Human beings are characterized for their ability to admire and be curious, for their capacity of searching and opening up to knowledge, all of which justify the practice of research. In research, human beings approach different areas of reality through the use of various strategies called methods. A diversity of methods is justified by the many areas of interest and the researcher’s worldview, which has generated endless debates regarding methodology. This article shows how a change in people’s philosophical viewpoints affects the researcher’s methodological preferences. Taking into account the change from the mechanistic worldview of modernism to the systemic–organic–chaotic mind-frame of postmodernism, this debate continues to grow and requires a reconsideration of the concept of scientific research.

An appropriate research methodology is determined by the researcher’s philosophical framework and by the characteristics of the study. When dealing with educational research and methodology we are inevitably led to think of the following questions regarding ontology and epistemology: What is reality? What is truth? What does it mean to know? What does research mean? Each researcher operates within a personal belief system, which is related to his or her area of study, methodological selection, research stance, and specific research question.

This article does not claim to answer the previous paragraph’s questions. Rather, it succinctly reviews the commentaries that
appear in the literature. Its purpose is to show how changes in philosophical conceptualization give rise to sometimes heated debates regarding research methodology. Hopefully, it will contribute to an understanding of the hues, dilemmas, and ambiguities of research methodology.

This article considers how knowledge is operationally defined and how it relates to different research contexts. This is followed by a description of the original concept of scientific research and the limitations that educational research faces in terms of the production of educational scientific knowledge. The second part of the article describes how the change from a mechanistic to a systemic–organic worldview raises questions regarding the methodology of science, opening the door to a better future for Christian educational research.

Knowledge

According to León and Montero (1993), knowledge is the by-product of cultural experiences accumulated throughout history; however, the methods used for accumulating, organizing, and transmitting knowledge are varied, such as common sense, magic, religion, and science. These authors state that “the value and importance that we give to each of them will depend on our own criteria, and probably, the type of problem we are studying. Nevertheless, throughout history, some of these sources have acted as rivals of the others” (p. 3).

Considering that “over time, person and world are understood as separate and what one knows or can come to know is dichotomized as real and unreal, ideal and non-ideal” (Paul, 2005, p. 30), knowledge is operationally defined by Gutiérrez (1993) as containing four elements: subject, object, cognitive process, and thoughts. The subject (person) is the one assuming to possess knowledge, the one who knows and understands a certain aspect of reality and thus obtains a thought of that understanding. The object of knowledge is the thing or person that is known by the subject. Knowledge implies a correlation between object and subject. The subject suffers a modification during the act of gaining knowledge; meanwhile, the object may or may not suffer modification, depending on the context in which the act of knowing takes place. It is in this polarity that we see the problem of subjectivity
and objectivity of knowledge. The question that arises from this problem is, ‘Up to what point is it necessary and possible to be objective?’

The third element of knowledge is cognitive operation. This implies a psychological process in which it is necessary that the subject be in contact with the object and be able to obtain some thought about that object. This cognitive operation lasts a moment, but the obtained thought stays in the subject’s memory and can be retrieved by the conscience again with a second mental operation.

Each time an object triggers a thought, an internal print, which consists of a series of thoughts that remind us of the known object, is created in the subject’s memory. In this way, the fourth element of knowledge is made up of thoughts—mental expressions of the known object. It is an intra-mental construct, differing from the object, which is extra-mental. Thus, equipped with these thoughts obtained from the interaction of subjects and objects, it is possible to engage in the act of thinking. The process of thinking consists of focusing our attention on previously obtained intra-mental objects (thoughts) and combining them to obtain new ones (Gutiérrez, 1993).

Knowledge, according to Gutiérrez (1993), is the act by which a person or subject understands an object and internally produces a series of thoughts or expressions about that object. Knowledge is the phenomenon by which a subject obtains mental expressions of an object.

