the explanation of facts of why things happen.	3.82	1.00	.294	.784	-.214
CNS9. Science is asking why, giving an answer, and then checking to see if your answer was correct.	3.83	1.03	.238	.712	-.095
CNS10. Science includes every subject and uses subjects to create new things.	3.98	.81	.480	.237	-.876
CNS11. Science is about anything you want it to be about.	3.19	1.25	.288	.491	-.852
Total	3.93	.56			

The conceptions of the nature of science consisted of three factors as shown above. The first factor was named *science as a process* and it involved five items. The first one stated that science was the study and exploration of causes and effect to certain phenomena (CNS1); the second item was science as finding reasons to why things happen (CNS2); the third item was science is discovering things, or making guesses about the how's and why's of the world (CNS3); the fourth item was science as the study of how things work around us (CNS4); and the last item was science as investigating different things, and questioning them (CNS5). All those items were related to the process of investigation.

The second factor was designated as *science as discovery*, and consisted of four items. The first one involved science as searching for the truth about everything (CNS6); the second one was science looking for answers (CNS7); the third one was science as explaining facts and things (CNS8); and the last one was science asking for why's giving answers, and then checking for outcomes (CNS9). All those items were related to discover new things and exploring them.

Finally, the last factor was called *science as knowledge*, and it involved three items. The first item was science involving every subject and using subjects to create new things (CNS10); science is everything you want it to be about (CNS11), and science as investigating different things and questioning them (CNS5). This last factor is about the knowledge about science and how things work in the world.

7.1.5 Descriptive and factorial analysis of the feelings and emotions with the use of technology

This next section will gather information about teachers' feelings with the use of technology in the classroom. After analyzing the data, two main descriptions appeared, the ones referred to positive feelings, and the ones referred to negative feelings. Below is the factorial analysis of those results.

7.1.5.1Descriptive and factorial analysis of the positive feelings and emotions with the use of technology.

Application of exploratory factorial analysis was also conducted on the positive feelings of the teachers when they use technology in the classroom. The principal component analysis revealed a unidimensional structure composed of one factors (KMO = .943 and a significant Batlett's test, $p < .001$), which explains a significant total variance of 71.67%. The results are presented below in Table 91.

Table 91
Mean, standard deviation, explained variance and Cronbach's alpha of the three factors identified.

Factor	Mean (SD)	Explained variance	Cronbach's alpha
1. Positive feelings	3.53 (.67)	71.67%	.955
Total	3.53 (.67)	71.67%	.955

The factor that explains the only and highest variance is "positive feelings" ($M = 3.53$, $SD = .67$) which has a 71.67% of the total variance. There are no other components into the positive feelings, only one that involved all the factors.

Below is the Table 92, to present the overall factorial table obtained, which enables to characterize the specific content of each of the three factors.

Table 92
Rotated component matrix (factor loading) and descriptive statistics for the items related to positive feelings (N=205)

Items	Mean	SD	Positive feelings
PFE1. Energetic	3.47	.81	.886
PFE 2. Fulfilled	3.39	.77	.884
PFE3. Enthusiastic	3.59	.81	.884
PFE4. Glad	3.50	.76	.866
PFE5. Optimistic	3.55	.82	.857
PFE6. Pleased	3.62	.75	.854
PFE7. Completed	3.30	.77	.841
PFE8. Happy	3.57	.73	.831
PFE9. Confident	3.52	.88	.807
PFE10. Motivated	3.75	.81	.745
Total	3.53	.67	

The positive feelings consisted of only one factor. This factor was named *positive feelings* because of the nature of the finding. In addition, this factor involves ten items. The first one is energetic (PFE1); then fulfilled (PFE2); enthusiastic (PFE3); glad (PFE4); optimistic (PFE5); pleased (PFE); completed (PFE7); happy (PFE8); confident (PFE9); and motivated (PFE10). All this items have 6in common that they belongs into the positive set of feelings and that is why it received this name.

7.1.5.2 Descriptive and factorial analysis of the negative feelings and emotions with the use of technology

An exploratory factor analysis was also conducted on the negative feelings with the use of technology. The principal component analysis revealed a multidimensional structure composed of two factors related to negative feelings (KMO = .843 and a significant Batlett's test, $p < .001$), which explains a significant total variance of 78.35%. The results are presented below in Table 93.

Table 93
Mean, standard deviation, explained variance and Cronbach's alpha of the two factors identified.

Factor	Mean (SD)	Explained variance	Cronbach's alpha
1. Fear	2.81 (.92)	61.41%	.914
2. Anger	2.26 (.77)	16.93%	.877
Total	2.54 (.75)	78.35%	.928

The factor that explains the highest variance is "anxiety" (M = 2.81, SD = .92) which has a 61.41% of the total variance; in the other side, "anger" (M = 2.26, SD = .77) are the second factor explaining the negative feelings. Each factor showed a moderate rate of reliability, with Cronbach's alpha in 0.914 in the first factor, and 0.877 on the second factor. Only this two factors appeared to be significant in teachers' feelings with the use of technology in the classroom.

Below is the Table 94 to present the overall factorial table obtained, which enables to characterize the specific content of each of the two factors.

Table 94
Rotated component matrix (factor loading) and descriptive statistics for the items related to negative feelings (N=202)

Items	Mean	SD	Fear	Anger
NFE1. Nervous	2.75	0.97	0.955	0.514
NFE2. Anxious	2.91	1.06	0.922	.373
NFE3. Tense	2.65	0.98	.922	0.512
NFE4. Frustrated	2.94	1.08	0.774	0.548
NFE5. Mad	2.17	0.88	0.474	0.910
NFE6. Furious	2.01	0.81	0.345	0.893
NFE7. Irritated	2.51	0.99	0.509	0.810
NFE8. Upset	2.38	0.92	0.609	0.803
Total	2.54	0.76		

The first factor that was designated as *fear,* comprises four items related to negative feelings. These items refer to different feelings such as nervousness (NFE1); anxiety (NFE2); tension (NFE3), and frustration (NFE4). It is believed that all these items are part of fear that teachers feel when teaching.

The second factor was called *anger*, and also entails four items. The first feeling was madness (NFE5); furiousness (NFE6); irritability (NFE7); and upset (NFE8). All these feelings are more related to anger since it implies a state of being that is not comfortable for the teacher.

7.1.6 Descriptive analysis of the uses of technology

There is no factorial analysis for the uses of technology by science and history secondary school teachers; however, there is a description of the characteristics of this topic and its results. In this particular section, there were a distinction between history and science uses due to the curriculum of each discipline, as well as a differentiation between teacher uses and student uses. This section will start, then, with a description of the uses of technology by history teachers.

7.1.6.1 Uses of technology by history teachers

The questionnaire regarding uses of technology by history teachers was classified according to two main areas of focus: the teacher; and the student. The learner use of technology was also differentiated into three sub-categories that were: (1) technology as a curricular tool, where technology is a resource to learn the standards of each subject; (2) technology as an informational tool, where it is a tool to select, recover, save, access, watch, show, and send information; and finally (3) technology as a collaborative/interactive too, where it is used for educational interaction and collaboration between teacher and students, or between students.

The teacher use was classified into four sub-categories: (1) instructional-teaching tool, where technology is a didactical resource to teach the curriculum; (2) design tool, where technology is a tool to design lessons; (3) collaborative-Interaction tool, where technology is a tool to communicate and interact with students, parents, and other professionals; and final, (4) as an assessment tool, where technology is part of a process to evaluate the outcomes of the students. Below is Table 95 with a summary of the results.

Table 95
Mean, standard deviation, and Cronbach's alpha of the three factors identified on students' use of technology by history teachers.

Factor	Mean	Standard deviation	Cronbach's alpha
1. Curriculum tool	3.67	.87	.866
2. Informational tool	4.02	.75	.865
3. Collaborative tool	3.53	.83	.865
Total	3.75	.73	.933

After assessing the results, it can be appreciated that the students uses of technology might refer to all of the classifications proposed above, even though curriculum was the stronger one with a Cronbach alpha of .866, it did not differentiate that much from its other factors. The informational tool had a Cronbach alpha of .865; and the collaborative tool also had a Cronbach alpha of .865. The mean also showed that most of the teachers made their students use technology very frequently for those aspects.

After analyzing the main factors in students' use of technology, there will be an analysis of the items in each category. The use of technology as a *curriculum tool* by the students included five factors that will be shown below on table 96

Table 96
Mean, standard deviation and number of the use of technology as a *curriculum tool*.

Items	N	Mean	Standard deviation
1. To learn about Utah history	97	3.26	1.25
2. To learn about USA history	101	3.97	.93
3. To learn about geography	97	3.66	1.12
4. To learn about world civilizations	101	3.57	1.09
5. To learn about government and citizenship	99	3.88	.97
Total		3.67	.87

As shown on the table above, most of the teachers made their students use technology almost every time to learn about secondary curriculum. "To learn about Utah history" is the item that had the highest rate of use among the students (M = 3.97; SD = .93); the second item that they used more frequently is "to learn about government and citizenship" (M = 3.88; SD = .97); then "to learn about geography" (M = 3.66; SD = 1.12); the fourth factor was "to learn about world civilizations" (M = 3.57; SD = 1.09); and finally the item that has the lower amount of use but which still had a significant frequency was "to learn about Utah history" (M = 3.26; SD = 1.25).

The second factor was *informational tool*, which also included five items. They will be shown on table 97.

Table 97
Mean, standard deviation and number of the use of technology as an *information tool*.

Items	N	Mean	Standard deviation
1. To define a problem that needs to be resolved.	98	3.87	.95
2. To search information.	104	4.44	.69
3. To filter and find relevant information.	104	4.02	.97
4. To retrieve, store and evaluate information.	103	3.95	.98
5. To analyze and synthesize information.	101	3.67	1.12
Total		4.02	.75

Again, the use of technology as an *informational tool* had a significant frequency on all the items in the questionnaire. The item with the highest ratio was "to search information" (M = 4.44; SD = .69); then "to filter and find relevant information" (M = 4.02; SD = .97); the third item was "to retrieve, store and evaluate information" (M = 3.95; SD = .98); then "to define a problem that needs to be resolved" (M = 3.87; SD = .95); and finally, the last item, "to analyze and synthesize information" (M = 3.67; SD = 1.12). Most of the items included in this factor scored significantly high in the scale of uses, being used or every time or almost every time in the classroom.

The last factor was the use of technology as a *collaborative tool*, which included also five items. Below they will be presented on table 98

Table 98
Mean, standard deviation and number of the use of technology as a *collaborative tool*.

Items	N	Mean	Standard deviation
1. To design projects/activities with other students.	103	3.71	1.03
2. To share with other students.	104	3.66	1.04
3. To interact with peers and teachers.	107	4.06	1.02
4. For peer tutoring.	104	2.88	1.01
5. To combine ideas.	105	3.30	1.08
Total		3.53	.83

The use of technology as a *collaborative tool* fluctuated from every time to sometimes frequencies. The highest use was "to interact with peers and teachers" (M = 4.06; SD = 1.02); then, "to design projects/activities with other students" (M = 3.71; SD = 1.03); the third item was "to share with other students" (M = 3.66; SD = 1.04). The fourth item was "to combine ideas" (M =

3.30; SD = .83), and the last usable item was “for peer tutoring” (M = 2.88; SD = 1.08). In this section here is a significant different from the most usable item to the less usable item; however, teachers still make their students use it for all the aspects mentioned above.

The second evaluation was the use of technology by science teachers. The teacher use of technology was divided into four main groups as it will be shown below on table 99.

Table 99
Mean, standard deviation, and Cronbach’s alpha of the four factors identified on teachers’ use of technology by history teachers.

Factor	Mean	Standard deviation	Cronbach’s alpha
1. Instructional tool	4.32	.62	.827
2. Design tool	4.07	.75	.823
3. Collaborative tool	4.12	.84	.819
4. Assessment tool	3.70	1.02	.908
Total	4.05	.71	.938

On the table shown above it can be appreciated that most of the teachers were completely agree on the frequent use of technology in the classroom. In addition, the Cronbach alphas are significantly high, being the highest one the use of technology as an “assessment tool” with .908. Then it follows technology as an “instructional tool” with .827; technology as a “design tool” with .819; and finally technology as a “collaborative tool” with .819. It can be appreciated that most of the participants implemented technology very frequently in the classroom as part of the four factors mention above.

The use of technology as an *instructional tool* by the students included four factors that will be shown below on table 100

Table 100
Mean, standard deviation and number of the use of technology as an *instructional tool*.

Items	N	Mean	Standard deviation
1. To present history content through a multimedia or hypermedia system	105	4.36	.79
2. To support oral presentation of content.	105	4.39	.67
3. To show examples to students.	104	4.51	.62
4. To perform demonstrations to simulate scenarios.	104	4.02	.95
Total		4.32	.62

On the table above, it can be appreciated that most of the teachers were using those items every time in their classrooms. The item with the highest use was “to show examples to students” (M = 4.51; SD = .62); then, “to support oral presentation of content” (M = 4.39; SD = .67), the third item was “to present history content through a multimedia or hypermedia system” (M = 4.36; SD = .79); and finally “to perform demonstrations to simulate scenarios” (M = 4.02; SD = .95).

The second factor was *design tool*, which also included four items. They will be shown on table 101.

Table 101
Mean, standard deviation and number of the use of technology as a *design tool*.

Items	N	Mean	Standard deviation
1. To design a history lesson.	105	4.30	.85
2. To elaborate learning content.	105	4.38	.69
3. To create a brainstorming.	104	3.67	1.01
4. To organize and classify learning content.	104	3.88	1.05
Total		4.06	.75

The use of technology by teachers as an *instructional tool* had significantly high results being used every time or almost every time by educators. The item with the highest use was “to elaborate learning content” (M = 4.38; SD = .69); then, “to design a history lesson” (M = 4.30; SD = .85), the third item was “to organize and classify learning content” (M = 3.88; SD = 1.05); and finally “to create a brainstorming” (M = 3.67; SD = 1.01). All the items in the design tool factor scored really high being one of the items that had a high use by educators.

The third factor regarding teacher’s use of technology was *collaborative tool*, which included three items. They will be shown on table 102.

Table 102
Mean, standard deviation and number of the use of technology as a *collaborative tool*.

Items	N	Mean	Standard deviation
1. To communicate with students.	106	4.25	.91
2. To assign homework to students.	103	3.76	1.22
3. To communicate with parents.	106	4.34	0.74
Total		4.12	0.84

The use of technology by teachers as a *collaborative tool* had also high results being used very frequently by teachers. The item with the highest use was “to communicate with parents” (M = 4.34; SD = .74); then, “to communicate with students” (M = 4.25; SD = .91), and the third item was “to assign homework to students” (M = 3.76; SD = 1.22). Again, the use of technology is highly present in the classroom to collaborate and interact with other people involved in the school community.

Finally, the last item regarding teachers use was technology as an *assessment tool*, which included four items that will be shown below on table 103.

Table 103
Mean, standard deviation and number of the use of technology as an *assessment tool*.

Items	N	Mean	Standard deviation
1. To evaluate the prior knowledge before the implementation of a lesson.	104	3.59	1.13
2. To keep track of their progress during a lesson.	104	3.62	1.20
3. To see if we need to review a lesson or if the majority understood the issue.	104	3.66	1.16
4. To evaluate the student proficiency at the end of a lesson, unit or topic.	105	3.91	1.09
Total		3.70	1.02

The use of technology by teachers as an *assessment tool* had also moderate results being used almost every time by teachers. The item with the highest use was “to evaluate the student proficiency at the end of a lesson, unit or topic” (M = 3.91; SD = 1.09); then, “to see if we need to review a lesson or if the majority understood the issue” (M = 3.66; SD = 1.16), the third item was “to keep track of the student progress during a lesson” (M = 3.62; SD = 1.20); and the last item “to evaluate the prior knowledge before the implementation of a lesson” (M = 3.59; SD = 1.13). This item was not as high as the other uses by the teacher, but still significantly high in the Likert scale.

7.1.6.2 Uses of technology by science teachers

The questionnaire regarding uses of technology by science teachers was classified also according to two main areas of focus: the teacher; and the student. The learner use of technology was also differentiated into three sub-categories that were: (1) technology as a curricular tool, where it is a resource to learn the standards of each subject; (2) technology as an informational tool, where it is a tool to select, recover, save, access, watch, show, and send information; and finally (3) technology as a collaborative/interactive too, where it is used for educational interaction and collaboration between teacher and students, or between students.

The teacher use was classified into four sub-categories: (1) instructional-teaching tool, where technology is a didactical resource to teach the curriculum; (2) design tool, where technology is a tool to design lessons; (3) collaborative-Interaction tool, where it is a tool to communicate and interact with students, parents, and other professionals; and final, (4) as an assessment tool, where technology is part of a process to evaluate the outcomes of the students. The only difference between the science and the history uses of technology was into the first section where the answers were stipulated according to the curriculum taught in each discipline. Below is Table 104 with a summary of the results.

Table 104
Mean, standard deviation, and Cronbach's alpha of the three factors identified on students' use of technology by science teachers.

Factor	Mean	Standard deviation	Cronbach's alpha
1. Curriculum tool	3.50	.85	.700
2. Informational tool	4.05	.83	.911
3. Collaborative tool	3.61	.79	.808
Total	3.75	.69	.897

After evaluating the results, it can be appreciated that the students' uses of technology might refer to all of the classifications proposed above, even though curriculum was the weakest one with a Cronbach alpha of .700. The informational tool had a Cronbach alpha of .911, being the highest one; and the collaborative tool had a Cronbach alpha of .808. The mean also showed that most of the teachers made their students use technology for those aspects very frequently.

After analyzing the main factors in the use of technology by students that learn science, there will be an analysis of the individual items in each category. The first item will be the use of technology as a *curriculum tool*, and it included four items according to the Utah curriculum. These items will be shown below on table 105

Table 105
Mean, standard deviation and number of the use of technology as a *curriculum tool*.

Items	N	Mean	Standard deviation
1. To learn about earth science.	105	3.40	1.21
2 To learn about biology.	101	3.65	1.15
3. To learn about physics.	103	3.50	1.20
4. To learn about chemistry.	105	3.51	1.12
Total		3.50	.85

As shown on the table above, most of the teachers made their students use technology almost every time to learn about secondary curriculum. “To learn about biology” is the item that had the highest rate of use among the students (M = 3.65; SD = 1.15); the second item that they used more frequently is “to learn about chemistry” (M = 3.51; SD = 1.12); then “to learn about physics” (M = 3.50; SD = 1.20); and the fourth factor was “to learn about earth science” (M = 3.40; SD = 1.21). All four items shown a similar ratio of usage within the classroom.

The second factor was *informational tool*, which included five items. They will be shown on table 106.

Table 106
Mean, standard deviation and number of the use of technology as an *informational tool*.

Items	N	Mean	Standard deviation
1. To define a problem that needs to be resolved.	107	4.04	.98
2. To search information.	105	4.41	.78
3. To filter and find relevant information.	107	4.03	.98
4. To retrieve, store and evaluate information.	107	3.94	1.06
5. To analyze and synthesize information.	107	3.74	1.07
Total		4.05	.83

The use of technology as an *informational tool* had a significant frequency on all the items in the questionnaire, even though three of them scored higher than the other two. The item with the highest ratio was “to search information” (M = 4.41; SD = .78); then “to define a problem that needs to be resolved” (M = 4.04; SD = .98); the third item was “to filter and find relevant information” (M = 4.03; SD = .98); the four item, “to retrieve, story and evaluate information” (M = 3.94; SD = 1.06), and finally, “to analyze and synthesize information” (M = 3.74; SD = 1.07).

The last factor was the use of technology as a collaborative tool, which included also five items. Below they will be presented on table 107

Table 107
Mean, standard deviation and number of the use of technology as a *collaborative tool*.

Items	N	Mean	Standard deviation
1. To design projects/activities with other students.	107	3.79	1.09
2. To share with other students.	107	3.73	1.13
3. To interact with peers and teachers.	106	4.13	.91
4. For peer tutoring.	107	2.99	1.06
5. To combine ideas.	106	3.34	1.03
Total		3.61	.79

The use of technology as a collaborative tool fluctuated from every time to sometimes frequencies. The highest use was “to interact with peers and teachers (M = 4.13; SD = .91); then, “to design projects/activities with other students” (M = 3.79; SD = 1.09); the third item was “to share with other students” (M = 3.73; SD = 1.13). The fourth item was “to combine ideas” (M = 3.34; SD = 1.03), and the last and less usable item was “for peer tutoring” (M = 2.99; SD = 1.06). In this section here is a significant different from the most usable item to the less usable item; however, teachers still make their students use it for all the aspects mentioned above.