**Research and Its Context(s)**

The existence of the intra- and extra-mental phenomenon of knowledge described by Gutiérrez (1993) allows us to identify at least two general contexts and contents for research. The first context is that of the researcher focusing on the study of intra-mental content that he/she was able to develop. An example would be the philosopher or mathematician who utilizes mental operations in their specific discipline of study to solve a problem. Whether used to explain a phenomenon or to improve a traditional mathematical method, they each resort to their own repertoire of thoughts. The second context is that of the empirical researcher who focuses on extra-mental objects or phenomena, be they natural, psychological, or social in nature.
An individual “by nature seems to tend towards an expansion of him or herself” (Gutiérrez, 1993, p. 164). The prime example is that of a child who is constantly seeking answers about the world outside of him- or herself. This human ontological intentionality, this spirit of admiration and curiosity, is the reason behind research; it is the effort of a human being to develop knowledge. This effort can be exerted consciously or unconsciously. In his or her searching for answers, a person can withdraw, turning to intra-mental elements, or can turn towards the exterior, focusing on extra-mental objects. Whatever direction is taken, this search varies in quality and effectiveness depending on the methodology and the way in which it is practiced. This variability contributes to debates regarding what constitutes research, the quality of research, the types of research proposed, and the hues of the different methodologies.

Human knowledge is organized into disciplines clustered in three groups: non-scientific, scientific, and metaphysical, without including the formal disciplines of mathematics and logic. During the past century, scientific knowledge, as a product of scientific research, has been recognized as the most reliable knowledge; as a result, all disciplines have tried to apply the scientific method in an effort to be recognized as scientific disciplines. A scientific methodology is a system of explicit rules and procedures that provides rules for communication between researchers, creating the conditions for replication and constructive criticism; these include rules for valid reasoning, which allow users to draw reliable inferences, and rules for inter-subjectivity, which involve the sharing of observations and factual information among scientists (Frankfort-Nachmias & Nachmias, 2007). This scientific knowledge, which stemmed from the initial positivist point of view, implied a total independence between the researcher and the object being studied (objectivity), as well as the rejection of anything that is not observable and measurable or of any force other than those found in nature. The present article describes how this original concept of science and methodology has been evolving.

The Scientific Context of Research and the Ambition of Scientific Prestige

The practitioners of the different disciplines tried to assimilate the scientific method at the time when they claimed scientific status for
their areas of study. It is said that scientific philosophers observe, because they are open to any real intra- or extra-mental phenomenon. Later on, they raise questions, provide provisional solutions, and then support them by aligning rational concepts and implications with reality in such a manner that could be universally applied. Finally, they publish those theories in a logical way, noting the congruency of some theses with others, and the alignment of the total system with reality. In this way, philosophers build a worldview that consists of a series of basic principles and contexts from which the whole system develops.

Mathematicians do something similar by starting with an observation, finding provisional solutions, and testing them in order to form new theories or principles. Historians, likewise, can be scientific when they not only record specific facts but also establish relationships, explanations, and implications, supporting them in testimonies and documents. Scientific historians look for proof of what they declare and support as fact. The majority of the conclusions are not laws or universal concepts, but rather singular propositions that become scientific if they have rational bases. Its contribution lies not only in explaining the past, but also in yielding a better understanding of the present and the consequences anticipated in the future (McGuigan, 1996).

Therefore, we can say that society tends to identify research as a scientific endeavor, so that all the disciplines that aspire to conduct research have made the effort to apply or at least emulate the scientific method. This is how some disciplines have justified their status as scientific. In this regard, education faces serious challenges in aspiring to maintain the status of a scientific discipline, because logical empiricists expect that educational (social) scientists attain objective knowledge by the same methodology applied to the natural sciences.

Labaree (1998) argues that the key characteristic of educational knowledge limits and hinders the work of social researchers, as producers of educational knowledge. He asserts that the problem lies in that educational knowledge is soft (in contrast with other knowledge that is considered hard), applied (in contrast with pure knowledge), and provides useful values (in contrast with interchangeable values).

Hard knowledge is that in which the results of the research are verifiable, definitive, and cumulative, as is the case with the natural
sciences, which take the lead in this area. In another regard, with soft knowledge it is difficult to obtain results that can be reproduced and whose validity can be successfully defended according to the specifications of “hard science.”

Thus, educational researchers have difficulty in establishing causal, cumulative, and enduring propositions, are unable to speak with authority in their fields, and feel pressed to imitate unproductive forms of intellectual practice. However, educational researchers have the advantage of a vast and diverse audience and of participating in an academic endeavor that is open and unregulated. This does not mean that they rely on non-scientific methodology. On the contrary, they apply a system of explicit rules and procedures that undergo constant revision and improvement, and as scientists they look for new means of observation, analysis, logical inference, and generalization, which is compatible with the underlying assumptions of the scientific approach.

Those underlying assumptions implied 1) recognition of regularity and order in the natural world, 2) that human beings are capable of knowing, 3) that all natural phenomena have natural causes, and 4) that we must rely on our perceptions, experiences, and observations acquired through our senses. However, during the last century, some of these assumptions have suffered some modifications, at least in terms of their implications, as science and its by-product, technology, have generated a profound change in human worldview.

**From a Mechanistic to a Systemic–Organic Universe**

Russel Ackoff (1993) believes that “the most important change is happening in the way we try to understand the world, as well as in our concept of nature” (p. 28). He continues to explain his opinion regarding the nature of that change. According to Ackoff, we are exiting an era dominated by the idea of a machine and entering an era of systems. How did the machine era arise and what did it consist of? Ackoff explains it in the following way: During the Middle Ages, intellectual force did not reside in knowledge or scientific accomplishments, but in the brightness of spiritual imagination. The real world was not perceived objectively, as things were veiled by the mist of subjectivity. The Middle Ages could be regarded as the age of faith, when curiosity was deemed a
cardinal sin; to think of discovering the reality of things as a duty was completely foreign to the mindset of that time. Revelation was the source of truth. However, during that period, the Crusades generated an interest in other civilizations and countries and resurrected the desire for research, leading to many inventions and discoveries.

René Descartes (1596–1650) proposed that knowledge arises from doubting and questioning (skepticism). He also asserted that knowledge has its foundation in self-consciousness and in the person’s innate ideas. Descartes’ ideas provided the basis for analytical geometry and for the assumption that knowledge could be reduced to logical mathematical methods supported by human beings’ innate operational structure (Yu, 1994). This way, the experimental method arose from the context of the Renaissance. This method is an analytical procedure that basically consists of reducing the object, trying to understand the behavior of its parts, and then bringing together the partial understandings to conform the whole.

This interest fueled observation and experimentation and produced what we can call modern science. According to Ackoff (1993), during that time it was perceived as possible to completely understand the world based on what could be called fundamental elements, according to the doctrine of reductionism that affirms that reality and our experience can be reduced to ultimate and indivisible elements. Thus, it lead to the importance of concepts such as the atom, as the indivisible particle of matter, and the cell, as the basic element of life. In another regard, human behavior can be explained by basic elements such as the id, the ego, the super ego, and the energy (libido).

Once the parts have been determined, the explanation of their relationships is formulated by the concept of cause–effect, which leads determinism to affirm that everything that exists has a cause. However, since science had not been able to demonstrate the natural cause of reality, some theologians proposed this was the cosmological proof of the existence of God, in adherence to the cause–effect relationship and the belief in a total understanding of the universe. Also still pending, from the scientific–naturalistic perspective, is the explanation of free will, which was not necessary to explain natural phenomena. Likewise, this perspective contributed to the neglect of the environment, because only one cause,
as in the case of the laws of motion, was sufficient to explain an effect. The concept of cause–effect was the origin of the mechanistic theory of the universe, whereby “the world was conceived as a machine, not as something like a machine” (Ackoff, 1993, p. 24). Consequently, two central concepts arose that established the foundation for the industrial revolution: work and machinery.