The second evaluation was the use of technology by science teachers. The teacher use was divided into four main groups as it will be shown below on table 108.

Table 108
Mean, standard deviation, and Cronbach’s alpha of the four factors identified on teachers’ use of technology by science teachers.

Factor	Mean	Standard deviation	Cronbach’s alpha
1. Instructional tool	4.35	.65	.827
2. Design tool	4.00	.81	.864
3. Collaborative tool	4.15	.82	.840
4. Assessment tool	3.81	.91	.887
Total	4.07	.66	.923

On the table shown above it can be appreciated that most of the teachers were using technology in the classroom at a very frequently rate since the ratios of response were significantly into the high frequency boxes. In addition, the Cronbach alphas are significantly high, being the highest one the use of technology as an “assessment tool” with .887. Then it follows technology as a “design tool” with .864; technology as a “collaborative tool” with .840; and finally technology as an “instructional tool” with .827.

The results of the use of technology are an indicative of the high frequency use of it by teachers and students in Utah classrooms. This results might be related to the amount of technology they have, the training they received or other factors regarding their schools and districts.

After the first analysis of the main factors affecting teachers’ use of technology in the classroom, there will be an analysis of the different items in each factor. The use of technology as an *instructional tool* by the students included four factors that will be shown below on table 109

Table 109
Mean, standard deviation and number of the use of technology as an *instructional tool*.

Items	N	Mean	Standard deviation
1. To present science content through a multimedia or hypermedia system.	107	4.41	.78
2. To support oral presentation of content.	107	4.37	.73
3. To show examples to students.	107	4.49	.65
4. To perform demonstrations to simulate scenarios.	107	4.13	1.02
Total		4.35	.65

On the table above, it can be appreciated that most of the teachers were using those items every time in their classrooms, with a significant ratio of response. The item with the highest use was “to show examples to students” (M = 4.49; SD = .65); then, “to present science content through a multimedia or hypermedia system” (M = 4.41; SD = .78), the third item was “to support oral presentation of content” (M = 4.37; SD = .73); and finally “to perform demonstrations to simulate scenarios” (M = 4.13; SD = 1.02).

The second factor was *design tool*, which also included four items. They will be shown on table 110.

Table 110
Mean, standard deviation and number of the use of technology as a *design tool*.

Items	N	Mean	Standard deviation
1. To design a science lesson.	107	4.19	.92
2. To elaborate learning content.	107	4.30	.87
3. To create a brainstorming.	107	3.49	1.08
4. To organize and classify learning content.	106	4.03	.95

Total	4.00	.81

The use of technology by teachers as an *instructional tool* had significantly high results being used every time or almost every time by educators. The item with the highest use was "to elaborate learning content" (M = 4.30; SD = .87); then, "to design a science lesson" (M = 4.19; SD = .92), the third item was "to organize and classify learning content" (M = 4.03; SD = .95); and finally "to create a brainstorming" (M = 3.49; SD = 1.08). All the items in the design tool factor scored really high being one of the factors why teachers use technology in the classroom.

The third factor regarding teacher's use of technology was *collaborative tool*, which included three items. They will be shown on table 111.

Table 111
Mean, standard deviation and number of the use of technology as a *collaborative tool*.

Items	N	Mean	Standard deviation
1. To communicate with students.	107	4.25	.90
2. To assign homework to students.	107	3.89	1.13
3. To communicate with parents.	107	4.30	.74
Total		4.15	.82

The use of technology by teachers as a *collaborative tool* had also high results being used very frequently by teachers. The item with the highest use was "to communicate with parents" (M = 4.30; SD = .74); then, "to communicate with students" (M = 4.25; SD = .90), and the third item was "to assign homework to students" (M = 3.89; SD = 1.13). Again, the use of technology is highly present in the classroom to collaborate and interact with other people involved in the school community.

Finally, the last item regarding teachers use was technology as an *assessment tool*, which included four items that will be shown below on table 112.

Table 112
Mean, standard deviation and number of the use of technology as an *assessment tool*.

Items	N	Mean	Standard deviation
1. To evaluate the prior knowledge before the implementation of a lesson.	107	3.65	1.15
2. To keep track of their progress during a lesson.	106	3.60	1.14

3. To see if we need to review a lesson or if the majority understood the issue.	107	3.85	1.02
4. To evaluate the student proficiency at the end of a lesson, unit or topic.	107	4.10	.93
Total		3.81	.91

The use of technology by teachers as an *assessment tool* had also moderate results being used almost every time by teachers. The item with the highest use was “to evaluate the student proficiency at the end of a lesson, unit or topic” (M = 4.10; SD = .93); then, “to see if the teacher needs to review a lesson or if the majority understood the issue” (M = 3.85; SD = 1.02); the third item was “to evaluate the prior knowledge before the implementation of a lesson” (M = 3.65; SD = 1.15); and finally the last item that was “to keep track of the student progress during a lesson” (M = 3.60; SD = 1.14) This item was not as high as the other uses by the teacher, but still significantly high in the Likert scale.

7.2 Correlations

This section is intended to show the degree of relationship stablished between different variables that have been analyzed in this study such as the competency of teachers using technology, the conceptions of teaching and learning, the conceptions of the nature of history and science, and the feelings and emotions that these teachers experience.

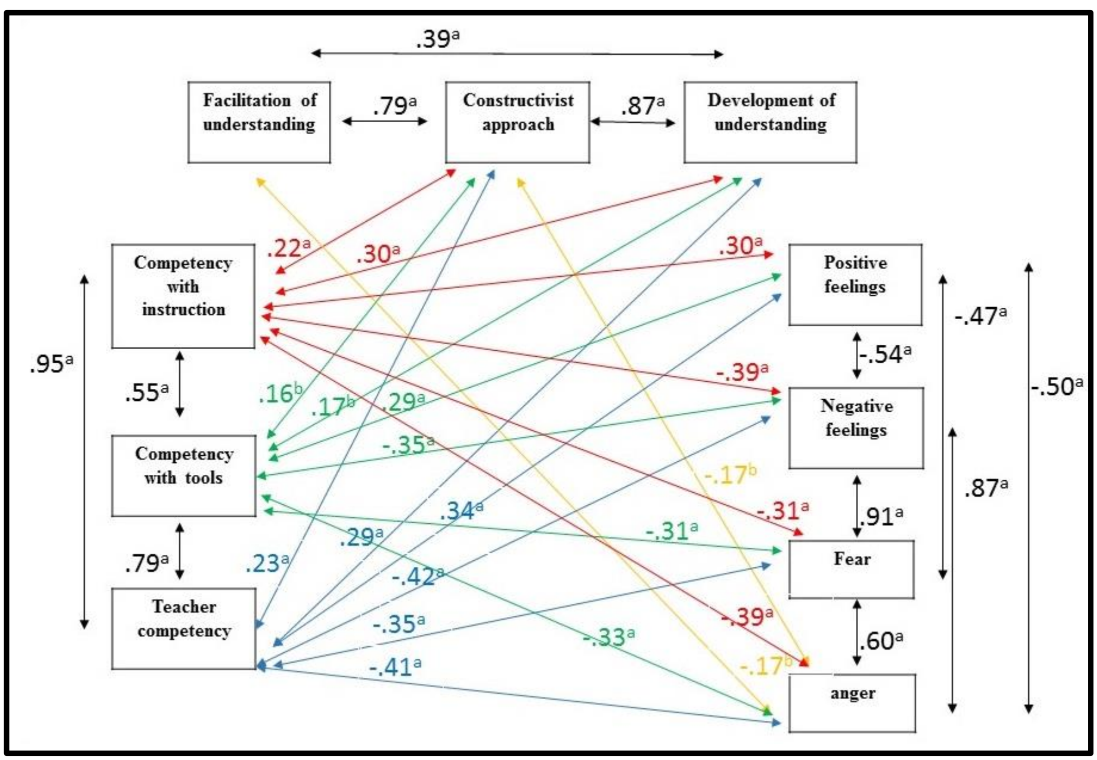
7.2.1 Correlations between history and science teachers’ competency, constructivist approach, traditional approach and feelings and emotions.

The following table 113 will show the significant correlations that appeared between the teachers’ competency and the constructivist approach; the teacher competency and the traditional approach; the teacher competency and the feelings; the constructivist approach and the traditional approach; the constructivist approach and the feelings; and the traditional approach and the feelings. This first table will focus on the overall of all history and science teachers.

Table 113
Correlations between the observed variables (N=216).

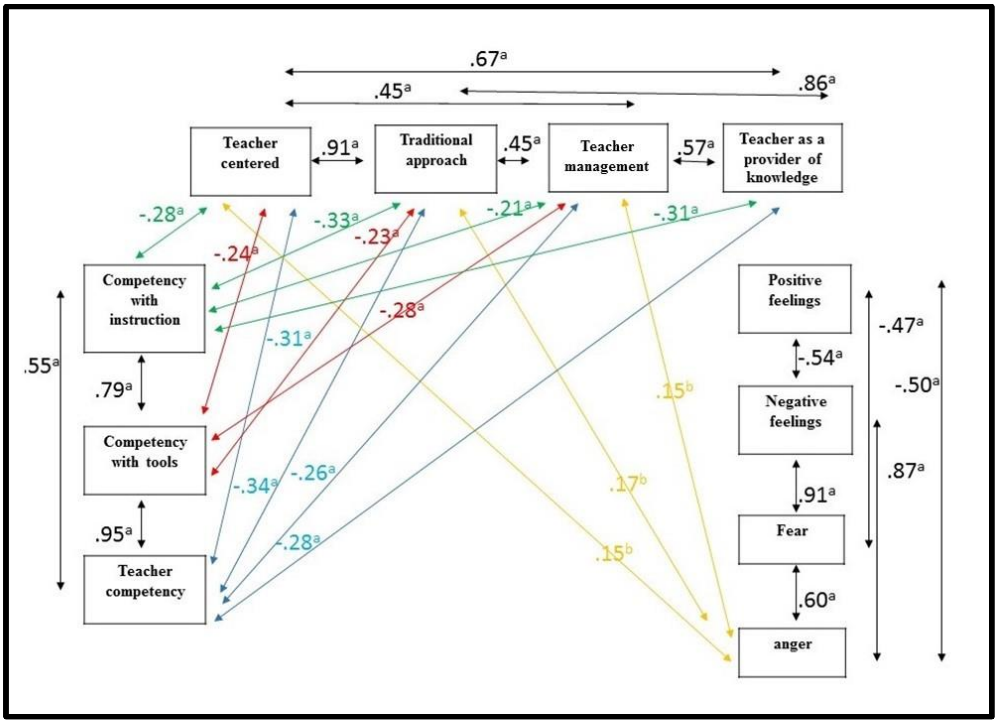
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1	Teacher competency (all)	-													
2	Competency with tools	.79[a]	-												
3	Competency with instruction	.95[a]	.55[a]	-											
4	Constructivist approach (all)	.23[a]	.16[b]	.22[a]	-										
5	Facilitation of understanding	.08	.09	.05	.79[a]	-									
6	Development of understanding	.29[a]	.17[b]	.30[a]	.87[a]	.39[a]	-								
7	Traditional approach (all)	-.34[a]	-.23[a]	-.33[a]	-.29[a]	-.07[a]	-.39[a]	-							
8	Teacher-centered	-.31[a]	-.24[a]	-.28[a]	-.30[a]	-.11	-.37[a]	.91[a]	-						
9	Teacher management	-.26[a]	-.28[a]	-.21[a]	-.23[a]	-.13	-.25[a]	.45[a]	.45[a]	-					
10	Teacher as a provider of knowledge	-.28[a]	-.13	-.31[a]	-.23[a]	.29	-.37[a]	.86[a]	.67[a]	.57[a]	-				
11	Positive feelings	.34[a]	.29[a]	.30[a]	.13	.13	.10	-.06	-.04	-.08	.21	-			
12	Negative feelings	-.42[a]	-.35[a]	-.39[a]	-.09	-.11	-.04	.06	.03	.11	.01	-.54[a]	-		
13	Fear	-.35[a]	-.31[a]	-.31[a]	.01	-.05	.04	-.04	-.07	.06	-.08	-.47[a]	.91[a]	-	
14	Anger	-.41[a]	-.33[a]	-.39[a]	-.17[b]	-.17[b]	-.12	.17[b]	.15[b]	.15[b]	.12	-.50[a]	.87[a]	.60[a]	-

Figure 4. Correlation between the constructivist approach, competencies and feelings.



[a] p < .01; [b] p < .05

Figure 5. Correlation between the traditional approach, competencies and feelings.



[a] p < .01; [b] p < .05

Table 113 shows the correlations between different variables. Then, figure 4 represents graphically the main significances among constructivist teachers, competency with technology, and feelings and emotions. And figure 5 characterizes the main significances between the traditional approach, competencies, and feelings and emotions. The correlations will be described below.

7.2.1.1 Correlations between teacher competency and the constructivist approach

Overall, there was a positive correlation between teacher competency and the constructivist approach. Increases in one variable were correlated with increases in the other variable. The most intense relationships were established between teacher competency, the constructivist approach, and the competency with instruction. As it can be observed, “teacher competency” has a direct and weak pattern of relationship with the “constructivist approach” ($r = .23$, $p = .001$), as well as the constructivist view of “development of understanding” ($r = .29$, $p = .000$).

In addition, “competency with instruction” and the “constructivist approach” has a direct and weak relationship ($r = .22$, $p = .002$), and it also has a similar patter with the “development of understanding” ($r = .30$, $p = .000$). In the other hand, other variables that presented a positive and significant relationship even though it was weaker than the others were the “competency with tools” and the “constructivist approach” ($r = .16$, $p = .023$), and also the “development of understanding” ($r = .17$, $p = .017$).

7.2.1.2 Correlations between teacher competency and the traditional approach

As it can be appreciated on table 113, “teacher competency” and the “traditional approach” are inversely related with a slightly strong pattern of relationship ($r = -.34$, $p = .000$). “Teachers’ competency” and the three traditional approaches have also a similar pattern of inverse relationship. The first one “teacher centered” ($r = -.31$, $p = .000$), then “teacher management” ($r = -.26$, $p = .000$); and finally “teacher as a provider of knowledge” ($r = -.28$, $p = .000$). This is also far from a strong or a near perfect relationship between factors.

The “competency with tools” also follows an inversely weak relationship among the “traditional approaches” ($r = -.23$, $p = .001$). The first relationship between this competency and “teacher centered” are inversely associated ($r = -.24$, $p = .000$). and it also has an inverse relationship with “teacher management” ($r = -.28$, $p = .000$).

Finally, “competency with instruction” and the” traditional approach” are also inversely related, with a slightly strong pattern of relationship ($r = -.33$, $p = .000$). In addition, the relationship with “teacher centered” are inversely associated ($r = -.28$, $p = .000$). The second relationship with “teacher management” is also inversely related ($r = -.21$, $p = .003$). The last relationship with “teacher as a provider of knowledge” is slightly higher than the previous ones, and it also follows an inverse pattern of association ($r = -.31$, $p = .000$).

7.2.1.3 Correlations between teacher competency and feelings and emotions

The last relationship established among teacher competency is between this variable and feelings and emotions. This last relationship has direct relationship with positive feelings and emotions, as well as an inverse correlations with negative feelings and emotions.

As shown above, "teacher competency" and "positive feelings" are directly related with a slightly moderate pattern of relationship ($r = .34$, $p = .000$). However, this competencies and the "negative feelings" are inversely associated with a slightly strongest pattern ($r = -.42$, $p = .000$). In addition, competency and "fear" are also inversely related ($r = -.35$, $p = .000$); as well as "anger" ($r = -.41$, $p = .000$). Both relationships are inverse and higher than the "positive feelings".

The "competency with tools" also has a direct relationship with "positive feelings" with a weak relationship of ($r = .29$, $p = .000$). This competency is inversely associated with the "negative feelings" ($r = -.35$, $p = .000$), and it also follows an inverse relationship with the two main negative feelings that are "fear" ($r= -.31$, $p = .000$) and "anger" ($r = -.33$, $p = .000$).

The second "competency with instruction" also follows a direct and slightly strong pattern of relationship with the "positive feelings" ($r= .30$, $p = .000$). However, "competency with instruction" and the "negative feelings" have an inverse association ($r= -.39$, $p = .000$). This competency also follows an inverse relationship with "fear" ($r= -.31$, $p =.000$); and "anger" ($r= -.39$, $p = .000$).

7.2.1.4 Correlations between the constructivist approach and the traditional approach

As it can be appreciated, the "constructivist" and "traditional" approaches are inversely related ($r = -.29$, $p = .000$). Even though the relationship with the three approaches is opposite, all the different perspectives have a slightly strong inverse relationship. The "constructivist approach" with the "teacher centered" has the strongest inverse relationship ($r = -.30$, $p = .000$); and the other two have a similar outcome. The "teacher management" is inversely associated with a constructivist view (r = -.23, p = .001) as well as the "teacher as a provider of knowledge" is also inverse to the constructivist perspective (r = -.23, p = .001).

The last relationship is the one stablished between the "development of understanding", that also has a slightly strong inverse relationship, with the "traditional approach" (r = -.39, p = .000). Hence, the "teacher centered" approach has a significant inverse relationship (r = -.37, p = .000). In addition, the "teacher management" also has an inverse relationship that is somewhat weaker than the previous variables (r = -.25, p = .000), and the "teacher as a provider of knowledge" has a similar outcome than the "teacher centered" (r = -.37, p = .000).

7.2.1.5 Correlations between the constructivist approach and feelings and emotions

The constructivist approach and feelings have a different pattern ranging from mostly a direct relationship when referring to positive feelings, and an inverse relationship when denoting negative feelings. However, only the feeling of anger appeared to be significant. The "constructivist approach" has a negative and weak relationship with "anger" (r = -.17, p = .019), as well as the "facilitation of understanding" follows a weak and inverse relationship with the same feeling (r = -.17, p = .019).

7.2.1.6 Correlations between the traditional approach and feelings and emotions

Only three variables related to the traditional approach had some significant relationship with teacher competency. The "traditional approach" only resulted in a significant outcome when referred to the negative feeling of "anger" (r = .17, p = .018). In addition, "teacher centered" had a direct and slightly weak relationship with this feeling (r = .15, p = .041), and "teacher management" also had a direct and weak relationship with the feelings of "anger" (r = .15, p = .040).

7.2.2 Correlations between teacher competency, the constructivist approach, the traditional approach, conceptions of the nature of history, and feeling and emotions by history teachers.

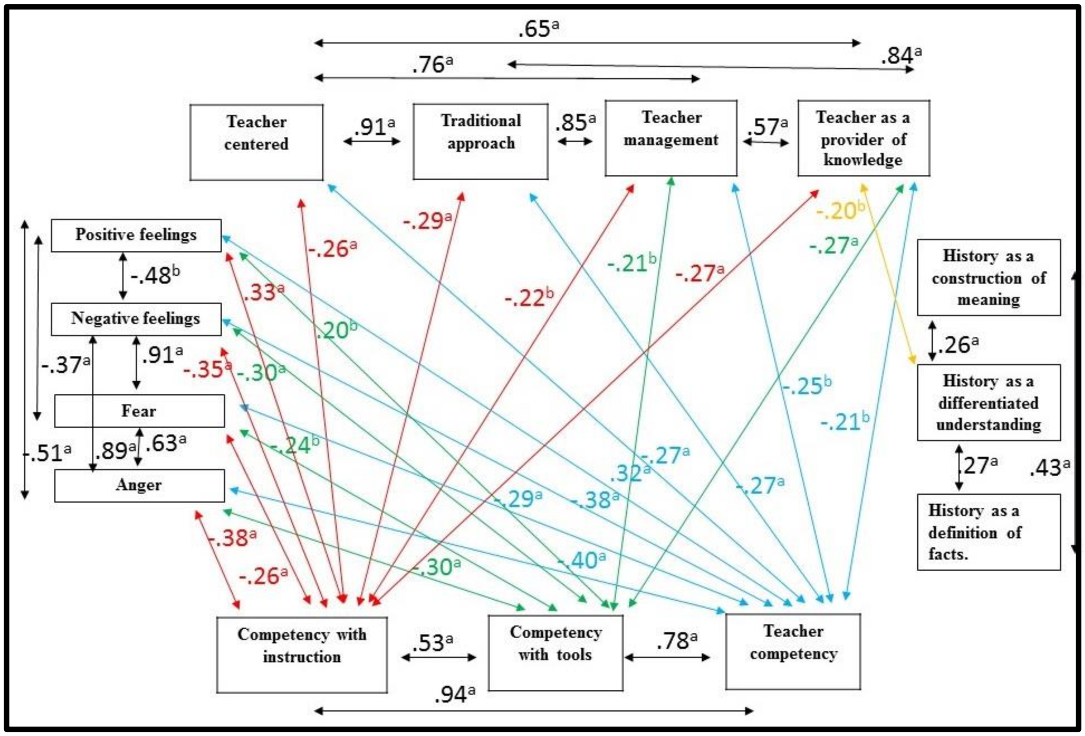
The following table will show some of the correlation that appeared in the analysis of history teachers. Those correlations will refer to teachers' competency with technology and the constructivist approach; and teacher competency with technology and the traditional approach. This table will focus specifically on this group of teachers.