The description that Ackoff (1993) provides of the origin and development of modernism implies an understanding of the scientific method as it has been traditionally applied. The appropriate pathway for quantitative empirical studies was to establish a relationship among the components of the phenomena studied in order to determine principles and laws that could explain them and that could predict cause–effect. The degree of adherence or opposition to the quantitative methodology in research depends on the degree of the adoption or rejection of the mechanistic approach to reality.

However, modernism did not come to stay. According to Ford and Denny (1995), a popular television series at the end of the past century can illustrate the change that society undergoes when it transitions from the age of the machine to the age of systems. The series is Star Trek, and later Star Trek: The Next Generation. In the first series, the powerful conqueror and hero was Captain James T. Kirk. He travels from one planet to another, guided by the purpose to correct what is wrong and to make the universe a safer place for democracy. His mission is to explore new worlds, discover new civilizations, and unite them under the Federation. There is also another key person, Spock, who is half-Vulcan and half-human. He always attempts to suppress his emotions, so it could be argued that he represents a human who tries to behave like a machine.

This television program reflects modernism, in a society different from the present one, as an age in which families were more functional, decisions were simpler, the future was brilliant, and events could be divided into good or evil, positive or negative (Ford & Denny, 1995). This was the mindset at the time of the decline of the Middle Ages and the surge of the Renaissance. It was nurtured by the European intellectual Enlightenment, which exalted reason and human values. This era arose at the same time as the change in sciences that gave way to the modernist concept of the world, according to Ackoff (1993).
Havel (1994) posits that science, founded in an unconditional faith in an objective reality and in its complete dependence on general and rational laws, led to modern technology, which for the first time ever allowed humans to freely move through all parts of the globe, firmly uniting all human societies with a common global destiny. This science allowed humans to see planet Earth from space for the first time, as if it were another star in the sky.

According to Ford and Denny (1995), the relationship between modern science and the society it has nurtured and modeled seems to have exhausted its potential. Science seems to have failed in connecting nature’s most intrinsic reality with human experience. At present, this relationship between science and the world is more a source of disintegration and doubt than a source of integration and meaning. Classical modernistic science was limited to describing the surface of things and only one dimension of reality. Today we know more about the universe than our ancestors could have imagined; but every day it seems more evident that they knew more about essentials that escape our scrutiny. The more we know about our organs, their functions, their internal structure, and the biological reactions that take place in them, the more evident is our failure in understanding the spirit, the purpose, and the meaning of the system made up of these organs, which we perceive as our self. Although we enjoy a more comfortable existence, we do not know exactly what to do with ourselves and what direction to take. The world of our experience presents itself as chaotic, disconnected, and confusing. It seems there are no integrating forces or meanings that will unify, nor a true understanding of the phenomena that constitute our experience in the world. The experts can explain anything in the objective world while, day after day, we understand less and less of our own lives. In short, we live in a postmodern world where everything is possible and nothing is certain.

Subjectivity and Scientific Research

The decline of modernism can be detected around the mid-19th century in the work of Charles Peirce (1839–1914), who not only questioned Descartes’ skepticism and reductionism, but also affirmed that, even though knowledge is by nature fallible and our limited life span does not allow us to discover the ultimate truth, we can, nevertheless, establish our beliefs in certain things.
According to Yu (1994), Peirce’s type of thinking was the precursor of pragmatism – he proposed what he referred to as pragmaticism. He understood knowledge to be the interaction between doubt and belief. For him there was a difference between truth and reality. Truth is the understanding of reality through a process of a self-correcting search made by the intellectual community throughout the ages. In another regard, reality exists independent of human searching. In methodological terms, there is more than one way to approach knowledge but only one reality. Reality is what “is,” and the truth is what the subject considers that reality to be.

Later on, intellectuals such as William James modified Peirce’s ideas and asserted that truth is whatever things prove to be good in relation to our beliefs, meaning that absolute truth is not important, but rather what we perceive as truth (James, [1898] 1975, [1909], 1927). This led intellectuals such as James and Dewey to adopt a humanistic view of truth and to conclude that knowledge is a human and social construct, so that it is possible to know without having transcendental criteria. In another regard, Peirce introduced a metaphysical dimension into pragmaticism, which implied that he recognized the existence of a transcendental and universal norm. For Peirce, the search for knowledge is a form of free association or creative thinking that emulates the divine mind. He also affirmed that knowledge is cumulative and self-correcting. Therefore, we could say that Peirce’s 19th century ideas highly contributed to doubt about the inductive analytical method, and, in some way, prepared the way for modernism’s weakening.

As proposed by Ford and Denny (1995), modernism as a worldview declined at the beginning of the 20th century, as a result of the following factors:

1) Einstein’s theory of relativity questioned Newtonian physics. For Einstein there were no objective viewpoints, all points are relative in time and space; under certain conditions, subjective experiences are superior to objective measurements, and space and time are relative, not absolute concepts, which contributed to the decline of the quantitative model.

2) Friedrich Nietzsche attacked Christianity and negated morality in favor of the Will to Power, preaching a gospel of rejection of God and affirming that the human race should learn to live without its gods and religion’s mythical stories.
3) Charles Darwin, with his theory of evolution, contributed to post-modernism by replacing the Genesis creation account with concepts of evolution by natural selection. This also applies to sociology and economics.

4) James Joyce’s antinovel, *Ulysses*, a book with no dramatic coherence nor the possibility of taking place in a real world, also contributed to this change in worldview (Ford & Denny, 1995).

This gradual change in worldview that we have described is what lies behind the debate that has consumed researchers’ time: the debate of quantitative versus qualitative research models. Paul (2005) declares that these “debates about knowledge and method centered on different perspectives, each of which was vying for a place in the void created by the defeat of logical positivism, or logical empiricism, the philosophy of science that had guided educational research through most of the 20th century” (p. 43). Perspectives are general points of view, not all mutually exclusive, but which in some cases represent diametrically opposed views of basic topics such as reality, knowledge, truth, and value.

Qualitative researchers think that the best way to understand any phenomenon is to see it in its context. They consider quantification to be limited in nature, as it only observes a portion of reality and, as a result, understanding of the whole is affected. Therefore, qualitative researchers immerse themselves in the phenomenon, culture, or organization that they study and live the experience as part of it. They are flexible when questioning people within context. They also operate according to ontological assumptions about the world; they do not accept the existence of one simple reality, independent of our perceptions. As each one of us lives according to our personal point of view, each one experiences a different reality. Thus, conducting research that does not consider these different realities is violating the fundamental view that the qualitative researcher has of the individual. Consequently, qualitative researchers are opposed to methods that pretend to arrive at conclusions or integration across individuals, as each individual is unique. Likewise, they argue that each researcher is unique as an individual and that all research is essentially biased by the perception of the researcher. Therefore, there is no sense in trying
to establish validity in an external and objective sense. In short, qualitative researchers are philosophically committed to a postmodern and systemic-organic approach. In addition, the more involved they are in this philosophy, the more polarized is their attack on quantitative research. The debate is not methodological because both qualitative and quantitative methods are grounded in a rich and varied tradition that proceeds from multiple disciplines, and both have been applied to every kind of topic imaginable.

Chong Ho Yu (1994) asserts that those who believe that quantitative methodology produces clear and definitive answers are wrong. Likewise, he posits those who believe that qualitative methodology is more difficult because the information gathered is confusing and responses are not clear or precise are equally wrong. The decisions based on accepting or rejecting a null hypothesis should not be considered simple or easy responses in light of the probabilistic approach of the test and the assumptions that justify it. In fact, quantitative and qualitative methodologies share more things in common than they have differences: 1) both admit that there is more than one way to approach reality, 2) both admit a kind of continuity between quantitative and qualitative knowledge, 3) both admit a tension between the complexity of the world and the reductionistic models, 4) both try to reconstruct the data into a pattern, 5) both recognize that all research has a fallible nature in the process of searching for a pattern of behavior, and 6) both methods use symbolic representations.