Table 114
Correlations between the observed variables (N=108).

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1	Teacher competency (all)	-																
2	Competency with tools	.78[a]	-															
3	Competency with instruction	.94[a]	.53[a]	-														
4	Constructivist approach (all)	.22[b]	.18	.20[b]	-													
5	facilitation of understanding	.07	.12	.03	.77[a]	-												
6	Development of understanding	.28[a]	.15	.29[a]	.78	.19[a]	-											
7	Traditional approach (all)	-.27[a]	-.12	-.29[a]	-.31[a]	-.04	-.44[a]	-										
8	Teacher-centered	-.27[a]	-.19	-.26[a]	-.34[a]	-.09	-.43[a]	.91[a]	-									
9	Teacher management	-.25[b]	-.21[b]	-.22[b]	-.28[a]	-.11	-.33[a]	.85[a]	.76[a]	-								
10	Teacher as a provider of knowledge	-.21[b]	-.01	-.27[a]	-.17	-.10	.36[a]	-.84[a]	.65[a]	.57[a]	-							
11	History as a construction of meaning	.54	.17	-.028	.20	.28[a]	.29	.12	.10	.09	.15	-						
12	History as a differentiated understanding	.07	.05	.07	.15	.06	.17	-.19	-.16	-.13	-.20[b]	.26[a]	-					
13	History as a definition of facts	.00	.04	-.02	.10	.08	.09	.13	.11	.19	.04	.43[a]	.27[a]	-				
14	Positive feelings	.32[a]	.20[b]	.33[a]	.13	.17	.04	-.01	-.07	.05	.02	.13	-.04	.13	-			
15	Negative feelings	-.38[a]	-.29[a]	.35[a]	-.07	-.09	.00	.07	.05	.09	.09	-.09	.10	.04	-.48[a]	-		
16	Fear	-.29[a]	-.24[b]	-.26[a]	.01	-.02	.06	-.02	-.07	.04	.01	-.10	.14	.14	-.37[a]	.92[a]	-	
17	Anger	-.40[a]	-.30[a]	-.38[a]	-.15	-.16	-.05	.17	.17	.15	.15	-.08	.03	-.07	-.51[a]	.90[a]	.63[a]	-

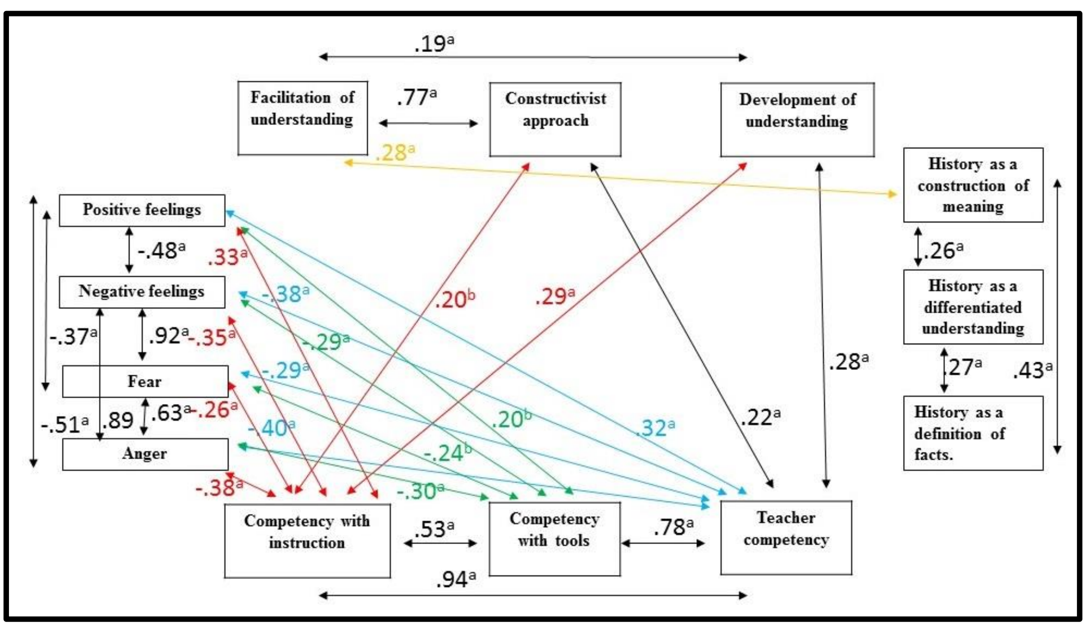
[a] $p < .01$; [b] $p < .05$

Figure 6. Correlation among history teachers' competency, traditional approach, conceptions of the nature of history and feelings and emotions.



[a] p < .01; [b] p < .05

Figure 7. Correlation among history teachers' competency, constructivist approach, conceptions of the nature of history, and feelings and emotions.



[a] p < .01; [b] p < .05

7.2.2.1 Correlations between teacher competency and the constructivist approach

As shown on table 114, history "teachers competency" follows a direct and slightly weak pattern of relationship with the "constructivist approach" ($r = .22$, $p = .030$), as well as the "development of understanding" ($r = .28$, $p = .006$). In addition, the "competency with instruction" has a direct and weak relationship with the "constructivist approach" ($r = .20$, $p = .047$), as well as with the "development of understanding" ($r = .29$, $p = .004$). This is distant from a strong or near perfect correlation among teacher competencies and the constructivist approach, indicating that might imply different determining factors and explanations.

7.2.2.2 Correlations between teacher competency and the traditional approach

"Teacher competency" and the "traditional approach" are inversely related with a moderate pattern of relationship ($r = -.27$, $p = .007$). In addition, "teacher competency" and the three traditional approaches have a similar pattern of inverse relationship: "teacher centered" ($r = -.27$, $p = .007$), "teacher management" ($r = -.25$, $p = .013$), and "teacher as a provider of knowledge" ($r = -.21$, $p = .041$). This is also far from a strong or a near perfect relationship between factors.

The "competency with tools" also follows an inverse relationship among the traditional approach in which "teacher management" is inversely associated ($r = -.21$, $p = .036$), as well as "teacher as a provider of knowledge" ($r = -.01$, $p = .950$). Finally, the "competency with instruction" and the "traditional approach" are also contrariwise related, with a slightly strong pattern of relationship ($r = -.29$, $p = .004$). The relationship with "teacher centered" is inversely associated ($r = -.26$, $p = .010$), the relationship with "teacher management" is also inversely related ($r = -.22$, $p = .032$), and the correlation with "teacher as a provider of knowledge" is slightly higher than the previous ones, and it also follows an inverse pattern of association ($r = -.27$, $p = .007$).

7.2.2.3 Correlations between teacher competency, and feelings and emotions

Teacher competency, and feelings and emotions are positive and negatively correlated. First of all, history "teachers competency" follows a direct and slightly strong pattern of relationship with the "positive feelings" (r = .32, p = .001). "Competency with tools" has a weak relationship with this type of feelings (r = .20, p = 0.045); and "competency with instruction save a strong relationship (r = .33, p = .001).

In the other hand, "teacher competency" with "negative feelings" save a strong and negative pattern of relationship with all its variables. "Negative feelings" (r = -.38, p = .000), "fear" (r = -.29, p = .004), and "anger" (r = -.40, p = .000). In addition, "competency with tools" also save a significantly negative relationship with "negative feelings" (r = -.29, p = .004), "fear" (r = -.24, p = .018), and "anger" (r = -.30, p = .002). Also, the relationship between "competency with instruction" keeps a strong and negative relationship with "negative feelings" (r = -.35, p = .000), with fear (r = -.26, p = .010), and with "anger" (r = -.38, p = .000).

7.2.2.4 Correlations between the constructivist and the traditional approach

As expected, the "constructivist" and "traditional" approaches are inversely related (r = -.31, p = .002), and save a slightly moderate relationship. The "constructivist approach" with the "teacher centered" perspective has the strongest inverse relationship (r = -.34, p = .001); and the "teacher management" is inversely associated with a constructivist view (r = -.28, p = .005).

The last relationship is the one stablished by the "development of understanding" that also has a slightly strong inverse relationship with the "traditional approach" (r = -.44, p = .000). Hence, the "teacher centered" approach has a significant inverse relationship (r = -.43, p = .000). In addition, the "teacher management" also has an inverse relationship that is somewhat weaker than the previous one (r = -.33, p = .001), and the "teacher as a provider of knowledge" has a similar outcome than the "teacher management" (r = -.36, p = .000).

7.2.3 Correlations between teacher competency, the constructivist approach, the traditional approach, conceptions of the nature of science, and feelings and emotions by science teachers.

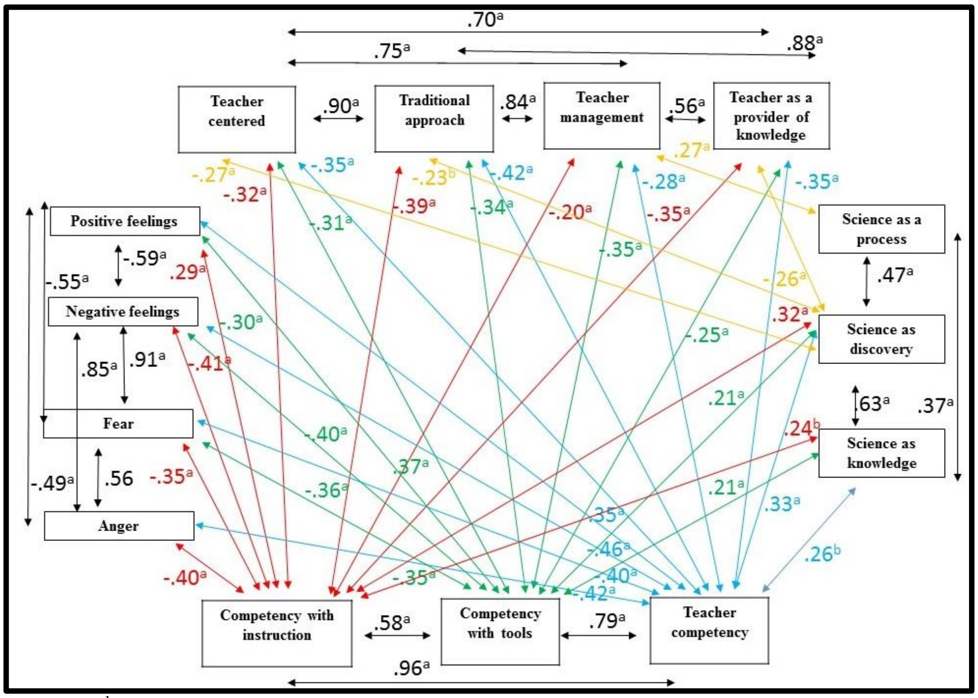
This section will provide the significant correlations that appeared in the analysis of science teachers. Those correlations will refer to teachers' competency with technology, and the constructivist approach; teacher competency with technology, and the traditional approach; constructivist and traditional approach, and competency and feelings and emotions. Below is table 115 that will show these correlations.

Table 115
Correlations between the observed variables (N=108).

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17
1	Teacher competency (all)	-																
2	Competency with tools	.79[a]	-															
3	Competency with instruction	.96[a]	.58[a]	-														
4	Constructivist approach (all)	.24[b]	.14	.24[b]	-													
5	Facilitation of understanding	.09	.06	.08	.83[a]	-												
6	Development of understanding	.30[a]	.18	.31[a]	.93[a]	.57[a]	-											
7	Traditional approach (all)	-.42[a]	-.34[a]	-.39[a]	-.29[a]	-.10	-.37[a]	-										
8	Teacher-centered	-.35[a]	-.31[a]	-.32[a]	-.29[a]	-.14	-.33[a]	.90[a]	-									
9	Teacher management	-.28[a]	-.35[a]	-.20[a]	-.19[a]	-.15	-.20	.84[a]	.75[a]	-								
10	Teacher as a provider of knowledge	-.35[a]	-.25[b]	-.35[a]	-.29[a]	.05	-.39[a]	.88[a]	.70[a]	.57[a]	-							
11	Science as a process	.10	-.08	.18	.18	.00	.25[b]	.03	-.02	.27[a]	-.09	-						
12	Science as discovery	.33[a]	.21[b]	.32[a]	.53[a]	.34[a]	.55[a]	-.23[b]	.27[a]	-.05	-.26[a]	.47[a]	-					
13	Science as knowledge	.25[b]	.21[b]	.24[b]	.39[a]	.39[a]	.33[a]	-.18	-.17	-.11	-.16	.37[a]	.63[a]	-				
14	Positive feelings	.35[a]	.37[a]	.29[a]	.13	.10	.13	-.10	-.02	-.19	.02	-.12	.07	.10	-			
15	Negative feelings	-.46[a]	-.40[a]	-.41[a]	-.09	-.13	-.07	.05	.01	.13	-.07	.17	-.05	-.02	-.59[a]			
16	Fear	-.40[a]	-.36[a]	-.35[a]	.01	-.07	.04	-.06	-.08	.09	-.17	.30[a]	.07	.07	-.55[a]	.91[a]	-	
17	Anger	-.42[a]	-.35[a]	-.40[a]	-.19	-.18	-.18	.17	.13	.15	.09	-.06	-.18	-.14	-.49[a]	.85[a]	.56[a]	-

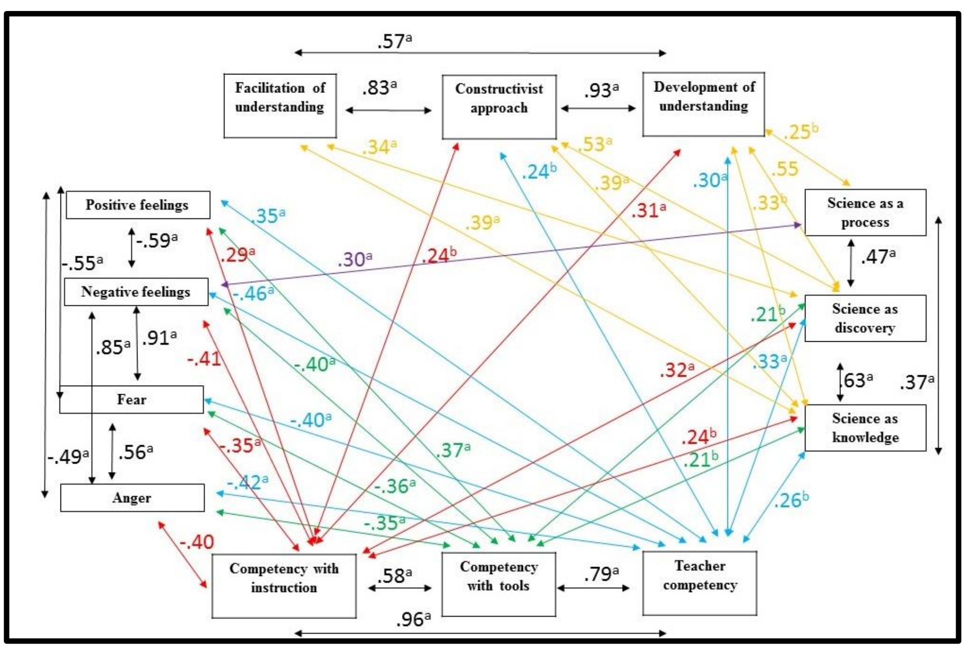
[a] $p < .01$; [b] $p < .05$

Figure 8. Correlation among science teachers' competency, the traditional approach, conceptions of the nature of science, and feelings and emotions.



a p < .01; b p < .05

Figure 9. Correlation among science teachers' competency, the constructivist approach, conceptions of the nature of science, and feelings and emotions.



a p < .01; b p < .05

7.2.3.1 Correlations between teacher competency and the constructivist approach

A few variables resulted from the correlation analysis between teacher competency and the constructivist approach. First of all, “science teachers’ competency” follows a weak pattern of relationship with the “constructivist approach” (r = .24, p = .019), and it has a moderate direct pattern of relationship with the “development of understanding” (.30, p = .003).

Then, the last relationship established in this first section would be between the “competency with instruction” and the constructivist approach which has a direct and weak relationship (r = .24, p = .020), as well as with the “development of understanding”, that have a moderate direct relationship (r = .31, p = .002).

7.2.3.2 Correlations between teacher competency and the traditional approach

“Teacher competency” and the “traditional approach” are inversely related with a slightly strong pattern of relationship (r = -.42, p = .000). In addition, “teacher competency” and the three traditional approaches have a similar pattern of inverse relationship. The first one “teacher centered” (r = -.35, p = .000); “teacher management” (r = -.28, p = .005); and “teacher as a provider of knowledge” (r = -.35, p = .000). The correlations are still weak but they save a substantial significance between variables.

Then, the “competency with tools” also follows a moderate inverse relationship among the “traditional approaches” (r = -.34, p = .000). The first relationship between this competency and “teacher centered” are inversely associated (r = -.31, p = .02. In addition, it also has an inverse relationship with “teacher management” (r = -.35, p = .000); and with “teacher as a provider of knowledge” (r = -.25, p = .010); even though this last relationship is weaker than the previous ones.

Finally, the “competency with instruction” and the traditional approaches are also inversely related, with a moderate pattern of relationship (r = -.39, p = .000). The first relationship with "teacher centered" are inversely associated ($r = -.32$, $p = .002$). The second relationship with "teacher management" is also inversely related and the weaker of the three perspectives ($r = -.20$, $p = .049$). The last relationship with "teacher as a provider of knowledge" is slightly higher than the previous ones, and it also follows an inverse pattern of association ($r = -.35$, $p = .000$).

7.2.3.3 Correlations between constructivist and traditional approach

As expected, the constructivist and traditional approaches are inversely related ($r = -.29$, $p = .005$). Even though the relationship with the two traditional variables is opposite, all the significant variables have a weak relationship. The "constructivist approach" with "teacher centered" hold the strongest inverse relationship ($r = -.29$, $p = .005$), and then the "teacher as a provider of knowledge" is also inverse to the constructivist perspective ($r = -.29$, $p = .005$).

The last relationship is the one stablished by the "development of understanding" that also has a slightly moderate inverse relationship with the "traditional approach" ($r = -.37$, $p = .000$). Hence, the "teacher centered" approach has a moderate inverse relationship ($r = -.33$, $p = .001$), and the "teacher as a provider of knowledge" has a slightly strong inverse relationship with the "teacher as a provider of knowledge" ($r = -.39$, $p = .000$).

7.3 Multiple regression analyses

This section is intended to show the relationship among variables that were analyzed in this study. In the following paragraphs there will be a description of two matters. The first one will be teacher uses of technology, and it will be also separated regarding history or science teacher. The second one will be an analysis of students' uses of technology, as well as the difference between history and science students' uses of technology. In every one of those section there will be a dependent variable that will counterpart the categories that we stated for teachers and students. Teachers will consist of instruction, design, collaboration and assessment; whereas the student's section will be divided into: curriculum, information and collaboration. With the aim of answering all the objectives of this investigation, we will first state the influence of each category of variables, followed by the effects of those variables in each model.

7.3.1 Multiple regression analysis for teacher uses of technology

This first section will analyze and describe teachers' use of technology in the classroom as a dependent variable, including all the science and history teachers. The first results will be presented below on table 116.

Table 116
Multiple regression analysis of the factors that influence teachers' use of technology.