It is important to be able to use all the methodological resources that are available (abduction, deduction, and induction) to attain a total understanding. Abduction and deduction are used to obtain a conceptual understanding of the phenomenon, and induction is used for quantitative verification. In the abduction stage, the objective is to explore the data, find patterns of behavior, and suggest possible hypotheses using the appropriate categories. Deduction is used to elaborate on logical and verifiable hypotheses grounded in feasible premises. Induction is the way we approximate truth with the purpose of establishing our beliefs for further searches. In short, abduction creates, deduction explains, and induction verifies.

In summary, the methodological debate arises in the context of the accelerated philosophical change that characterized the last
century. It is the same change that is evident in the later series *Star Trek: The Next Generation*. This series is not about individuals any more, but rather the community they form. The directions they follow indicate that instead of imposing good and rejecting evil, the ship *Enterprise* has to avoid altering or modifying the cultures it encounters. The objective is to learn from alien cultures instead of assimilating them. There is a great respect shown towards non-human realities and different ways of thinking. In this new series, there is a machine, *Data*, that wants to become a human being. This new movement, of machine to human being, is likewise demonstrated in the film *The Bicentennial Man*, in which a robot, over a period of 200 years, is transformed into a human being.

*Research Methodology in a Postmodern Society*

Ambiguity, subjectivity, instability, globalization, paradox, chaotic models, and an interest in the esoteric characterize postmodernism. Postmodernism brought about ‘Generation X’, which lives more in the present without much consideration of the future and is concerned by the deterioration of the eco-systems at the same time that it is trapped by cutting-edge technologies.

As the Enlightenment was the central piece of modernism, the key factor in postmodernism is deconstruction, a term proposed by Jacques Derrida (1980, 1998) in the 1970s as part of a theory regarding literature and language. He affirms that words do not have an objective content, and that the world, in its totality, is a textbook. He also maintains that the only objective reality is the one that language creates in our mind. According to Jonathan Culler (1983), the purpose is to prove the way in which the content of the text or the discourse undermines the philosophy it tries to sustain. In other words, to interpret a text means to impose a meaning: “this is what it means.” Therefore, there is no objective truth. Words do not contain meaning or truth. There is no objective viewpoint. The popularity of Western logocentrism is self-destructive; there is no place for moral judgments or for someone to feel morally superior; it is a new way of understanding reality and truth. Even though many people have not reflected on these ideas, they are present in society. This is the message of the television program *Star Trek: The Next Generation*. 
How do these changes show up in scientific thinking and research methodology at the end of the 20th century? To answer this question, at least in a partial way, we present examples from three different perspectives: from the point of view of how historical research reports differ, from the new developments in statistical techniques, and from the testimonies of well-known researchers.

Robert Donmoyer, editor of the journal *Educational Researcher*, in presenting the last issue for 1997, called our attention to two historical investigations. He explained that those reports represent different ways in which historians do their work and two different forms of recording results. One of the historians, Lagemann (1997), used chronology and a sole theme based on theory as her guide for her work. In another regard, Popkewitz (1997) wrote in a way that some academicians view as untidy. Considering that the present is composed of multiple records superimposed on each other, this historian preferred to use what is called a *rhetorical grid strategy*, backing away from linearity even though he has to use language – which is essentially a linear mode of communication – to describe the ideas that he has developed and the events he has unearthed throughout time, which in a certain sense is linear, too.

Donmoyer (1997) concluded his commentary by saying that Lagemann’s (1997) and Popkewitz’s (1997) articles show that historical research is not immune to the paradigm differences and disputes common to other fields and areas of expertise. He also affirms that in the case of historical research, as well as in studies in other fields, it would be wise not to take an early stand in paradigm disputes, even if we have strong initial preferences for a certain type of historical research and a certain way of reporting it. He concludes that what is needed are intelligent discussions, not defensive ones, with regard to what is gained and what is lost when we research and write history in one way or another.

It is important to consider the changes that the postmodern worldview has generated in theory and in statistical techniques. Statistics, being a study of probabilities, was initially developed in response to the needs of positivism, and, later on, post-positivism. However, in the past 40 years, and in response to an increasing interest in the qualitative approach (interpretivism) in research methodology, new techniques have emerged that facilitate the simultaneous use of a great number of variables and wide variety of data (including qualitative ones).
Traditionally, statistics has focused on the confirmatory analysis of data. This type of analysis is grounded in certain assumptions regarding data structure. Working within these assumptions, it provides inferences that suppose normality, homogeneity, and independence. This is the foundation for the hypotheses. However, according to Yu and Behrens (1995), often these assumptions are not confirmed by the data. We also know that there is a long tradition in statistics called Exploratory Analysis of Data, pioneered by John Tukey (1977). This kind of statistical analysis looks for unexpected structures and the development of rich descriptions, obtained by graphics, robust statistics, and indicators of alignment to the model.

One of the exploratory techniques is visualization, an approach to data analysis that looks for a deep observation of the data structure. It is defined as the process of exploring or presenting the data in such a way that it constructs a visual analogy to the physical world with the goal of improving comprehension and learning. Although no analogy is complete, often physical sciences build visualization tools based on the analogy of appearance in the physical world. When dealing with data from other sciences, such as social sciences, the difficulty of presenting a physical analogy is greater. Although in these sciences it is not possible to find support in a physical analogy, such as color or movement, to indicate physical color or movement, these attributes can be creatively used to indicate some aspects of a conceptual difference. Thus, this methodological technique depends on the researcher’s conceptualization of the problem to be studied. In other words, the appropriate visualization depends on the questions being asked by the researcher. Once there is an image containing all the relevant information, a person that observes it will also construct a personal interpretation of the image. This interpretation generated by the observer will allow him or her to write and talk about the image. This means that the use of an image is a construct or conceptualization both of the person that observes it as well as the person that created it (Yu & Behrens, 1995).

As we can see, statistics is a resource that is available for the new worldview of the postmodern society. The line in linear regression or the plane in multiple linear regression can be interpreted according to the analogy of a mean that runs in a multidimensional space (Behrens & Yu, 1994). The same is true for
other multivariate statistical techniques, such as the multiple correspondence analysis (MCA) used, for example, as a tool to quantify or classify data related to professions (Van Der Heijden, Teunissen, & Van Orle´, 1997). Also, Peter Hill and Harvey Goldstein (1998) proposed a method to resolve the difficulties that are present when observing subjects that move from one place to the other (academic level, school, for example, among others) when there is no information about where they come from. What we are saying is that in the practice of empirical methodology there is no evidence of a dualism between numbers and words. The scientific society of our time is moving toward an integration of the subjective search, developing methods and techniques that operate in the non-expected potentialities of electronic media.

Another example of the statistical evolvement towards holistic and subjective analysis of data is concept mapping. This is a structured process that focuses on a topic or a construct of interest, involving the contribution of one or several participants, with the aim of producing an interpretation of the concepts and how they relate to each other. It is said that this process helps groups manage complex ideas without trivializing or losing the details. The ideas in the study are grouped according to their degree of similarity and classified by giving a name to each group of ideas. Later on, a value is given to each of the groups according to its relative importance, and then the value of each idea (in the assigned group) is represented on a map. Each idea is represented by a point on the map, so that the ideas that the participants placed in the same group will appear on the map near each other. Then in a second stage, taking into account the results of the mapping technique, the map is divided into groups of ideas using a cluster technique. For example, if the responses are about the activities of a program, this final grouping will show how these activities can be logically clustered (Jackson & Trochim, 2002).