	All			Instruction			Design			Collaboration			Assessment		
	B (S.E.)	Beta	t	B (S.E.)	Beta	t	B (S.E.)	Beta	t	B (S.E.)	Beta	t	B (S.E.)	Beta	t
Constant	1.195 (.725)		1.649^{a}	1.470 (.670)		2.193^{b}	1.869 (.845)		2.211^{b}	1.374 (.813)		1.691^{a}	2.256 (.950)		2.375^{b}
Competency with tools	.206 (.089)	.180	2.309^{b}	.232 (.083)	.230	2.809^{c}	.183 (.104)	.146	1.760^{a}	.225 (.100)	.175	2.245^{b}	-.016 (0.117)	-.011	-.137
Competency with instruction	.240 (.059)	.341	4.089^{d}	.113 (.054)	.182	2.074^{b}	.205 (.068)	.267	2.998^{c}	.272 (.066)	.345	4.124^{d}	.368 (.077)	.397	4.780^{d}
Facilitation of understanding	-.046 (.116)	-.029	-.400	-.069 (.107)	-.049	-.643	-.005 (.135)	-.003	-.039	.063 (.130)	.035	.488	-.210 (.151)	-.100	-1.387
Development of understanding	.050 (.100)	.039	.498	.094 (.092)	.084	1.020	.001 (.116)	.001	.009	-.016 (.112)	-.011	-.141	.122 (.130)	.073	.935
Traditional approach	.299 (.795)	.186	.376	.411 (.736)	.290	.559	-.290 (.927)	-.165	-.312	.046 (.892)	.025	.051	-.424 (1.042)	-.200	-.407
Teacher-centered	-.170 (.278)	-.131	-.612	-.076 (.258)	-.066	-.294	.094 (.325)	.066	.290	-.173 (.312)	-.119	-.555	-.026 (.365)	-.015	-.072
Teacher management	-.006 (.291)	-.004	-.021	-.196(.269)	-.143	-.727	.002 (.339)	.001	.005	.233 (.326)	.134	.715	.337 (.381)	.165	.883
Teacher as a provider of knowledge	-.450 (.301)	-.341	-1.494	-.421 (.279)	-.362	-1.511	-.190 (.351)	-.132	-.541	-.526 (.338)	-.355	-1.555	-.365 (.395)	-.210	-.924
Positive feelings	.140 (.088)	.120	1.584	.145 (.082)	.141	1.782^{a}	.192 (.103)	.151	1.872^{a}	.011 (.099)	.009	.116	.186 (.116)	.121	1.613
Fear	.086 (.071)	.097	1.211	.049 (.066)	.063	.747	.081 (.083)	.083	.972	.088 (.080)	.089	1.100	.017 (.093)	.015	.186
Anger	.043 (.085)	.042	.504	-.035 (.079)	-.039	-.448	-.045 (.099)	-.040	-.454	.098 (.096)	.085	1.024	.051 (.112)	.037	.453
Summary of the model															
R^2 (Adjusted R square)	.388 (.347)			.325 (.280)			.30 (.257)			.358 (.344)			.393 (.352)		
F for the dependent variable	9.509^{d}			7.209^{d}			6.537^{d}			9.386^{d}			9.696^{d}		

^{a} $p < .10$; ^{b} $p < .05$; ^{c} $p < .01$; ^{d} $p < .001$.

The information provided from the summary of all the categorizations in teachers' uses, including science and history teachers, allows to observe the influence of some of the variables in each category to the independent variable. The first description is based on all the categories together for the uses of technology and it is significantly strong ($F = 9.509$, $p < .001$) as well as it has an acceptable degree of explained variable ($R^2 = .388$). In relationship with all the variables that were analyzed, only teacher competencies were significant and positive where *competency with tools* (Beta = .180, $p < .001$); and *competency with instruction* (Beta = .341, $p < .001$).

The dependent variable referred to the uses of technology for instructional purposes appeared to be strong ($F = 7.209$, $p < .001$), with a minor acceptable degree of explained variable ($R^2 = .280$). From all the variables that were analyzed, only three showed a positive and significant outcome; two referred to teachers competencies such as *competency with tools* (Beta = .230, $p < .10$); and instruction (Beta = .182, $p < .05$). The third variable that showed a positive impact was the *positive feelings* (Beta = .141, $p < .10$).

Another dependent variable that was analyzed was the use of technology to design. The relationship appeared strong even though it was the weakest of the ones being analyzed ($F = 6.537$, $p <.001$), with an acceptable degree of explained variable ($R^2 = 0.257$). This particular model showed three variables that affected the uses of technology as a design mechanism. The first one was *competency with tools* (Beta = .146, $p < .10$); and *competency with instruction* (Beta = .267, $p < .01$). The last variable was again the *positive feelings* that also showed a positive impact (Beta = .151, $p < .10$).

The third category pointed to the uses of technology for collaboration purposes appeared to be highly strong ($F = 9.386$, $p < .001$), with an acceptable degree of explained variable ($R^2 = .344$). From all the variables that were analyzed, only two showed a positive and significant relationship and both referred to the teachers' competencies: *competency with tools* (Beta = .175, $p < .05$); and *competency with instruction* (Beta = .345, $p < .001$).

Finally, the last category mentioned the uses of technology as an assessment tool. The relationship also appeared as highly strong ($F = 9.696$, $p < .001$), with an acceptable degree of explained variable ($R^2 = .352$). From all the variables, only one showed a significant relationship being the *competency with instruction* (Beta = .397, $p < .001$).

7.3.1.1 Multiple regression analysis for history teacher's uses of technology

This second section will describe the influence of each variable in history teachers' use of technology. This representation will be presented below on table 117.

Table 117
Multiple regression analysis of the factors that influence history teachers' use of technology.

	All			Instruction			Design			Collaboration			Assessment		
	B (S.E.)	Beta	t	B (S.E.)	Beta	t	B (S.E.)	Beta	t	B (S.E.)	Beta	t	B (S.E.)	Beta	t
Constant	1.790 (.913)		1.960[a]	2.087 (.873)		2.1390[b]	2.260(1.055)		2.142[b]	1.864(1.095)		1.702[a]	1.140(1.342)		.850
Competency with tools	.138 (.121)	.125	.256	.336 (.132)	.403	2.548[c]	.439 (.160)	.442	2.753[c]	.530 (.167)	.509	3.179[c]	1.155 (.203)	.853	5.677[d]
Competency with instruction	.341 (.077)	.491	4.445[d]	.046 (.152)	.046	.300	.053 (.186)	.045	0.283	.109 (.196)	.088	.558	-.733 (.237)	-.455	-3.085[c]
Facilitation of understanding	-.032 (.142)	-.022	-.228	-.001 (.134)	-.000	-.008	-.035 (.165)	-.022	-.210	-.004 (.172)	-.003	.-.025	-.079 (.209)	-.037	-.380
Development of understanding	-198 (.148)	.136	1.336	-.147 (.134)	-.117	-1.093	-.244 (.170)	-.158	-1.432	-.220 (.171)	-.139	-1.283	-.163 (.208)	-.080	-.783
Traditional approach	.034 (1.007)	.024	.034	.136 (.956)	.107	.142	-.732(1.168)	-.484	-.627	-.694(1.225)	-.438	-.566	.966 (1.488)	.469	.649
Teacher-centered	-.170 (.380)	-.147	-.447	-.182 (.359)	-.177	-.506	.205 (.439)	.168	.467	.240 (.462)	.186	.519	-.716 (.560)	-.429	-1.279
Teacher management	-.017 (.337)	.012	.050	-.041(.322)	-.034	-.128	.119 (.395)	.082	.301	.152 (.412)	.100	.370	-.048 (.502)	-.024	-.095
Teacher as a provider of knowledge	-.397 (.377)	-.332	.296	-.424 (.361)	-.400	-1.176	-.129 (.441)	-.102	-.293	-.185 (.460)	-.139	-.402	-.743 (.562)	-.430	-1.321
Positive feelings	.165 (.133)	.126	1.239	.054 (.125)	.047	.433	.222 (.153)	.162	1.457	.168 (.159)	.114	1.053	.228 (.193)	.122	1.181
Fear	.052 (.185)	.051	.280	.016 (.088)	.021	.178	.000 (.108)	.000	.003	.153 (.113)	.160	1.350	-.047 (.138)	-.039	-.344
Anger	.071 (.183)	.072	.385	.059 (.112)	.068	.529	.064 (.139)	.062	.461	-.035 (.142)	-.032	-.249	.243 (.174)	.172	1.391
History as a construction of meaning.	.325 (.142)	.237	2.285[c]	.389 (.136)	.319	2.861[c]	273 (.165)	.187	1.652	.119 (.173)	.078	.692	.451 (.211)	.226	2.139[b]
History as a differentiated understanding.	-.014 (.087)	-.015	-.161	.023 (.83)	.027	.272	.087 (.101)	.086	.861	-.068 (104)	-.064	-.650	-.128 (.128)	-.093	-.998
History as a definition of the facts.	-.045 (.107)	-.042	-.420	-.096 (.099)	-.103	-.964	-.154 (.122)	-.136	-1.255	-.029 (.129)	-.025	-.229	.119 (.154)	.078	.769
Summary of the model															
R^2 (Adjusted R square)	.570 (.530)			.492 (.508)			.466 (.623)			.482 (.648)			.532 (.794)		
F for the dependent variable	6.340[d]			4.774[d]			4.304[d]			4.581[d]			5.682[d]		

[a] p< .10; [b] p< .05; [c] p< .01; [d] p< .001.

In the first analysis we observed that the results were significantly strong ($F = 6.340$, $p < .001$) with a high acceptable degree of explained variable ($R^2 = .570$). In relationship with the other variables that were analyzed, there were specifically two that resulted significant. The first one was the teacher competency *with instruction* (Beta = .491, $p < .001$), and the second one was the history conception of *construction of meaning* (Beta = .237, $p < .05$).

The dependent variable referred to *instruction* appeared to be significant ($F = 4.774$, $p < .001$) with an acceptable degree of explained variable ($R^2 = .492$). This particular variable showed a positive relationship with two other variables. The first one is *teacher competency*, including all of the ones analyzed before (Beta = .403, $p < .05$) and again, the history conception of *construction of meaning* (Beta = .319, $p < .01$).

A different dependent variable that was analyzed was the use of technology as a design tool. The relationship appeared weak ($F = 4.304$, $p < .001$), with an acceptable degree of explained variable ($R^2 = .466$). The only relationship that resulted significant was *teacher competency* (Beta = .442, $p < .01$).

The third category pointed to the uses of technology for *collaboration* purposes appeared to be acceptable ($F = 4.581$, $p < .001$), with a satisfactory degree of explained variable ($R^2 = .532$). From all the variables that were computed, three showed to be influencing in assessment. Two of them had a positive and significant relationship being *teacher competencies* (Beta = .853, $p < .001$), and the conception of history of *construction of meaning* (Beta = .226, $p < .01$).

Finally, the competency referring to assessment appeared significantly higher than the others specific ones ($F = 5.685$, $p < .001$), with an acceptable degree of explained variable ($R^2 = .532$). From all the variables, three showed some sort of relationship. Two of them had a positive and significant relationship being *teacher competency* (Beta = .853, $p < .001$), and the conception of history of *construction of meaning* (Beta = .226, $p < .05$). The third variable showed a negative significant relationship and was *competency with tools* (Beta = -.455, $p < .05$).

7.3.1.2 Multiple regression analysis for science teacher's uses of technology

This section is intended to show the relationship between science teacher uses of technology and different variables that were included in this study. This relationships will be shown on table 118.

Table 118
Multiple regression analysis of the factors that influence science teachers' use of technology.

	All			Instruction			Design			Collaboration			Assessment		
	B (S.E.)	Beta	t	B (S.E.)	Beta	t	B (S.E.)	Beta	t	B (S.E.)	Beta	t	B (S.E.)	Beta	t
Constant	2.573 (.776)		3.314[d]	1.584 (.913)		1.734[a]	2.327(1.187)		1.960[a]	1.699(1.118)		1.520	4.345(1.282)		3.390
Competency with tools	.083 (.096)	.081	.863	.204 (.113)	.200	1.796[a]	.097 (.147)	.077	.657	.130 (.139)	.101	.938	-.089 (.159)	-.063	-.560
Competency with instruction	.182 (.060)	.300	3.042[c]	.106 (.071)	.174	1.497	.213 (.092)	.284	2.322[b]	.200 (.087)	.261	2.311[b]	.221 (.099)	.262	2.226[b]
Facilitation of understanding	-.375 (.155)	-.253	-2.412	-.384 (.183)	-.258	-2.095[b]	-.306 (.238)	-.167	-1.286	-.381 (.225)	-.202	-1.698	-.442 (.257)	-.214	-1.716[a]
Development of understanding	.151 (.115)	.157	1.318	.230 (.136)	.238	1.698[a]	.122 (.176)	.103	.695	.141 (.166)	.115	.849	.105 (.190)	.078	.549
Traditional approach	-1.134(1.008)	-.762	-1.125	.853 (1.172)	.571	.728	-1.213(1.542)	-.661	-.787	-1.970(1.436)	-1.043	-1.372	-2.124 (1.646)	-1.025	-1.291
Teacher-centered	.102 (.289)	.081	.352	-.236 (.337)	-.188	-.700	.214 (.442)	.139	.484	.007 (.412)	.004	.017	.318 (.473)	.183	.672
Teacher management	.300 (.392)	.204	.765	-.611(.460)	-.415	-1.329	.039 (.599)	.022	.065	1.217 (.563)	.655	2.162[b]	.710 (.645)	.348	1.100
Teacher as a provider of knowledge	.226 (.411)	.189	.548	-.251 (.478)	-.210	-.525	.544 (.629)	.369	.864	.231 (.585)	.152	.394	.257 (.671)	.155	.383
Science as discovery	.090 (.082)	.109	1.100	.040 (.096)	.050	.420	.177 (.125)	.174	1.418	.044 (.118)	.042	.369	..086 (.135)	.076	.634
Science as knowledge	-.015 (.101)	-.016	-.143	-.033 (.119)	-.038	-.276	.110 (.155)	.101	.711	-.076 (.146)	-.069	-.523	-.065 (.167)	-.054	-.391
Science as a process	.171 (.183)	.072	.385	.117 (.163)	.083	.720	-.083(.212)	-.048	-.394	.444 (.200)	.249	2.223[b]	.295 (.229)	.151	1.287
Positive feelings	.228 (.084)	.241	2.719[a]	.289 (.099)	.304	2.920[c]	.249 (.128)	.213	1.934[a]	.067 (.121)	.056	.552	.275 (.139)	.208	1.976[a]
Fear	.015 (.078)	.019	.186	.097 (0.92)	.125	1.048	.073 (.120)	.077	.613	-.071 (113)	-.073	-.632	-.051 (.129)	-.048	-.398
Anger	-.057 (.082)	-.062	-.694	-.191 (.097)	-.209	-1.975	-.168 (.125)	-.150	-1.344	.233 (.118)	-.202	-1.968[a]	-.038 (.136)	-.030	-.278
Summary of the model															
R^2 (Adjusted R square)	.689 (.416)			.563 (.491)			.521 (.636)			.590 (.601)			.552 (.689)		
F for the dependent variable	10.583[d]			6.269[d]			5.202[d]			6.979[d]			5.988[d]		

[a] p< .10; [b] p< .05; [c] p< .01; [d] p< .001.

The first results showed to be significantly high ($F = 10.583$, $p < .001$), with a strong degree of explained variable ($R^2 = .689$). When it comes to gather together all teacher uses, it resulted in three categories that showed some significance on top of the others. The first one that showed a significant positive relationship was the *competency with instruction* (Beta = .300, $p < .01$); the *positive feelings* also showed a positive and significant relationship (Beta = .241, $p < .01$); and finally, the constructivist approach of *facilitation of understanding* showed a significant negative relationship (Beta = -.253, $p < .01$).

The category of uses of technology for *instruction* also showed to be significantly high ($F = 6.269$, $p < .001$), with a significant degree of explained variable ($R^2 = .563$). The results showed five variables that had some sort of impact in the use of technology for instruction. The first one was the competency of *instruction* with a positive and significant relationship (Beta = .200, p <

.10), also the constructivist approach of *development of understanding* (Beta = .238, $p < .10$), and the *positive feelings* (Beta = .304, $p < .01$). In the other side, two variables showed a negative and significant relationship and were the constructivist approach of *facilitation of understanding* (Beta = -.258, $p < .05$), and the negative feelings of *anger* (Beta = -.209, $p < .10$),

The category of uses of technology as a design tool showed a significant relationship (F = 5.202, $p < .001$), with a significant degree of explained variable (R^2 = .521). In this category, only two variables were positively significant being the *competency with instruction* (Beta = .284, $p < .05$); and the *positive feelings* (Beta = .213, $p < .10$).

The following category that referred to teacher uses as a *collaborative tool* also had a significantly high result of (F = 6.979, $p < .001$), with a significant degree of explained variable (R^2 = .590). In the use of technology as a *collaboration tool*, five variables showed to be influencing, in which four of them had a positive impact and one had a negative influence. The positive and significant relationship variables were *competency with instruction* (Beta = .261, $p < .05$); the traditional approach of the *teacher management* (Beta = .655, $p < .05$); the science conception of *science as a process* (Beta = .655, $p < .05$); and the negative feelings of *anger* (Beta = .202, $p < .10$); In the other hand, the constructivist approach of *facilitation of understanding* had a negative significant relationship (Beta = -.202, $p < .10$).

The last analysis was for teacher use of technology as an assessment tool. This one showed a significant relationship (F = 5.988, $p < .001$), with a significant degree of explained variable (R^2 = .552). This fourth variable resulted in three factors influencing positive and negatively. Two of the positive and significant relationship were with the teacher competency of *instruction* (Beta = .262, $p < .05$); and the *positive feelings* (Beta = .208, $p < .10$); while the negative and significant relationship was with the constructivist approach of *facilitation of understanding* (Beta = -.214, $p < .10$).

7.3.2 Multiple regression analysis for students' uses of technology

This second section will be an analysis of all the student uses of technology including the history and science disciplines. It will show an overall of the results with a combination of all the students' outcomes on table 119.

Table 119
Multiple regression analysis of the factors that influence students' use of technology

	All			Curriculum			Information			Collaboration		
	B (S.E.)	Beta	t	B (S.E.)	Beta	t	B (S.E.)	Beta	t	B (S.E.)	Beta	t
Constant	0.37 (.975)		0.38	.230(.870)		.264	1.200 (.875)		1.371	.230(.870)		.264
Competency with tools	-.270 (.120)	-.193	-2.249[b]	.105 (.107)	.079	.976	-.019 (.108)	-.015	-.175	.105 (.107)	.079	.976
Competency with instruction	.371 (.079)	.430	4.696[d]	.331 (.070)	.405	4.693[d]	.245 (.071)	.313	3.454[d]	.331 (.070)	.405	4.693[d]
Facilitation of understanding	.121 (.155)	.062	.778	-.026 (.139)	-.014	-.186	-.013(.140)	-.007	-.091	-.026 (.139)	-.014	-.186
Development of understanding	.285 (.134)	.183	2.133[b]	.172 (.119)	.117	1.441	.164 (.120)	.116	1.363	.172 (.119)	.117	1.441
Traditional approach	.332(1.069)	.168	.311	-.823(.954)	-.441	-.862	-.095 (.961)	-.6053	-.099	-.823(.954)	-.441	-.862
Teacher-centered	.327 (.379)	.198	.862	.461 (.334)	.305	1.380	.095 (.336)	.065	.282	.461 (.334)	.305	1.380
teacher management	-.508 (.395)	-.269	-1.285	.109 (.349)	.061	.313	-.121 (.351)	-.070	-.344	.109 (.349)	.061	.313
Teacher as a provider of knowledge	-.341 (.407)	-.212	-.837	.045 (.362)	.029	.124	-.209 (.364)	-.142	-.575	.045 (.362)	.029	.124
Positive feelings	.181 (.119)	.127	1.522	.261 (.106)	.193	2.462[b]	.189 (.107)	.146	1.772[a]	.261 (.106)	.193	2.462[b]
Fear	.138 (.096)	.127	1.439	.176 (.086)	.171	2.059[a]	.237(.086)	.241	2.758[c]	.176 (.086)	.171	2.059[a]
Anger	.105 (.115)	.912	.363	.059 (.102)	.049	.565	-.086 (.103)	-.075	-.832	.059 (.102)	.049	.565
Summary of the model												
R^2 (Adjusted R square)	.258 (.845)			.214 (.966)			.277 (.759)			.342 (.601)		
F for the dependent variable	5.193[d]			4.076[d]			5.750[d]			6.979[d]		

[a] p< .10; [b] p< .05; [c] p< .01; [d] p< .001.