The third perspective has to do with researchers’ testimonies of change in their concept of the reality. The following examples do not imply any kind of adherence to their scientific, cosmological, or theological content. The purpose is to illustrate that scientific knowledge is sometimes not enough to explain the complexity of reality as it is studied at present. Consider the case of Francis S. Collins, head of the Human Genome Project, who, based on Bayes’
Theory, asserts that “all of this simply goes to say that a discussion about the miraculous quickly devolves to an argument about whether or not one is willing to consider any possibility whatsoever of the supernatural. I believe that possibility exists, but at the same time, the ‘prior’ should generally be very low. That is, the presumption in any given case should be for a natural explanation” (2006, p. 51). Based on a sound probabilistic or inductive explanation, Collins questions one of the core assumptions of the scientific revolution: that all natural phenomena have natural causes.

A similar position comes from William Dembski (1999), who tries to demonstrate the weaknesses of naturalism and argues that Intelligent Design operates as a scientific theory of information with more epistemological support and greater explanatory power for the origins and development of life than Darwinian evolutionary theory. In this way he opened the door for a science that recognizes the existence of a designer agent even if he remains agnostic as to its identity.

Physicist John Polkinghorne (2003) believes that traditional science was surprised by the many unpredictabilities inherent in the processes of the physical world demonstrated by quantum physics and chaos theory, which destroyed the concept of “a mechanical system as one whose behavior is predictable, and so in principle tame and controllable” (p. 50). He also affirms that, although God is external to creation, there is some connecting place indicated by the theories, through which God’s will and wisdom influence the conduct of beings, particularly human beings.

Others scientists, such as Vernor Vinge (1993), a computer scientist and mathematician, prefer to consider a natural world in a process of evolution that moves towards a world without the classical frame of good or evil, fitting with the larger tradition of change and cooperation that started long ago – perhaps even before the rise of biological life. Speaking with regard to the acceleration of technological progress, he states that we are on the edge of a change comparable to the rise of human life on Earth: the imminent creation, by technology, of entities with greater than human intelligence by means of computers that are “awake” and superhumanly intelligent, large computer networks as superhumanly intelligent entities, computer/human interfaces, and biological science to improve natural human intelligence. These testimonies could be evidence of the “longing for the sacred, a
universal and puzzling aspect of human experience that may not be wish fulfillment but rather a pointer toward something beyond us” (Collins, 2006, p. 38); but, at the same time, they are evidence of scientific unwillingness to recognize the possibility of something far beyond the basic assumptions of traditional science.

**Conclusion**

Modernistic science starts with an analytical worldview and tries to explain natural phenomena by showing that they follow set universal laws and that the dynamics of cause and effect describe, explain, and predict some kind of fragmented-mechanic-static reality. “A science of being has absolute, ultimate constituents of reality as its subject and a final and complete system of laws as its goal. Upward causation is primary, with theories and methods assuming relative simplicity and regularity to be lying beneath natural diversity” (Pickering, 2006, paragraph 6). However, nature is an organic and dynamic whole, not merely a collection of discrete objects, and any attempt to explain organic events by the reduction to minute details of isolated systems cannot fit with reality. The science of being is not enough for educational research because education is not just a science of being but a science of becoming, “concerned with stability in dynamic relations; its goal is to understand the emergence of autonomous organizations from simpler precursors” (Pickering, 2006, paragraph 6).

Some educational researchers seem committed to mechanism because the accomplishments obtained by classical science encourage them to view it as an ideal, even at a time when sciences like physics and biology are moving beyond traditional practices and views. However, considering that education focuses on scenarios that are permanently changing, that student development is a continuous and integrated process, that the phenomena involved are complex, and that the end result of those scenarios is more than the sum of its parts, educational researchers and especially those that share a Christian worldview should take into account the profound changes in methodology as an open door to apply methods that go beyond explaining and predicting to understanding and admiring. It is a methodology open to uncharted ideas, open to phenomena that up to the present time have not even been
considered as worthy of study because they are not easily measured or observed, such as free will, the inherent perception of good and evil, and the altruistic or selfish impulse, which are all present in human experience and are indispensable in an education that seeks the development of character, mind, body, and spirit.

REFERENCES