The first report is based on all the categories together and it showed a significant result (F = 5.193, p < .001) as well as it has an acceptable degree of explained variable (R^2 = .258). In this overall analysis, three variables showed a significant relationship, even though two had a positive result and one was negative. The positive variables were the *competency of instruction* (Beta = .430, p < .001); and the constructivist approach of *development of understanding* (Beta = .208, p < .10); otherwise, the competency of *competency with tools* had a significant negative relationship (Beta = -.193, p < .05).

The student use of technology as a curriculum tool resulted in a significant result (F = 4.076, p < .001) as well as it had an acceptable degree of explained variable (R^2 = .214). Only four variables showed positive and negative relationship. The first one was *competency with instruction* (Beta = .342, p < .001); the constructivist approach of *development of understanding* (Beta = .196, p < .05); and the *positive feelings* (Beta = -.186, p < .05). In the other hand, the competency of *competency with tools* had a significantly negative relationship of (Beta = -.174, p < .05).

The second variable of students use of technology as an information tool presented an acceptable global adjust (F = 5.750, p < .001) as well as it had a weak degree of explained variable (R^2 = .277). In this second use only three variables were significant and all of them had a positive impact being *competency with instruction* (Beta = .313, p < .001); the *positive feelings* (Beta = -.146, p < .10), and the negative feeling of *fear* (Beta = -.241, p < .01).

To conclude, the third use of technology was for *collaboration* and it presented an acceptable significance of (F = 7.812, p < .001) as well as it had a weak degree of explained variable (R^2 = .342).

7.3.2.1 Multiple regression analysis for history students' uses of technology

This next section will focus on the history students' use of technology and it will also include history conceptions of the nature of the subject they teach. The results are presented below on table 120.

Table 120
Multiple regression analysis of the factors that influence students' use of technology

	All			Curriculum			Information			Collaboration		
	B (S.E.)	Beta	t	B (S.E.)	Beta	t	B (S.E.)	Beta	t	B (S.E.)	Beta	t
Constant	1.808 1.182)		1.530	2.288(1.463)		1.564	1.611(1.132)		1.423	1.153(1.273)		.905
Competency with tools	.127 (.170)	.103	.744	-.039 (.210)	.-.026	-.185	.625 (.169)	.622	3.707^d	.103 (.164)	.084	.630
Competency with instruction	.340(.099)	.471	3.440^d	.326 (.124)	.387	2.636^c	-.145 (.195)	-.121	-.741	.376 (.106)	.488	3.551^d
Facilitation of understanding	-.050 (.180)	-.032	-.276	-.244 (.226)	-.133	-1.083	-.025 (.172)	-.016	-.146	.204 (.196)	.119	1.038
Development of understanding	-.122 (.179)	-.084	-.683	.008 (.220)	.004	.034	-.058 (.170)	-.039	-.340	-.191 (.198)	-.118	-.956
Traditional approach	-.615(1.394)	-.426	-.441	-1.341 (1.718)	-.722	-.781	.251 (1.288)	.165	.195	-.855(1.373)	-.531	-.623
Teacher-centered	.312(.525)	.266	.594	.484 (.643)	.343	.752	.075 (.483)	.060	.155	.439 (.537)	.342	.818
Teacher management	-.014 (.456)	-.010	-.031	.083(.557)	.050	.150	-.278 (.425)	-.190	-.654	.144 (.468)	.094	.308

Teacher as a provider of knowledge	-.180 (.510)	-.146	-.353	.141 (.638)	.096	.221	-.448 (.482)	-.348	-.929	-.128 (.483)	-.094	-.265
Positive feelings	.085 (.157)	.071	.539	.118 (.197)	.082	.598	.044 (.155)	.035	.282	.154 (.175)	.116	.880
Fear	.084 (.116)	.095	.728	-.005 (.147)	-.004	-.032	.180 (.113)	.201	1.602	.098 (.127)	.103	.771
Anger	.135 (.155)	.134	.869	.260 (.194)	.215	1.342	-.048(.149)	-.047	-.323	.163 (.167)	.150	.975
History as a construction of meaning.	.195 (.192)	.132	1.012	.180 (.225)	.106	.800	.281 (.175)	.190	1.602	.154 (.202)	.094	.762
History as a differentiated understanding.	-.044 (.116)	-.044	-.380	-.024 (.134)	-.021	-.183	-.046 (.106)	-.045	-.434	-.075 (.126)	-.068	-.598
History as a definition of the facts.	.107 (.145)	.092	.735	.208 (.175)	.152	1.190	-.046 (.130)	-.040	-.356	.068 (.152)	.056	.448
Summary of the model												
R^2 (Adjusted R square)		.410 (.654)			.324 (.828)			.432 (.650)			.356 (.736)	
F for the dependent variable		3.078[d]			2.228[d]			3.742[d]			2.685[d]	

[a] p< .10; [b] p< .05; [c] p< .01; [d] p< .001.

The first analysis will include all the uses and it showed a significant result (F = 3.078, p< .001) as well as it has an acceptable degree of explained variable (R^2 = .410). As an overall, the only variable that showed some sort of significance was the competency of *instruction* (Beta = .471, p < .001).

Going more in depth, the next description will be on history students use of technology as a *curriculum tool*, which had a significant result (F = 2.228, p < .001) as well as it has an acceptable degree of explained variable (R^2 = .324). There was only one variable that showed a positive significance and it was the teacher *competency with instruction* (Beta = .387, p < .010).

The second category of history students' uses of technology as an *information tool* also showed a significant result (F = 3.742, p < .001) as well as it has an acceptable degree of explained variable (R^2 = .432). Again, only one variable showed some relationship and it was the overall of all competencies (Beta = .622, p < .001).

Finally, the next category was on students' use of technology as a *collaboration tool* which also showed an acceptable significance of (F = 2.685, p < .01) as well as it has an acceptable degree of explained variable (R^2 = .356). Also in this category only one variable showed some significance and it was the teacher *competency with instruction* (Beta = .488, p < .001).

7.3.2.2 Multiple regression analysis for science students' uses of technology

This last part will gather information regarding science students' use of technology in the classroom. The results will be presented below on table 121.

Table 121
Multiple regression analysis of the factors that influence students' use of technology

	All			Curriculum			Information			Collaboration		
	B (S.E.)	Beta	t	B (S.E.)	Beta	t	B (S.E.)	Beta	t	B (S.E.)	Beta	t
Constant	1.058 (.962)		1.099	1.233(1.527)		.808	2.790(1.250)		2.232	1.528(1.047		1.459
Competency with tools	-.164 (.109)	-.156	-1.495	-.219 (.174)	-.173	-1.256	-.188 (.155)	-.143	-1.211	-.038 (.131)	-.032	-.292
Competency with instruction	.267 (.068)	.438	3.943[d]	.248 (.110)	.326	2.250[b]	.205 (.095)	.272	2.164[b]	.270 (.082)	.383	3.309[c]
Facilitation of understanding	-.334 (.173)	-.222	-1.934[a]	-.224 (.287)	-.117	-.782	-.386 (.242)	-.212	-1.593	-.518 (.211)	-.296	-2.456[b]
Development of understanding	.215(.129)	.224	1.671[a]	.105 (.211)	.086	.495	.231 (.180)	.195	1.285	.269 (.157)	.237	1.714[a]
Traditional approach	-.786 (1.093)	-.528	-.719	-1.581(1.811)	-.846	-.873	-.685(1.551)	-.371	-.443	1.167(1.343)	.675	-.869
Teacher-centered	.241 (.313)	.194	.772	.719 (.519)	.460	1.386	-.144 (.445)	-.093	-.324	-.122 (.386)	-.084	-.316
Teacher management	.224 (.437)	.148	.513	.383(.725)	.200	.528	.158 (.606)	.087	.260	-.586 (.526)	-.345	-1.114
Teacher as a provider of knowledge	.092 (.446)	.079	.207	.371 (.737)	.250	.503	.182 (.634)	.123	.287	-787 (.548)	-.568	-1.437
Science as discovery	.071 (.089)	.088	.799	.060 (.147)	.059	.412	.092 (.128)	.091	.716	.035 (.110)	.037	.315
Science as knowledge	.111 (.115)	.128	.965	.338 (.187)	.310	1.812[a]	-.039 (.161)	-.036	-.243	.033 (.137)	.032	.239
Science as a process	-.055 (.166)	-.039	-.332	-.533 (.260)	-.300	-2.047[b]	198 (.229)	.114	.866	.126 (.188)	.077	.668
Positive feelings	.389 (.106)	.106	.364[d]	.437 (.165)	.354	2.648[c]	.287 (.137)	.227	2.095	.363 (.118)	.324	3.091[c]
Fear	.174 (.087)	.219	1.998	.109 (.143)	.112	.764	.230 (.123)	.235	1.867	.170 (.107)	.191	1.597
Anger	-.059 (.098)	-.060	-.606	.017 (.157)	.015	.108	-.288 (.132)	-.237	-2.185	-.046 (.112)	-.043	-.409
Summary of the model												
R^2 (Adjusted R square)	.645 (.447)			.377 (.742)			.505 (.647)			.577 (.562)		
F for the dependent variable	7.913[d]			2.723[d]			4.803[d]			6.520[d]		

[a] p< .10; [b] p< .05; [c] p< .01; [d] p< .001.

This last analysis will infer science students' use of technology and it also showed a significant global adjustment ($F = 7.913$, $p < .001$) as well as it had a high degree of explained variable ($R^2 = .645$). Four of the variables analyzed had a positive and significant impact being *competency with instruction* (Beta = .438, $p < .001$); the constructivist approach of *development of understanding* (Beta = .224, $p < .10$); the *positive feelings* (Beta = .364, $p < .001$); and the negative feeling of *fear* (Beta = .219, $p < .05$). In the other hand, the constructivist approach of *facilitation of understanding* showed a negative and significant relationship (Beta = -.222, $p < .10$).

The science students' use of technology as a *curriculum tool* showed a significant adjustment ($F = 2.723$, $p < .001$) as well as it had a significant degree of explained variable ($R^2 = .377$). The curriculum tool had four variables that influenced and showed some significant positive and negative relationships. The positive significant relationship was with teacher *competency with instruction* (Beta = .326, $p < .05$); the science conception of *science as knowledge* (Beta = .310, $p < .10$); and also the *positive feelings* (Beta = -.354, $p < .10$). In the other hand, the science conception of *science as a process* showed a negative and significant relationship (Beta = -.300, $p < .05$).

The following category falls under students' use of technology as an information tool which showed a significant result ($F = 4.803$, $p < .001$) as well as it had a significant degree of explained variable ($R^2 = .505$). The variables that influenced significantly positive were the teacher competency of *instruction* (Beta = .272, $p < .05$); and the *positive feelings* (Beta = -.227, $p < .05$). The negative feeling of *anger*, in the other hand, had a significantly negative influence (Beta = -.237, $p < .05$).

Finally, the last category was students' use of technology as a collaboration tool which had a significant global adjustment ($F = 6.520$, $p < .001$) as well as it had an acceptable degree of explained variable ($R^2 = .577$). In addition, there were four variable that influence significantly. The positive and significant variables were the teacher *competency with instruction* (Beta = .383, $p < .01$); the constructivist approach of *development of understanding* (Beta = .237, $p < .10$); and the *positive feelings* (Beta = .354, $p < .10$). In the other hand, the constructivist approach of *facilitation of understanding* had a significant negative relationship (Beta = -.296, $p < .05$).

7.4 Cluster analysis

This section is intended to achieve a degree of understanding on the identity of teachers, as well as the relationship of the different variables that have been considered in this research. In addition, there will be a comparison between science and history educators, to demonstrate the degree of similitude between the two groups of professionals. In order to achieve this purpose, a WARD method analysis has been performed among history and science disciplines. Both groups included the subsequent variables: (a) teacher competencies; (b) constructivist approach; (c) traditional approach; (d) conception of construction of meaning; (e) conception of differentiated understanding; (f) conception of definition of facts; (g) positive feelings; (h) negative feelings; (i) teacher uses of technology; and (j) student uses of technology. Below will be an explanation of the results obtained in this analysis, separated by disciplines.

7.4.1 History teachers

This following section is intended to analyze the history teachers and their outcomes in the cluster analysis. For the examination of this subject, 73 out of 108 teachers were selected by the computer method to be part of the sample (67,6%), while 35 were categorized as missing due to the lack of some information in the questionnaire (32,4%). The results and its description will be presented below on table 122.

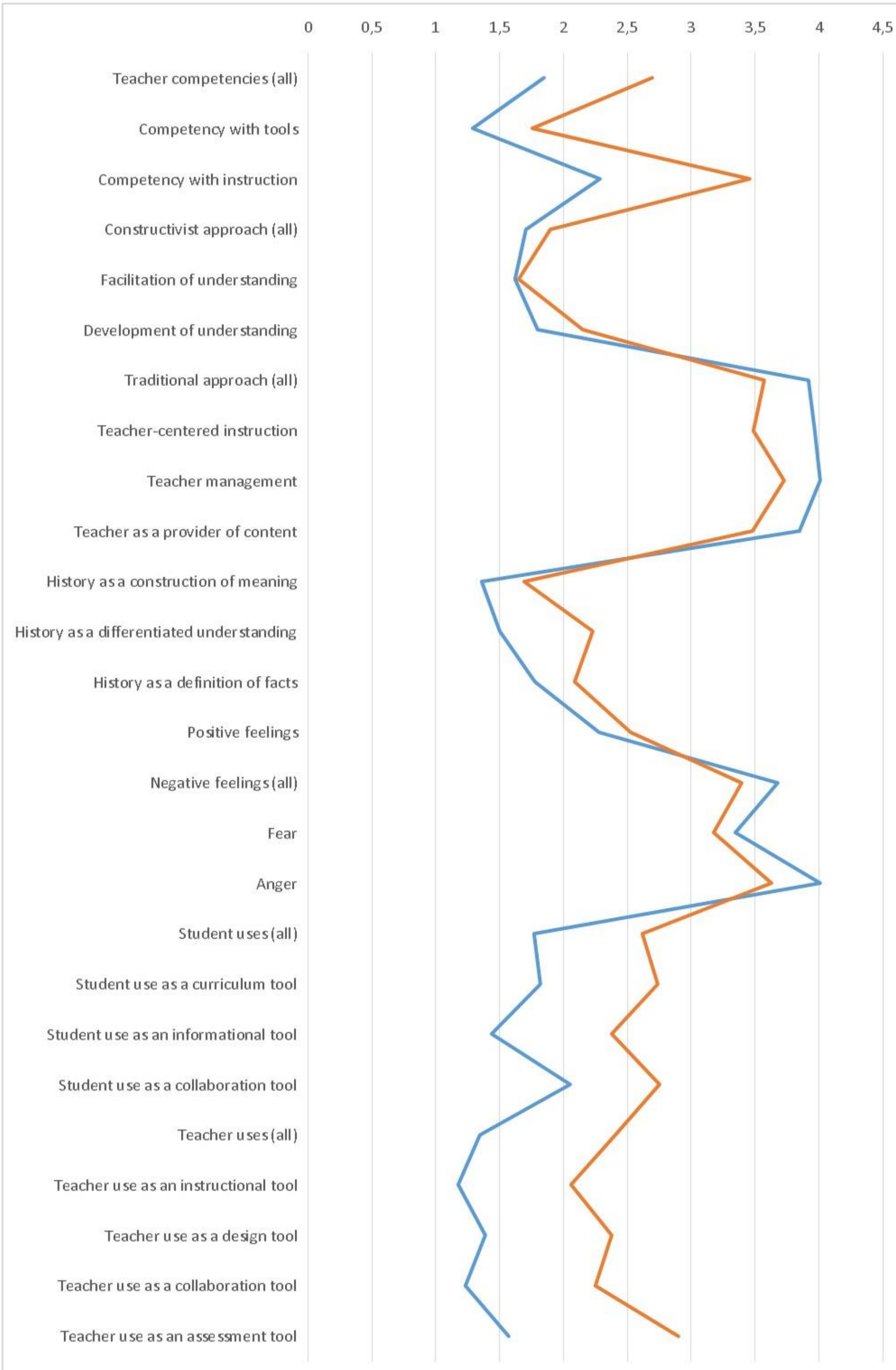
Table 122
Clusters solution derived from history teachers.

	History teachers (N=73, 100%)			
	Cluster 1	Cluster 2		
	M (SD)	M (SD)	t	p
Cluster size	N = 34 (46.6%)	N = 39 (53.4%)		
Teacher competencies (all)	1.85 (0.48)	2.70 (0.73)	-5.816	.000
Competency with tools	1.29 (0.39)	1.76 (0.72)	-3.388	.001
Competency with instruction	2.29 (0.78)	3.46 (0.92)	-5.774	.000
Constructivist approach (all)	1.71 (0.38)	1.90 (0.40)	-2.109	.038
Facilitation of understanding	1.62 (0.54)	1.65 (0.49)	-0.300	.763
Development of understanding	1.80 (0.49)	2.15 (0.49)	-3.064	.003
Traditional approach (all)	3.92 (0.41)	3.57 (0.58)	2.889	.004
Teacher-centered instruction	3.97 (0.50)	3.49 (0.71)	3.311	.001
Teacher management	4.01 (0.41)	3.73 (0.64)	2.185	.028
Teacher as a provider of content	3.85 (0.58)	3.48 (0.62)	2.582	.011
Construction of meaning	1.36 (0.42)	1.69 (0.57)	-2.777	.006
Differentiated understanding	1.50 (0.51)	2.23 (0.79)	-4.609	.000
Definition of facts	1.78 (0.52)	2.09 (0.74)	-1.985	.046
Positive feelings	2.28 (0.52)	2.53 (0.61)	-1.886	.061
Negative feelings (all)	3.68 (0.63)	3.40 (0.74)	1.703	.089
Fear	3.35 (0.85)	3.18 (0.87)	0.822	.414
Anger	4.01 (0.62)	3.63 (0.79)	2.294	.022
Student uses (all)	1.77 (0.51)	2.62 (0.75)	-5.581	.000
Student use as a curriculum tool	1.82 (0.76)	2.74 (0.87)	-4.751	.000
Student use as an informational tool	1.44 (0.47)	2.38 (0.78)	-6.119	.000
Student use as a collaboration tool	2.05 (0.60)	2.75 (0.89)	-3.841	.000

Teacher uses (all)	1.35 (0.32)	2.41 (0.68)	-8.262	.000
Teacher use as an instructional tool	1.18 (0.28)	2.06 (0.64)	-7.455	.000
Teacher use as a design tool	1.39 (0.46)	2.38 (0.75)	-6.649	.000
Teacher use as a collaboration tool	1.23 (0.36)	2.25 (0.85)	-6.526	.000
Teacher use as an assessment tool	1.57(0.68)	2.90 (1.03)	-6.463	.000

The data presented above will be represented below on figure 10.

Figure 10. Cluster analysis derived from history teachers



Traditional teachers
Constructivist teachers

From the WARD analysis of history teachers derived two clusters. Cluster one was comprised by 34 (46, 6%) teachers, while cluster two was comprised by 39 (53,4%). Independent sample t-test found significant differences between both clusters of teachers; however, it recognized that positive feelings and the feeling of fear did not influence in teacher identity, as well as the constructivist conception of development of understanding. In the other hand, the negative feeling of anger was part of a significant outcome on differentiating teachers' identity, being the only feeling that contributed to this issue. Both clusters comprised a mixture of male and female teachers. In addition, cluster one comprised the majority of teachers that hold a constructivist approach while cluster two was mainly comprised by traditional approach teachers.

As a summary of the information described above, all the variables included in this study were significant in building teachers identity, except for the positive feelings and the negative feeling of fear, as well as the constructivist conception of development of understanding. In addition, there was a difference in teachers' identity regarding the conceptual approach that teachers held, being distinguished by constructivist teachers and traditional teachers, which would be the two clusters that appear on the WARD analysis.

7.4.2 Science teachers

This second section is intended to analyze science teachers and their outcomes in the cluster analysis. For the examination of this subject, 75 out of 108 teachers were selected by the computer method to be part of the sample (69, 4%), while 35 were categorized as missing due to the lack of some information in the questionnaire (30.64%). The results and its description will be presented below on table 123.

Table 123
Clusters solution derived from science teachers

	Science teachers (N=75, 100%)			
	Cluster 1 M (SD)	Cluster 2 M (SD)	t	p
Cluster size	N = 37 (49.3 %)	N = 38 (50.7%)		
1.Teacher competencies (all)	1.97 (0.57)	2.82 (0.80)	-5.387	.000

2. Competency with tools	1.41 (0.40)	1.83 (0.77)	-2.971	.004
3. Competency with instruction	2.42 (0.84)	3.64 (1.02)	-5.635	.000
4. Constructivist approach (all)	1.66 (0.35)	2.20 (0.53)	-5.226	.000
5. Facilitation of understanding	1.63 (0.42)	1.85 (0.47)	-2.157	.034
6. Development of understanding	1.68 (0.38)	2.55 (0.70)	-6.635	.000
7. Traditional approach (all)	3.90 (0.43)	3.47 (0.39)	4.555	.000
8. Teacher-centered instruction	3.93 (0.44)	3.44 (0.53)	4.323	.000
9. Teacher management	3.90 (0.45)	3.68 (0.42)	2.193	.031
10. Teacher as a provider of content	3.89 (0.59)	3.32 (0.41)	4.861	.000
11. Process	1.70 (0.55)	2.81 (0.67)	-7.861	.000
12. Discovery	1.68 (0.60)	2.67 (0.60)	-7.125	.000
13. Knowledge	1.45 (0.44)	1.94 (0.38)	-5.202	.000
14. Positive feelings	2.38 (0.64)	2.58 (0.63)	-1.406	.164
15. Negative feelings (all)	3.52 (0.52)	3.32 (0.78)	1.312	.192
16. Fear	3.07 (0.82)	3.13 (0.90)	-.288	.774
17. Anger	3.97 (0.50)	3.51 (0.78)	3.032	.003
18. Student uses (all)	1.80 (0.44)	2.67 (0.59)	-7.237	.000
19. Student use as a curriculum tool	2.17 (0.74)	2.82 (0.80)	-3.681	.000
20. Student use as an informational tool	1.40 (0.49)	2.44 (0.83)	-6.579	.000
21. Student use as a collaboration tool	1.91 (0.60)	2.79 (0.61)	-6.344	.000
22. Teacher uses (all)	1.50 (0.49)	2.35 (0.54)	-7.093	.000
23. Teacher use as an instructional tool	1.32 (0.46)	1.93 (0.62)	-4.761	.000
24. Teacher use as a design tool	1.57 (0.59)	2.38 (0.75)	-5.196	.000
25. Teacher use as a collaboration tool	1.36 (0.65)	2.35 (0.79)	-5.904	.000
25. Teacher use as an assessment tool	1.72 (0.80)	2.73 (0.82)	-5.411	.000

From the WARD analysis of science teachers also derived two clusters. Cluster one was comprised by 37 (49, 3%) teachers, while cluster two was comprised by 38 (50, 7%). Independent sample t-test found significant differences between both clusters of teachers; however, it recognized that positive feelings and the feeling of fear did not influence in teacher identity. In the other hand, the negative feeling of anger was part of a significant outcome on differentiating teachers' identity, being the only feeling that contributed to this issue. Both clusters comprised a mixture of male and female teachers. In addition, cluster one comprised the majority of teachers that hold a constructivist approach while cluster two was mainly comprised by traditional approach teachers. A representation of this table is presented below on figure 11.

Figure 11. Cluster analysis derived from science teachers.

Traditional teachers
Constructivist teachers

As a summary of the information described above, all the variables included in this study were significant in building teachers identity, except for the positive feelings and the negative feeling of fear. In addition, there was a difference in teachers' identity regarding the conceptual approach that teachers held, being distinguished between constructivist teachers and traditional teachers.

7.4.3 Comparison of both groups of teachers

After analyzing each group individually, it can be observed that science and history teachers have a similar profile; as a matter of facts, both groups resulted in the appearance of two clusters divided into educators that hold a traditional or a constructivist identity. These result was an indicator that the history and science teachers that participated in this particular study resulted on a supra identity in which both sectors had an equal type of profile divided in two types of educators. In addition, the variable of positive feelings, as well as the negative feeling of fear, did not influence in the identity of neither group.

VIII. Conclusions

The main purpose of this investigation was to deepen into the study of science and history teachers that perform their tasks at a secondary level, and to study the use of technology in the classroom by those groups of teachers. Considering all the literature that has been presented above, as well as the results from the empirical analyses, this section will present the conclusions to this investigation.

First of all, this study presented three main objectives: (1) to identify and describe the main characteristics about science and history teachers from Utah that participated in this study, (2) to establish the relationship between competency with the use of technology, conceptions of teaching and learning, conceptions of the subject they teach, feelings and emotions with the use of technology, and uses of technology in the classroom. And finally, (3) to identify the profile of science and history teachers according to all the variables that appeared in the investigation. According to these three objectives, the next paragraphs will present the conclusions regarding each of the aims that were specific to this investigation.

Objective 1: *to identify and describe science and history teachers' conceptions of teaching and learning, teachers' conceptions of the subject they teach, teachers' emotions and feelings, and teachers and students' use of technology in the classroom, among teachers that participated in this study.*

To identify and describe teacher conceptions of teaching and learning.

Since in this section we have used the questionnaire created by Chan and Elliot (2004), two main dimensions of the conceptions of teaching and learning were identified: the constructivist approach, and the traditional approach. However, in this study, and based on the teachers that participated, the dimension of the constructivist approach resulted in two sub-categories, while the traditional approach resulted in three other categories. These classifications will be discussed below.

In relation with the constructivist dimension, this investigation contributes with the appearance of two conceptions that could be considered a sub-group: the *facilitation of understanding* and the *development of understanding.* However, these two categories were identified before in the study conducted by Boulton-Lewis et al. (2001), in which they proposed the facilitation of understanding and transformation as a conception of teaching; and the development of understanding and transformation as a conception of learning. In addition, the categories that were found were named with these designations because of the close similarity with the proposal offered by them.

In the other hand, and relative to the traditional dimension, this study contributes with the introduction of three categories that were: *teacher-centered, teacher management,* and *teacher as a provider of knowledge*. The first category of *teacher-centered* has also appeared on other literature such as Kember (2000), in which he proposed a category called *teacher and content centered* that saved close similarities with the one proposed in this study. In addition, it also resembles the category of *transmission of contents* and skills by Boulton-Lewis et al. (2001), which has similar characteristics too. Then, the category of *centered on the teacher* by Domenech et al. (2006), also defined the concept in a similar manner, and the category of *teacher-centered* by Alger (2009) that also saved closed features with this type of conception.

The second category of *teacher management* is similar to the belief category of *traditional management (TM)* by Wolley et al. (2006). Both categories are equal in the sense that the teacher institutes control over students, and directs instruction, even though this study found it as a conception, and the author referred to it as a belief. Finally, the category of *teacher as a provider of content* also appeared on the classification by Boulton-Lewis et al. (2001) which they denominated *acquisition and reproduction of content and skills*. These two categories also save close similarities because both considered content as indispensable for students to learn.

In summary, we used the classification stated by Chan and Elliot (2004), which separated conceptions of teaching and learning into a constructivist and a traditional approach. However, the conceptions that were found contributed to a more complex perspective to classify conceptions of teaching and learning than the categorization offered by these authors, as well as they saved similarities to the classification of conceptions by other authors (Boulton-Lewist et al., 2001; Domenech et al., 2006; Wooley, 2006).

To identify and describe teachers' conceptions of the nature of history.

The categorization of the conceptions of the nature of history was founded in the classification generated through the studies of Wineburg (1991) and Yilmaz (2008) that included four types of conceptions: *history as a construction of meaning, history as a story of human kind, history as an interpretation of the past,* and *history as a study of change and struggle over time*. However, this research resulted in the appearance of three categories of conceptions of the nature of history: *history as a construction of meaning, history as a differentiated understanding,* and *history as a definition of facts.*

From the previous categorization that was proposed, only the first category that referred to *history as a construction of meaning* corresponded with the categorization that was already proposed and adapted from the study by Wineburg (1991). In addition, it also retained the same designation due to its close similarities between both connotations, and they both presented parallel characteristics. However, for the second category called *history as a differentiated understanding*, it was impossible to find a characterization that would be comparable to this concept. Finally, *history as a definition of facts* was also defined by Yilmaz (2008) in three different conceptions that she named *enactment of the past on one's mind, story of humankind, and nation's memory.* Though, it has been infeasible to find a single category that would correlate with the same or similar meaning that the one presented in this study.

As observed in the paragraph above, there is one new category that has appeared as a result of this investigation and its participants. This category was *history as a differentiated understanding* and it is believed that it is an original new contribution to the understanding of conceptions of the nature of history by secondary teachers. In addition, it is represented by the personal view of each individual to history, and its signification involves the personal experience of the educator to build the conceptions of the subject they will teach. To sum up, the reference categories used to identify conceptions of the nature of history were mainly obtained from theoretical perspectives (Wineburg, 1991; Yilmaz, 208). However, this study contributed to empirically demonstrate the appearance of some conceptions of the nature of history.

To identify and describe teachers' conceptions of the nature of science.

The conceptions of the nature of science were built according to the categorization adapted from the proposal by Abell and Smith (1994). Even though they suggested five categories, this study only included four in the final classification: *science as discovery, science as knowledge, science as a process,* and *science as explanation*. However, after implementing the questionnaire and analyzing the results, only three categories resulted for the conceptions of the nature of science: *science as a process*, *science as discovery*, and *science as knowledge.*

In addition, these three categories confirmed its similarities with the categorization proposed and adapted from the study by Abell and Smith (1994). The first category of *science as a process* maintains the same meaning and characteristics of the original type, and the name was conserved due to its similarities. Then, *science as discovery* also resulted in the same significance that it offered, and it also preserved the same connotation. Finally, the last conception of *science as knowledge* also involved a similar meaning and resulted in the same denomination.

Furthermore, some of these categories are also related to other types of classifications. As an example, *science as a process* conserves some of the characteristics of *science is empirical* by Abd-El-Khalick and Akerson (2009), or the *scientific method* by Buaraphan (2010) in which science is a process that involves observation, experiments, and so forth. In addition, *scientific knowledge* also kept some similarities with the *scientific knowledge* by Buaraphan (2010), in which science is knowledge about how things happen. And *science as a discovery* could be related to the *human creativity* by Abd-El-Khalick and Akerson (2009), in which science searches for why's and how's are things explained.

In summary, the categories used to identify conceptions of the nature of science were obtained from pre-service teachers (Abell and Smith, 1994). However, our study contributed to confirm that those conceptions that educators hold before implementing the subject in the classroom, also becomes a reality when teachers implement science at a secondary level.

To identify and describe teachers feelings and emotions with the use of technology in the classroom.

On the classification of teachers' feelings and emotions with the use of technology, this study based its categorization in those authors that separated feelings and emotions into positive and negative categories (Agyei & Voogt, 2011; Leng, 2011). In addition, the classification went further and it also included four other sub-categories with five different feelings and emotions each (Agyei & Voogt, 2011; Galanouli et al., 2004; Hogarty et al., 2003; van Braak et al. 2004). However, with the lack of investigations with a unified proposal of feelings and emotions with the use of technology, this research used a combination of different classifications to build its final taxonomy. As a result of the analysis, only two classifications resulted from the exploration of *positive* and *negative* feelings and emotions with the use of technology.

In regard of the positive feelings and emotions, and contrary to the classification that other authors proposed (Hogarty et al., 2003; Robertson et al., 1995), only a one dimensional factor arose called *positive feelings and emotions*. This factor included all ten feelings and emotions that were suggested: *energetic, fulfilled, enthusiastic, glad, optimistic, pleased, completed, happy, confident,* and *motivated,* skipping the sub-categories *of enjoyment and excitement.* Even though literature classified this issue in different manners, the main classification is not distant to the authors that already proposed this category (Agyei & Voogt, 2011; Chen & Chang, 2006; Peinado et al., 2011). The only distinction would be the feelings and emotions that each author would include into the group.

On the other hand, the *negative feelings and emotions* were classified into *fear* and *anger*, and the final proposal also resulted in these two types. This result ratifies the classification that was first proposed (Agyei & Voogt, 2011; Galanouli et al., 2004; Hogarty et al., 2003; van Braak et al., 2004), and the categories conserved the name that was attributed. The feeling and emotion of *fear* included four items that were proposed such as *nervousness, anxiety, tension, including frustration* that was first considered part of anger. The second factor called *anger* also entailed four items: *madness, furiousness, irritability,* and *upset* that corresponded with the items included into this group.

Most of the literature classified positive and negative feelings and emotions into one big category such as anxiety or comfortable (Agyei & Voogt, 2011; Clark, 2000), or even multiple types of feelings and emotions into each group (Galanouli et al., 2004; Hogarty et al., 2003; Van Braak, 2001). In addition, most of the feelings and emotions were considered into the affective domain of attitudes. Even though this study confirmed the separation into positive and negative feelings and emotions already offered by other authors, it also contributed to a new categorization into sub-groups that was not found in literature before.

To identify and describe teachers and students use of technology in the classroom.

For this category, a descriptive exploration was conducted to obtain a broad analysis of the types of use of technology by science and history teachers from Utah that participated in the study. This proposal provided with a description of the types of use of technology by teachers and students, and it also described the frequency of use among the agents involved in the teaching process.

Based on the classification proposed by Brand-Gruwel et al. (2009), McCormick, (2004), and Tondeur et al. (2008), this classification has been valuable to assess the types of use of technology as well as the frequency of use among the participants. In addition, the results demonstrated that all the uses that were proposed were significant and implemented in the classroom by teachers and students, as well as it was demonstrated a high percentage of correspondence among both groups of teachers, which reveals that they use technology for similar purposes.

In the theoretical framework, there was a review of numerous studies that found empirical evidence of the teacher and the student use in their classifications (Badia et al., 2014), some other authors characterized it as a unilateral use (Tondeur et al. (2008), and some others from a professional perspective outside the classroom (Meneses, Fàbregues, Rodríguez-Gomez and Ion, 2012). However, this study contributed with a more complete classification of uses of technology that proposed three categories regarding the learner, and four others concerning the teacher. In addition, it also measured the frequency of use of technology in each category, to assess the impact of each type of use.

Objective 2: *to establish the degree in which teacher competency with technology, conceptions of teaching and learning, conceptions of the subject they teach, feelings and emotions with the use of technology, and uses of technology in the classroom are related, as well as to identify which variables predict the use of technology.*

Correlation analyses

The analysis of the variables involved in this study resulted in the appearance of significant correlations among all type of teachers. First of all, teacher competency and the constructivist approach hold a significant and positive relationship. However, teacher competency and the traditional approach are inversely related. Then, teacher competency and positive feelings and emotions maintain a positive relationship, while teacher competency and negative feelings and emotions have a negative correlation. Furthermore, the traditional approach and negative feelings and emotions hold a positive correlation, and finally, the constructivist approach and negative feeling have an inverse relationship (see figure 4 and 5).

After reviewing the literature, only some authors were found that related competency with conceptions. Hakkarainen, Muukonen, Lipponen, Ilomäki, Rahikainen and Lehtinen (2001), found that strong skills with technology saved some relationship with a more dynamic conception of knowledge. These authors investigated a more general perspective of conception, and the present study found the positive and negative relationship between competency and the constructivist and traditional approaches. On the other hand, only one study was found related to competencies, feelings and emotions. Similar to our results, Player-Koro (2012) found that an increase in competencies also led to more positive attitudes using technology in the classroom.

Finally, in regards of the relationship between conceptions, feelings and emotions, and similar to the present study, Judson (2006) found that teacher practices had no significant correlation with teacher philosophy, as well as teaching attitudes. Even though the term attitudes might involve different connotations, it might also involve the affective domain that was referred in this investigation. In addition, and contrary to this study, Badia et al. (2014) and Trigwell (2012) found a positive and significant correlation between the student-focused approach and emotions; while the teacher-focused approach and emotions were no significant and negatively correlated. The only correlation that was found in the present study between conceptions and feelings was related to the negative feeling of anger.

In addition, there were also some correlations among history teachers. Most of these relationships involved teacher competency. First of all, teacher competency and the constructivist approach hold little positive relationship with some of its variables, while traditional approach and competency saved a negative relationship. Then, teacher competency and positive feelings and emotions maintain a positive relationship, while teacher competency and negative feelings and emotions have a negative correlation (see figure 6 and 7).

There is little literature about history and science teachers, and its relationship between variables. Some authors that referred to history teachers' uses and conceptions of history were

Arancibia and Badia (2015), which conducted a qualitative study in which they found some correlations between use of technology and conceptions of the nature of history. However, we contributed empirically to demonstrate the relationships between constructivist and traditional history teachers, and competency using technology.

Finally, science teachers also held similar positive and negative relationships among its variables. First of all, teacher competency and the constructivist approach also maintain a positive correlations while traditional approaches and competency keep a negative relationship. Then, teacher competency and positive feelings and emotions maintain a positive relationship, while teacher competency and negative feelings and emotions have a negative correlation. The conceptions of the nature of science also have a positive relationship with conceptions and competency (see figure 8 and 9).

Contrary to history, it was impossible to find studies that correlated competencies, conceptions, and feelings and emotions related to this discipline. It is because of this reason that these are new contributions to literature that determined that science teachers' competency with technology is one of the main variables that correlates with feelings and emotions, conceptions of teaching and learning, and conceptions of the nature of science.

However, it was possible to find studies that correlated teachers' beliefs and uses of technology at a general level. As an example, Ertmer (2005) considered that a more efficient approach might help teachers to use technology to support their practices (Ertmer, 2001). Our findings demonstrated that a more constructivist approach had a positive relationship with uses, while traditional teachers had a negative correlation. In addition, Bain and McNaught (2006) found that conceptions, when not well identified, might result in resistance to the adoption of technology. Then, Judson (2006) found that a more constructivist approach to teaching was also related to a higher use of technology, which also matched with the results that were found in this investigation. Furthermore, Hermans et al. (2008) concluded that teacher beliefs about the practice of teaching were a significant determinant in explaining why teachers adopt computers in the classroom.

Even though most of the research that was summarized did not referred to history and science teachers, the results of this study contributed empirically to demonstrate the relationships between conceptions of teaching and learning, conceptions of the nature of the subject, feelings and emotions, and level of competency using technology, which resulted in a positive relationship when constructivist teachers, and negative correlation when traditional teachers in both areas. In addition, most of the contributions that were found in this study were new, or assisted to support or refute the previous findings.

Multiple regression analyses

Furthermore, the study presented here examined the influence of competency, feelings and emotions, and conceptions towards the professional use of technology by teachers and students. When taking into account all the participants, it was observed that competency was a variable that influenced both teachers and students to implement technology. Similar to these results, Suárez, Almerich, Gargallo and Aliaga (2010) also sustained that the level of technologic competency will influence the level of implementation of technology, but the level of pedagogical competency will be directly related to the use of technology in the classroom.

However, being a traditional or a constructivist teacher did not influence in its use. Contrary to these outcomes, Petko (2012) found that educators who believed that the use of computers could improve student's learning, and those that retained a more constructivist view would use computers more often in the classroom. Our results indicated that history and science teachers from Utah use technology in the classroom, as well as educators make their students use technology according to their level of competency and not to the theoretical approach. These results might be determined by the teachers' requirement to use technology for many educational purposes in the classroom.

In addition, positive feelings and emotions influenced both teachers and students' use, while negative feelings and emotions only influenced the students' use. Similar to these findings, Albirini, (2006), Baylor and Ritchie (2002), Bullock (2004), and Teo (2008) found that the successful implementation and use of technology depended largely on the attitudes of educators. These authors, though, referred to attitudes in general. On the other hand, the results in this study contributed to not only infer that feelings and emotions are a variable that influence in the use of technology, but also which type of relationship is established, and which agents are affected by these feelings and emotions.

In addition, history teachers' uses of technology are influenced by their level of competency, as well as some conceptions of the nature of history. However, history students' use of technology is only related to competency with technology. Although there is not a specific study about history teachers and students use of technology, and their relationship with competencies, several studies argued that the relationship among these two variables is close (Law & Chow, 2008; Tejedor & García-Valcárcel, 2006). Because of the lack of studies referring to the history discipline, this investigation has proposed to consider teacher competency as a significant variable among history teachers' use of technology in the classroom.

Furthermore, there were more variables that influenced the use of technology among science teachers than history teachers. Competency with technology was a predictor of use for both teachers and students, while the constructivist conception might increase or decrease its use according to the different type of conception. In addition, some conceptions of the nature of science also influenced the use by teachers and students, the positive feelings and emotions was also a significant variable to predict the use of technology among both agents, and finally, negative feelings and emotions were a predictor that it would decrease the use of technology among teachers and students. As it already happened with history teachers, it was also impossible to find research that focused on these relationships among science teachers. It is for this reason that these results have contributed in presenting those variables that influence the participant science teachers from Utah. Overall, those teachers that hold positive feelings and emotions, and competency with technology, are more willing to use it, while negative feelings and emotions, as well as some conceptions might be a factor impeding its implementation.

Objective 3: *to identify the profile of science and history teachers according to all the variables that appeared in the investigation*.

This study found the appearance of two well differentiated profiles for history and science teachers. First of all, history teachers were differentiated into two categories that were named constructivist and traditional. These two profiles differed in the fact that constructivist teachers held more competency, had more positive feelings and emotions, and they used more technology in the classroom, while traditional teachers hold less level of competency, they hold a higher level of negative feelings and emotions, and the use of technology was lower than constructivist teachers. After reviewing the literature, it was found that these results did not appeared before in any other investigation.

In addition, science teachers also resulted in the appearance of two well differentiated categories that were named constructivist and traditional due to their similarities with history teachers. These two profiles had specific characteristics in each group in which constructivist teachers held more competency, had more positive feelings and emotions, and they used more technology in the classroom. On the other hand, traditional teachers hold less level of competency, they hold a higher level of negative feelings and emotions, and the use of technology was lower than constructivist teachers. In addition, these results were not described before in any investigation regarding science teachers.

As it can be observed after analyzing each group individually, science and history teachers have a similar type of profile. As a matter of fact, both groups resulted in the appearance of two clusters divided into educators that hold a traditional or a constructivist identity. These result were an indicator that history and science teachers that participated in this particular study resulted in a supra identity, in which both sectors had an equal type of profile divided in two types of educators, with its own characteristics. In addition, the variable of positive feelings and emotions, as well as the negative feeling of fear, did not have influenced in the identity of either group.

We will refer to these types of profiles as teacher identity (Monereo, Badia, Bilbao, Cerrato & Weise, 2009; Badia, Monereo & Meneses, 2011). Some literature has already studied this topic at different levels. As an example, Pillen, Den Brok and Beijaard (2013) found the relationship between tension and identity. This identity was studied into three themes: change in roles, conflicts on support, and conflicting conceptions, which also resulted in feelings.

In addition, Iglesias and Badia (2014) studied the change on teachers' identity through the roles, the conceptions of pedagogical practice, the procedures and the teaching strategies with ICT, and the teachers' feelings. Some of the feature that repeated and characterized these classifications were the roles, the conceptions and feelings, however, there was not conceivable to find a specific classification about identity that referred to history and science teachers. It is because of this reason that this study proposed to classify science and history teachers' identity through the conceptions of teaching and learning, so teachers' identity would result into traditional and constructivist educators.

IX. Limitations and future lines of research

Once the conclusions have been presented, this section would like to gather all the limitations of this investigation regarding the theoretical framework, as well as the empirical aspects. In addition, there will be some considerations that arose from these, and that led to think about future lines of investigation.

With regards to the limitations, first of all it is significant to mention that there might be other studies that could be suitable in this research that has been not considered because of the length of the dissertation, or because it was not possible to find them. Besides, these research started in 2012 and most of the investigation are from previous year. However, the theoretical framework tried to gather as many studies as possible about the discipline and subjects of analysis concerning the identity and uses of technology, as well as it included contemporary articles about the topics.

In addition, to build the theoretical framework, a significant number of studies that referred to elementary or even university levels were also considered. Even though those studies did not specifically represented secondary history and science teachers, it was belief of special interest for the theoretical framework that they proposed, and because it could be adapted to any education level. Moreover, the outcomes that the authors encountered were significant and could benefit this investigation.

Another limitation that might appear is the construction of a special questionnaire with enquiries that have not been previously implemented in any other study, in earlier investigations. However, in order to consider those questions as valid, they were tested on a sample of ten to twenty educators before considering them suitable for use.

Moreover, the section of feelings and emotions was sometimes related and included into the vast term of attitudes. Even though attitudes were not specifically considered in this investigation, the affective domain included those aspects that were pursued about this variable. In addition, attitudes, feelings and emotions keep some similarities in their meanings and in some occasions, investigators present them together.

There is a section in the empirical framework that included a description of the uses of technology by teachers and students, but it did not incorporated a factorial analysis. It was considered that an explicative analysis of the frequency of technology use by teachers and students would demonstrate a more reliable result of its use. This section pretended to achieve the frequency of use instead of the factor resultant from teacher responses.

In addition, the WARD analysis was intended for the total number of teachers that participated in the sample, but because some of the participants did not complete all the questions on the instrument, the program just discarded those questionnaires. Even though the whole sample has not been considered for this analysis, the amount might predict some of the outcomes that would have appeared considering all the educators' responses.

Lastly, the study was conducted among a certain number of science and history teachers from Utah that voluntarily participated in this study. Even though the sample was significant and many teachers participated, it does not imply that the results might be equal for the rest of the teachers in the state, as well as for any other state in the United Stated. Because of that, the results and conclusions should be considered carefully and significantly to the present group of educators trying to not generalize.

Taken into account all the limitations that are proposed in this study, the following paragraph will propose some of the future lines of research that could be considered in the upcoming years, according to our understanding. In addition, those future lines of research will be presented according to the main topics of this investigation.

First of all, all the variables that have been studied in this study could be investigated from the perspective of teachers' identity, and it could also include other aspects such as the roles of the teacher in the classroom. This is considered of special interest because it has been already reflected in other investigations, and there are a significant number of studies that consider this topic as part of teachers' identity (Lasky, 2005; Zembylas, 2003; Lee and Yin, 2011), In addition, the study could be directed to a larger number of educators in the state of Utah, as well as to other states in the United States, to have a better perspective of their conceptions in the nation. If that were possible, an overall aspect of the identity of the teachers could be originated, or a comparison of different states could emerge.

In the subject of uses of technology, it is believed that the integration of other groups of teachers should also be considered to have an enhanced perspective of the uses from a larger number of teachers and disciplines. This study conducted the investigation between science and history educators because it was considered that both disciplines were significantly different; however, other disciplines should be studied to identify their uses and compare to other groups of teachers.

In addition, it is considered that the relationship between identity and uses of technology is related, and it would be of special interest to revise more in depth these aspects to complete the analysis of this topic. The results of this investigation could also offer a better view of the implementation of technology by different groups of teachers, and it would also help to understand teacher practices, and how to help them to implement it better for their purposes and the benefits of the students.

Last, the generalizability of these results may be hindered by the low overall response rate if compared to the whole state of Utah. In the future, additional efforts would be required to achieve a more desirable level of response. This may be achieved by using different follow-up procedures, offering more attractive incentives, and instead of paper-pencil, making a web-based version of the survey that would be readily accessible.

X. Educational implications

After presenting the conclusions and the factual limitations of this research, it is also important to briefly introduce some educational implications that derive from the results obtained in this work. In order to summarize those implications, the next paragraphs will focus on teacher competencies, teachers' emotions and feelings, and teacher uses of technology.

- First of all, teacher competencies have shown to be significant in the outcome of this investigation. Because of that, it is believed that most of the teachers that participated in the sample were well trained in their districts, as well as they were technology savvy. Even though this cannot be generalize to the whole state of Utah, it is a good indicative of the technology implication at the schools. In addition, this result has demonstrated that teacher training should be mandatory for all the educators in every district in order to be proficient in the classroom.

- In addition, they were able to access a vast amount of technology resources such as: IPad, Laptops, computers, GPS, clickers, chrome books labs and so on. Because of all those facts, it is believe that Utah schools possess a good network and technological infrastructure to help in education, and teachers are willing to implement the resources they have at the school with their students, in order to achieve proficiency in different areas. Although a study was conducted in 2009 about this matter, the present study has been able to confirm the wide use of technology in the state of Utah.

- Moreover, teachers have shown two different types of identity that have not influenced the use of technology in the classroom. This means, that no matter the identity that teachers possess, they will use technology to teach their students if that is the proper things to do to achieve knowledge.

- Even though the use of technology does not affect teachers' identity, teacher competency is a good indicative of the teacher approach. In order to continue into a future with more constructivist teachers, and more student-centered instruction, it would be necessary to make teachers competent with technology. Not only for the approach in which they will orient teaching, but also for the use that they will do of technology in an immediate future where technology is substantial in many areas of knowledge.

- In addition, making teachers more competent will also make students more proficient, and they will have different future career choices. There are currently many job position in the field of computer science, and teachers should be experienced and a model for the students to open them new path in choosing a job in the society they live.

- It has been proved that technology use is well present among teachers and students of science and history disciplines. Is for this reason that would be of special interest to continue its implementation, as well as to promote their use among other teachers that are more distant to its implementation.

- Another important issue that has been considered in this investigation is teachers' feelings and emotions with the use of technology. This study has revealed the appearance of positive and negative feelings and emotions as an important factor derived from the use of technology. It would be important to aware teachers of the advantages of technology to create a more positive outcome regarding this matter. In addition, the more positive they feel, the more satisfied will be their practices. One of the elements that might help teachers to feel positively is the appearance of a technology specialist that might help resolve any software or hardware issue. In addition, it would be interesting to propose teachers with a plan B in case technology unexpectedly fails.

- Finally, the similarity between science and history teachers' profiles might suggest that no further emphasis in any group of teachers might be necessary since it seems to appear that both groups of teachers consider technology as an important and necessary aspect of education.

From our perspective, this section has reflected the more significant aspects that might contribute to understand teachers' conceptions, teachers' conceptions of the subject they teach, feelings and emotions of the use of technology, and the use of technology by teachers and students in order to improve educational practices at a secondary level.

XI. References

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XII. Annexes

Annex 1: sample

Table VI. 1 Distribution of districts and teachers

Total of Public Districts	41
Total districts contacted	40 (except Canyons School District)
Charter/private schools contacted	23
Number of secondary schools contacted for science	175
Number of secondary schools contacted for history	178
Total of history teachers in secondary schools	1037
Number of history teachers contacted	300
Total of science teachers in secondary schools	889
Number of science teachers contacted	300

Table VI. 2 Distribution of the participants that were contacted

# of history teachers at the school	# of history teachers contacted	District	School	# of science teachers at the school	# of science teachers contacted
3	1	San Juan District	Albert r lyman middle		
3	2	Duchesne District	Altamont high	2	1
11	2	Alpine District	American Fork high		
8	1	Alpine District	American Fork Jr. High	9	2
		American leadership academy	American leadership academy	4	1

1	1	Aristotle academy	Aristotle academy		
4	3	Box Elder District	Bear River High	4	3
3	1	Box Elder District	Bear River middle	3	1
4	1	Beaver District	Beaver high	3	1
5	3	Granite District	Bennion jr. High	6	1
		Kane District	Big water school	1	1
14	1	Jordan District	Bingham high	11	5
6	2	Grantie District	Bonneville jr high	4	2
10	2	Davis District	Bountiful high	8	5
3	1	Davis District	Bountiful jr high	4	2
		Box Elder District	Box Elder Middle	4	1
8	3	Box elder District	Box elder high		
5	1	Granite District	Brockbank jr high	5	4
2	1	Salt Lake District	Bryant middle		
3	1	Cache alternative high	Cache alternative high		
5	1	Iron District	Canyon view high	6	1
		Emery District	Canyon view jr. High	7	2
7	1	Iron District	Canyon view middle		
4	1	Carbon District	Carbon High	4	2
6	2	Iron District	Cedar City high	7	1
15	2	Iron District	Cedar middle	7	1
1	1	Sevier District	Cedar Ridge high		
		Davis District	Centennial jr high	6	1
5	1	Provo District	Centennial middle		
5	1	Davis District	Centerville jr. High	5	2

4	1	Davis District	Central Davis Jr. High	5	1
4	1	Granite District	Churchill jr high		
		City Academy	City Academy	3	2
		Tooele District	Clarke n johnsen jr high	7	1
7	3	Salt Lake District	Clayton Middle		
12	5	Davis District	Clearfield high	7	3
17	3	Jordan District	Copper hills high	11	2
10	3	Granite District	Cottonwood high	9	3
8	2	Granite District	Cyprus high	7	2
		Box Elder District	Dale young community high	1	1
5	1	Davinci academy	Davinci academy		
15	5	Davis District	Davis High	9	4
4	2	Millard District	Delta high	3	1
2	1	Millard District	Delta Middle	3	1
		Washington District	Desert hills high	5	1
4	2	Washington District	Desert hills middle		
5	1	Nebo District	Diamond fork junior high		
8	2	Washington District	Dixie high	4	1
		Dual Immersion Academy	Dual Immersion Academy	1	1
3	2	Duchesne district	Duchesne high		
		Tooele Ditrict	Dugway high	1	1
		Early light academy at daybreak	Early light academy at daybreak	2	1
9	2	Salt Lake District	East high	9	4
		East Holliwood high	East Holliwood high	2	1
5	1	Granite District	Eisenhower jr high	5	1

5	2	Jordan District	Elk Ridge middle	5	1
4	2	Emery District	Emery high	2	1
3	1	South Sanpete District	Ephraim middle		
6	3	Granite District	Evergreen jr high	4	2
5	1	Davis District	Fairfield jr high		
7	2	Davis District	Farmington jr. High	4	1
9	1	Jordan District	Fort herriman middle		
		Washington District	Fossil Ridge Intermediate	6	1
12	4	Weber district	Fremont high	7	1
		Ogden city District	George washington high	3	2
3	1	Grand District	Grand county high		
15	4	Granite District	Granger high	13	3
		Granite District	Granite connection high	3	1
4	2	Granite District	Granite park junior high	4	1
		Tooele District	Grantsville jr high	3	1
		Emery District	Green River high	2	1
		South Sanpete District	Gunison valley high	3	2
		Murray District	Hillcrest jr high		
		Salt Lake District	Hillside middle		
13	1	Jordan District	Herriman high	10	1
9	2	Salt Lake District	Horizonte instr & trn ctr	10	1
6	1	Washington District	Hurricane high	4	1
		Washington District	Hurricane middle	4	1
12	3	Granite District	Hunter high		
5	3	Granite District	Hunter Jr. High	5	3
5	1	Salt Lake District	Highland High	7	3

8	3	Ogden City District	Highland jr. high	6	1
		Highmark charter school	Highmark charter school	2	1
4	2	Murray District	Hillcrest jr high		
3	2	Salt Lake District	Hillside middle		
		Provo District	Independence high	3	1
2	1	Intech Collegiate high school	Intech Collegiate high school	1	1
		Jordan District	Joel p jensen middle	5	1
		Granite District	John f. kennedy jr high	5	2
		Juab District	Juab high	3	1
2	1	Juab District	Juab jr high	3	1
2	1	Kane District	Kanab high		
11	1	Karl g maeser preparatory academy	Karl g maeser preparatory academy	6	1
5	2	Davis District	Kaysville jr. high	5	1
15	5	Granite District	Kearns high	10	4
1	1	Kane District	Lake Powell high school		
5	1	Alpine District	Lakeridge jr. high	5	2
		Lakeview academy	Lakeview academy	3	1
		Nebo District	Landmark High	3	1
10	2	Davis District	Layton high	9	1
7	2	Davis District	Legacy jr. High	6	1
13	1	Alpine District	Lehi High	8	4
6	2	Alpine District	Lehi Jr. High	7	1
1	1	Liberty Academy	Liberty academy		
1	1	Carbon District	Lighthouse high		
		Lincoln Academy	Lincoln academy	3	1
12	2	Logan City District	Logan high	10	1
11	2	Alpine District	Lone Peak High	8	5
		Dagget District	Manila high	2	1

5	1	Nebo District	Manti high		
6	2	Nebo District	Maple mountain high	5	1
		Nebo District	Mapleton jr high	5	2
4	1	Merit college preparatory academy	Merit college preparatory academy		
		Beaver District	Milford High	2	1
		Millard District	Millard high	3	1
2	1	Washington District	Millcreek high	1	1
3	1	Davis District	Millcreek jr high		
6	1	Carbon District	Mont harmon middle		
2	1	San Juan District	Monticello high	2	1
		Morgan District	Morgan High	4	1
		Ogden City District	Mount fort junior high	4	1
6	1	Logan City District	Mount Logan middle		
		Ogden city district	Mount ogden junior high	5	1
8	4	Cache District	Mountain Crest high	7	3
5	1	Davis District	Mountain high		
		Mountain heights academy	Mountain heights academy	4	1
4	1	Nebo District	Mount Nebo jr high		
		Alpine District	Mountain Ridge jr.High	7	1
6	2	Alpine District	Mountain View high	5	1
		Davis District	Mueller park jr high	5	2
		San Juan District	Navajo mountain high	1	1
		Nebo District	Nebo advanced learning center	1	1
5	2	Cache District	North Cache Center	6	2

5	1	Davis District	North Davis jr high		
6	2	Davis District	North Layton jr. High	5	2
5	1	Weber District	North Ogden jr high		
11	4	Davis District	Northridge high	7	3
3	1	North Sanpete district	North Sanpete high	3	1
3	2	North Sanpete district	North sanptete middle		
3	1	Sevier district	North sevier middle		
2	1	Sevier district	North sevier high		
4	1	North Summit District	North Summit middle		
		North Summit District	North Summit high	2	1
4	1	No ut acad for math engineering & science (nuames)	No ut acad for math engineering & science (nuames)		
4	1	Salt Lake District	Northwest middle		
5	1	Alpine District	Oak Canyon jr. High	5	3
2	1	Ogden preparatory academy	Ogden preparatory academy		
7	1	Jordan District	Oquirrh hills middle	7	1
9	6	Granite District	Olympus high	7	5
		Granite District	Olympus jr. High	5	1
5	2	Alpine District	Orem high	5	4
		Alpine District	Orem jr. High	5	1
4	1	Weber District	Orion jr high		
1	1	Gardfield District	Panguitch middle		
4	2	Iron District	Parowan high		
9	2	Park City District	Park City high	10	3
5	1	Nebo District	Payson high	6	1

5	2	Washington District	Pineview high	4	1
2	1	Piute District	Piute high		
2	1	North Sanpete district	Pleasant creek high school		
		Alpine District	Pleasant Grove High	8	4
6	2	Alpine District	Pleasant Grove jr High		
5	1	Alpine District	Polaris High School	3	1
		Alpine District	Provo high	8	3
2	1	Sevier District	Red hills middle		
3	1	Davis District	Renaissance academy	4	1
1	1	Rich District	Rich middle school		
5	3	El Sevier District	Richfield high	4	2
11	2	Jordan District	Riverton High	9	3
5	1	Murray District	Riverview jr high	4	2
		Weber District	Rocky mountain jr high	6	1
4	2	Duchesne District	Roosevelt Jr. high	3	2
9	1	Weber District	Roy High	7	2
4	1	Weber District	Roy Jr. High	5	1
7	2	Nebo District	Salem hills high	5	2
		Nebo District	Salem Jr. High	5	1
5	1	Weber District	Sand Ridge Jr. High	5	1
6	1	Granite District	Scott m matheson jr high	6	1
9	4	Granite District	Skyline high	7	5
9	3	Cache District	Sky view High	6	3
8	1	Washington District	Snow Canyon high	6	1
5	1	Washington District	Snow canyon middle	5	2
2	1	Weber district	Snow crest jr high	2	1
6	1	Davis District	South Davis jr. High	6	5

9	3	Cache District	South Cache Center	6	2
		Jordan District	South Hills middle	6	1
8	4	Jordan District	South Jordan Middle	7	3
5	1	Weber District	South Ogden jr high		
2	1	South Sanpete District	South Sanpete District		
3	1	Sevier district	South Sevier middle		
4	1	Sevier district	South Sevier high		
		Iron District	Southwest Educational academy	2	2
2	2	South Summit District	South Summit high	2	1
		Nebo District	Spanish Fork High	5	2
5	3	Nebo District	Spanish Fork jr High		
		Cache District	Spring creek middle	4	1
6	2	Nebo District	Springville high	7	2
6	1	Nebo District	Springville jr. High	6	2
10	1	Tooele District	Stansbury high	7	3
		Success Academy	Success DSU	2	1
		Davis District	Sunset Jr. High	7	3
9	1	Jordan District	Sunset ridge middle		
11	2	Davis District	Syracuse High	7	2
7	3	Davis District	Syracuse jr. High	5	1
		Duchesne District	Tabiona high	2	1
11	1	Granite District	Taylorsville high	7	3
7	2	Alpine District	Timberline Middle	6	1
5	3	Alpine District	Timpanogos high	6	1

1	1	Thomas Edison south	Thomas Edison south		
4	3	Granite District	Thomas jefferson jr high	4	1
		Tooele District	Tooele High	7	2
		Park City District	Treasure mtn junior high school	5	1
3	2	Weber District	Two rivers high		
6	1	Uintah District	Uintah high	5	1
7	2	Duchesne District	Union High	3	1
		Utah career path high school	Utah career path high school	1	1
		Utah military academy	Utah military academy	4	1
		Utah Virtual Academy	Utah Virtual Academy	7	1
4	3	Jordan District	Valley High School	3	2
3	1	Granite District	Valley jr High	3	1
		Uintah District	Vernal Jr. High	6	2
11	3	Davis District	Viewmont high	9	2
6	1	Alpine District	Vista heights middle		
		Walden school of liberal arts	Walden school of liberal arts	5	1
6	2	Wasatch District	Wasatch high	8	2
6	3	Granite District	Wasatch jr high		
1	1	Wayne District	Wayne high	1	1
3	1	Weber District	Weber basin job corps	1	1
12	1	Weber District	Weber high	8	3
12	3	Salt Lake District	West high	9	2
6	1	Jordan District	West hills middle	6	2
11	1	Jordan District	West Jordan high	6	1
		Jordan District	West Jordan middle	5	1
5	1	Davis District	West point jr high		

		Alpine District	Westlake High	9	1
4	1	Granite District	West lake jr high		
4	1	San Juan District	Whitehorse high	2	1
10	1	Alpine District	Willowcreek middle		
9	2	Davis District	Woods cross high	6	5
4	3	Granite District	Youth Educational support school	4	4

Annex 2: Letter to the sample

Dear fellow teacher,

My name is Silvia Iglesias Barbany and I am a PhD Student at the UOC University in Spain, as well as a teacher in Utah. This year is my last year on my doctoral program as well as my last year teaching in Utah, and I need to gather data from history and science teachers in order to graduate. I contacted the USOE and they gave me a list of all the teachers in Utah with their information, and it is this reason that you are receiving this letter at home.

I am asking if you could please help me succeed in collecting enough information to graduate. I would really appreciate your help.

You will see that the questionnaire is long (5 pages), but hopefully it will be easy to fill out. You only have to do a check mark or an x in the appropriate box. I tried with 6 people as a sample and they told me it took them between 15-20 minutes to complete. I know that this is a lot of your time, especially being a teacher (trust me, I know what it is). But please, if you have this 5 minutes today and 5 tomorrow, I would really appreciate if you can send this questionnaire back to me. The envelope and the pre-paid stamp are already there so you will only have to leave them at your mailbox for the USPS to pick up.

Thank you so much for your help and I apologize for taking so much of your time.

Once I am done gathering all data, I will be holding a raffle. You do not have to add your name since it is anonymous, but you can add your email address so I can add you to the raffle pot. I will contact you at that email if you are the winner. I will give 5 gift cards.

Again, thank you so much for your time. If you also want to know the results, let me know in the letter and I will send it to you by email.

Lastly, if you would like to see one of my published articles regarding this topic (teachers' identity and their use of technology), here is the link: http://dialogoseducativos.cl/revistas/n27/iglesias.pdf. The article is in Spanish, but the abstract is in English.

Sincerely,
Silvia Iglesias Barbany (sbarbany@gmail.com)

Annex 3: Science teachers questionnaire

ICT=Information and communication technology

SP1. Gender:
Male 1
Female 2

SP2. How old are you?

SP3. What is your highest university degree?
Bachelors 1
Master 2
PhD 3

SP4. What type of school are you working in?
Public
Charter
Private

SP5. In which year did you start teaching as a full-time job?

SP6. How would you describe your own abilities in the following areas?

	No competency	Some competency	Average competency	Good competency	Very good competency
My level of competence using:					
SP7. A tablet.					
SP8. A computer/laptop.					
SP9. A Smartboard.					
SP10. A document camera.					
SP11. A smartphone.					
SP12. A word processor (ex: Word).					
SP13. A spreadsheets (ex: Excel).					
SP14. A slide show presentation (ex: Power Point).					
SP15. An email and personal information management (ex: Outlook).					
SP16. Publication of information online (ex: Blogs, Webpages).					
My level of competency using programs/software to:					
SP17. Present content (ex: Prezi)					
SP18. Assess students and knowledge (ex: UTIPS, Socrative)					
SP19. Develop learning activities (ex: Softchalk)					
SP20. Establish collaboration (ex: Kidblog, Wikis).					

My level of expertise:	Extremely poor	Below average	Average	Above average	Excellent
SP21. Designing activities in "virtual learning environments".					

	YES	NO
SP22. Have you received training on how to use technology in the classroom?		
SP23. Have you been involved in any training course regarding technology lately (in the last 5 years)?		

	I didn't receive any training	Minimum training (one day training)	Basic training (a week training)	Advanced training (a month or a couple of month training)	Experts training (a whole year training)
SP24. What is your perception of the training that you have received?					

	I didn't receive any training	Not that much useful	A little useful	Somewhat useful	Completely useful
SP25. How would you rate the usefulness of this training?					

	I didn't receive any training	Never	After a few months	After a week	From the first day I attended the training
SP26. When did this training start being useful at the school? (You were able to use what you learned).					

What is your level of agreement on the conceptions of teaching and learning with technology?

	Completely disagree	Disagree	Neutral	agree	Completely agree
CTL.1 It is important that a teacher understands the feelings of the students.					
CTL.2 Good teachers always encourage students to think for answers themselves.					
CTL.3 Learning means students have ample opportunities to explore, discuss and express their ideas.					
CTL.4 In good classroom there is a democratic and free atmosphere which stimulates students to think and interact.					
CTL.5 Every child is unique or special and deserves an education tailored to his or her particular needs.					
CTL.6 Effective teaching encourages more discussion and hands on activities for students.					
CTL.7 The focus of teaching is to help students construct knowledge from their learning experience instead of knowledge communication.					
CTL.8 Instruction should be flexible enough to accommodate individual differences among students.					
CTL.9 Different objectives and expectations in learning should be applied to different students.					

CTL.10 Students should be given many opportunities to express their ideas.					
CTL.11 The idea of students are important and should be carefully considered.					
CTL.12 Good teachers always make their students feel important.					
CTL.13 A teacher's major task is to give students knowledge/information, assign them drill and practice, and test their recall.					
CTL.14 During the lesson, it is important to keep students confined to the textbooks and the desks.					
CTL.15 Learning means remembering what the teacher has taught.					
CTL.16 Good students keep quiet and follow teacher's instruction in class.					
CTL.17 The traditional/lecture method for teaching is best because it covers more information/knowledge.					
CTL.18 It is best if teachers exercise as much authority as possible in the classroom.					
CTL.19 Good teaching occurs when there is mostly teacher talk in the classroom.					
CTL.20 Learning mainly involves absorbing as much information as possible.					
CTL.21 Students have to be called on all the time to keep them under control.					
CTL.22 Teaching is to provide students with accurate and complete knowledge rather than encourage them to discover it.					
CTL.23 A teacher's task is to correct learning misconceptions of students right away instead of verify them for themselves.					
CTL.24 No learning can take place unless students are controlled.					
CTL.25 Teachers should have control over what students do all the time.					
CTL.26 Learning to teach simply means practicing the ideas from lecturers without questioning them.					
CTL.27 I have really learned something when I can remember it later.					
CTL.28 Teaching is simply telling, presenting or explaining the subject matter.					
CTL.29 The major role of a teacher is to transmit knowledge to students.					
CTL.30 Learning occurs primarily from drilling and practice.					

What is your level of agreement in the conceptions of science?

	Completely disagree	**Disagree**	**Neutral**	**agree**	**Completely agree**
CS.1 Science is the study of how things work in the world around us.					

CS.2 Science is studying and exploring the causes and effects of certain phenomena. Example: why there are three states of matter.					
CS.3 Science is the search for the whole truth about everything.					
CS.4 Science looks for answer to big truths.					
CS.5 Science is about discovering things, or making educated guesses about the how's and whys of the world.					
CS.6 Science is finding reasons to why things happen in the world.					
CS.7 Science is about anything you want it to be about.					
CS.8 Science is all around us. It is about experimentation.					
CS.9 Science is about investigating different things and questioning everything.					
CS.10 Science includes every subject and uses subjects to create new things.					
CS.11 Science is looking at an object or an event and finding out how it works or why it occurs.					
CS.12 Science is asking why, giving an answer, and then checking to see if your answer was correct.					
CS.13 Science is investigating the things around you, making predictions about them, and then seeing what happens after observing.					
CS.14 Scientists conduct tests and experiments to prove or disprove certain assumptions or theories.					
CS.15 Through science nature unfolds and we are able to understand the "hows" and "whys".					
CS.16 Science is the discovering of things around us. It is trying to understand or conceptualize why things work the way they do.					
CS.17 Science is finding the answers to how, what and why things occur or work.					
CS.18 Science is the explanation of facts of why things happen.					

When I use technology in my classroom or I think about it, I feel…

CA=completely agree; A=agree; N= neutral; D=disagree; CD=completely disagree

	CD	D	N	A	CA		CD	D	N	A	CA
FE.1 Happy						FE.11 Anxious					
FE.2 Fulfilled						FE.12 Nervous					
FE. 3 Glad						FE.13 Tense					
FE.4 Completed						FE.14 Fright					
FE.5 Motivated						FE.15 Embarrassed					
FE.6 Energetic						FE.16 Irritated					
FE.7 Enthusiastic						FE. 17 Upset					
FE.8 Optimistic						FE. 18 Mad					
FE.9 Pleased						FE. 19 Furious					
FE.10 Confident						FE. 20 Frustrated					

	Never	Almost never	Sometimes	Almost every time	Every time
My students use technology…:					
US.1 To learn about earth science (ex: Wdi data finder, geological dictionary).					
US.2 To learn about biology (ex: Uen.org).					
US.3 To learn about physics (ex: virtual labs).					
US.4 To learn about chemistry (Ex: online periodic table).					
US.5 To define a problem that needs to be resolved (ex: Microsoft Word).					
US.6 To search information. (Ex: Firefox, Explorer,…).					
US.7 To filter and find information that is relevant (ex: journals online, not Wikipedia).					
US.8 To retrieve, store and evaluate information (ex: Dropbox, Google Docs).					
US.9 To analyze and synthesize information. (Ex: Notability).					
US.10 To design projects/activities with other students (ex:Wiggio).					
US.11 To share with other students (ex: Wikispaces, Google +).					
US.12 To interact with peers and teachers (ex: Email, Blogs).					
US.13 For peer tutoring (ex: Voicethread).					
US.14 To combine ideas (ex: evernote).					
I use technology…:					
US.15 To present science content through a multimedia or hypermedia system.					
US.16 To support oral presentation of content.					
US.17 To show examples to students.					
US.18 To perform demonstrations to simulate scenarios.					
US.19 To design a science lesson.					
US.20 To elaborate learning content.					
US.21 To create a brainstorming.					
US.22 To organize and classify learning content.					
US.23 To communicate with students					
US.24 To assign homework to students.					
US.25 To communicate with parents					
US.26 To evaluate the prior knowledge before the implementation of a lesson.					
US.27 To keep track of their progress during a lesson.					
US.28 To see if we need to review a lesson or if the majority understood the issue.					
US.29 To evaluate the student proficiency at the end of a lesson, unit or topic.					

Annex 4: History teachers questionnaire

ICT=Information and communication technology
SP1. Gender:
Male 1
Female 2

SP2. How old are you?

SP3. What is your highest university degree?
Bachelors 1
Master 2
PhD 3

SP4. What type of school are you working in?
Public
Charter
Private

SP5. In which year did you start teaching as a full-time job?

SP6. How would you describe your own abilities in the following areas?

How would you describe your own abilities in the following areas?

	No competency	**Some competency**	**Average competency**	**Good competency**	**Very good competency**
My level of competence using:					
SP7. A tablet.					
SP8. A computer/laptop.					
SP9. A Smartboard.					
SP10. A document camera.					
SP11. A smartphone.					
SP12. A word processor (ex: Word).					
SP13. A spreadsheets (ex: Excel).					
SP14. A slide show presentation (ex: Power Point).					
SP15. An email and personal information management (ex: Outlook).					
SP16. Publication of information online (ex: Blogs, Webpages, Wikis).					
My level of competency using programs/software to:					
SP17. Present content (ex: Prezi)					
SP18. Assess students and knowledge (ex: UTIPS, Socrative)					
SP19. Develop learning activities (ex: Softchalk)					
SP20. Establish collaboration (ex: Kidblog, Wikis, Email).					
Level of expertise:	**Extremely poor**	**Below average**	**Average**	**Above average**	**Excellent**
SP21. Designing activities in “virtual learning environments”.					

	YES	NO
SP22. Have you received training on how to use technology in the classroom?		
SP23. Have you been involved in any training course regarding technology lately (in the last 5 years)?		

	I didn't receive any training	Minimum training (one day training)	Basic training (a week training)	Advanced training (a month or a couple of month training)	Experts training (a whole year training)
SP24. What is your perception of the training that you have received?					

	I didn't receive any training	Not that much useful	A little useful	Somewhat useful	Completely useful
SP25. How would you rate the usefulness of this training?					

	I didn't receive any training	Never	After a few months	After a week	From the first day I attended the training
SP26. When did this training start being useful at the school? (You were able to use what you learned).					

What is your level of agreement on the conceptions of teaching and learning with technology?

	Completely disagree	Disagree	Neutral	agree	Completely agree
CTL.1 It is important that a teacher understands the feelings of the students.					
CTL.2 Good teachers always encourage students to think for answers themselves.					
CTL.3 Learning means students have ample opportunities to explore, discuss and express their ideas.					
CTL.4 In good classroom there is a democratic and free atmosphere which stimulates students to think and interact.					
CTL.5 Every child is unique or special and deserves an education tailored to his or her particular needs.					
CTL.6 Effective teaching encourages more discussion and hands on activities for students.					
CTL.7 The focus of teaching is to help students construct knowledge from their learning experience instead of knowledge communication.					
CTL.8 Instruction should be flexible enough to accommodate individual differences among students.					
CTL.9 Different objectives and expectations in learning should be applied to different students.					
CTL.10 Students should be given many opportunities to express their ideas.					
CTL.11 The idea of students are important and should be carefully considered.					
CTL.12 Good teachers always make their students feel important.					

CTL.13 A teacher's major task is to give students knowledge/information, assign them drill and practice, and test their recall.					
CTL.14 During the lesson, it is important to keep students confined to the textbooks and the desks.					
CTL.15 Learning means remembering what the teacher has taught.					
CTL.16 Good students keep quiet and follow teacher's instruction in class.					
CTL.17 The traditional/lecture method for teaching is best because it covers more information/knowledge.					
CTL.18 It is best if teachers exercise as much authority as possible in the classroom.					
CTL.19 Good teaching occurs when there is mostly teacher talk in the classroom.					
CTL.20 Learning mainly involves absorbing as much information as possible.					
CTL.21 Students have to be called on all the time to keep them under control.					
CTL.22 Teaching is to provide students with accurate and complete knowledge rather than encourage them to discover it.					
CTL.23 A teacher's task is to correct learning misconceptions of students right away instead of verify them for themselves.					
CTL.24 No learning can take place unless students are controlled.					
CTL.25 Teachers should have control over what students do all the time.					
CTL.26 Learning to teach simply means practicing the ideas from lecturers without questioning them.					
CTL.27 I have really learned something when I can remember it later.					
CTL.28 Teaching is simply telling, presenting or explaining the subject matter.					
CTL.29 The major role of a teacher is to transmit knowledge to students.					
CTL.30 Learning occurs primarily from drilling and practice.					

<u>What is your level of agreement in the conceptions of history?</u>

	Completely disagree	**Disagree**	**Neutral**	**agree**	**Completely agree**
CS.1 Every individual has different approaches (attitudes) to the same historical fact.					
CS.2 Every individual has different conclusions to the same historical fact.					
CS.3 History helps to understand facts that happened in life.					
CS.4 History builds understanding of different societies.					
CS.5 Through history, we can have a better approach to facts that happened around us.					
CS.6 History is in charge of creating a biography of important citizens.					

CS.7 Through history, we can understand the evolution of the human kind.					
CS.8 History helps to build relationships between different individuals.					
CS.9 History helps to understand the different civilizations that have been on earth.					
CS.10 History helps to find, build and understand relationships within different individuals.					
CS.11 History helps human beings to understand the details that have happened in life before.					
CS.12 History helps human beings to build a line with facts that happened in the past in chronological order.					
CS.13 Through the study of the past, history helps to understand the present.					
CS.14 History helps to reconstruct details that happened to different civilizations.					
CS.15 History helps to identify territorial boundaries that have changed over time.					
CS.16 History helps to understand the changes that different societies have experienced.					
CS.17 History defines about the different societies.					
CS.18 History defines good and bad events that have happened over time.					
CS.19 History explains different events that happen in different places in the world.					
CS.20 History gives an approach to human society behavior and acts.					

When I use technology in my classroom or I think about it, I feel…

CA=completely agree; A=agree; N= neutral; D=disagree; CD=completely disagree

	CD	**D**	**N**	**A**	**CA**		**CD**	**D**	**N**	**A**	**CA**
FE.1 Happy						FE.11 Anxious					
FE.2 Fulfilled						FE.12 Nervous					
FE. 3 Glad						FE.13 Tense					
FE.4 Completed						FE.14 Fright					
FE.5 Motivated						FE.15 Embarrassed					
FE.6 Energetic						FE.16 Irritated					
FE.7 Enthusiastic						FE. 17 Upset					
FE.8 Optimistic						FE. 18 Mad					
FE.9 Pleased						FE. 19 Furious					
FE.10 Confident						FE. 20 Frustrated					

	Never	**Almost never**	**Sometimes**	**Almost every time**	**Every time**
My students use technology…:					
UH.1 To learn about Utah history (ex: Uen.org).					
UH.2 To learn about USA history (ex: UShistory.org).					
UH.3 To learn about geography (ex: Esri).					
UH.4 To learn about world civilizations (ex: Uen.org).					

UH.5 To learn about government and citizenship (ex: Icivics.org).					
UH.6 To define a problem that needs to be resolved (ex: Microsoft Word).					
UH.7 To search information. (Ex: Firefox, Explorer,…).					
UH.8 To filter and find information that is relevant (ex: journals online, not Wikipedia).					
UH.9 To retrieve, store and evaluate information (ex: Dropbox, Google Docs).					
UH.10 To analyze and synthesize information. (Ex: Notability).					
UH.11 To design projects/activities with other students (ex: Wiggio).					
UH.12 To share with other students (ex: Wikispaces, Google +).					
UH.13 To interact with peers and teachers (ex: Email, Blogs).					
UH.14 For peer tutoring (ex: Voicethread).					
UH.15 To combine ideas (ex: Evernote).					
I use technology…:					
UH.16 To present history content through a multimedia or hypermedia system.					
UH.17 To support oral presentation of content.					
UH.18 To show examples to students.					
UH.19 To perform demonstrations to simulate scenarios.					
UH.20 To design a history lesson.					
UH.21 To elaborate learning content.					
UH.22 To create a brainstorming.					
UH.23 To organize and classify learning content.					
UH.24 To communicate with students					
UH.25 To assign homework to students.					
UH.26 To communicate with parents					
UH.27 To evaluate the prior knowledge before the implementation of a lesson.					
UH.28 To keep track of their progress during a lesson.					
UH.29 To see if we need to review a lesson or if the majority understood the issue.					
UH.30 To evaluate the student proficiency at the end of a lesson, unit or topic.					