The Debate Of Evolution Versus Intelligent Design: Is Critical Thinking Occurring Among K-12 Students?

A Thesis

Presented to

the Department of Education

School of Arts and Sciences

Biola University

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts in Education

By

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December 2010

Abstract

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This study investigates how evolution versus intelligent design is handled in the public, private Christian, private Jewish, and Christian Home-school K-12 settings through a review of the current literature and by interviewing teachers in these educational venues. Fourteen public, private, and homeschool educators responded to an interview protocol regarding how they incorporate critical thinking into the education of their students as it applies to the evolution versus intelligent design debate. Results indicated that there was actually more discussion about the debate happening in the private and homeschool setting, rather than in the public schools. However, public school teachers agreed that students should discuss these ideas within the social studies rather than in the science curriculum. There was a consensus among interviewees that students' critical thinking is lacking in regards to evolution versus intelligent design because today's curriculum leaves little time for student reflection and discussion. K-12 students in the United States could be presented with a balanced treatment of evolution and intelligent design in order to foster critical thinking in all educational settings – public, private, and homeschool.

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CHAPTER ONE

The Evolution versus Intelligent Design Debate

Evolution, creationism, and intelligent design all offer explanations on the origin of life. There is considerable scientific evidence that has been interpreted to show that all of these theories are plausible; however, limitations have been set to define what constitutes science. Public education has seen numerous court cases to determine appropriate science curriculum for K-12 education. As this debate continues, public school students are being limited in their critical thinking skills in regards to evolution versus intelligent design, but are there other educational environments where this discussion is taking place? It may be possible that private schools and or homeschools may provide a viable forum for students to discuss the significance of evolution versus intelligent design. This chapter will outline the basic arguments for evolution, creationism, and intelligent design because these are the central ideas that are frequently discussed in today's K-12 educational forum.

Evolution

Evolution is the idea that things change over time, but Darwinian evolution is more than just change over time. "In the Darwinian theory of natural selection, evolution exploits individual variations that are purposeless (although not absolutely random, as is popularly supposed) by simply eliminating those that confer no benefit to the organism" (Bowler, 2003, p. 6). Through many variations over millions of years, evolution is thought to have given rise to all life by natural means. In other words, evolution does not suppose design, or a designer for that matter, because nature acts through unguided processes. Naturalism, also known as methodological naturalism according to intelligent

design proponents, is the philosophical stance taken by evolutionists, which "supposes only naturalistic explanations for the origin and development of the universe" (Hunter, 2007, p. 140). Evolution has become the dominant scientific theory on origins, which relies on naturalism to explain a purposeless universe.

The history and development of evolution has been established over the last few centuries. Evolution grew out of scientific inquiry during "the Age of Enlightenment in the late seventeenth century" (Bowler, 2003, p. 48). With advancements in technology scientists began to move away from superstitions to empirical explanations that relied primarily on measurable data. Two hundred years later Charles Darwin further developed the idea of evolution when he published *On the Origin of Species*, which viewed natural selection as the primary mechanism for evolution. "Natural selection is the slow changing, preservation, and accumulation of successive slight favorable variations" (Darwin, 2003, p. 480). Darwinian evolution began to change scientific thinking over the next 150 years as scientists allowed naturalism to guide their investigations.

Since Darwin's day, the world has experienced a saturation of evolution through naturalism; herein lays the problem that science students in American K-12 education face today. The educational climate in the United States is such that critical thinking in many science classrooms is allowed only through the lens of naturalism. Organizations such as the American Academy of Sciences and the National Center for Science Education have determined evolution to be the only acceptable scientific theory (National Center for Science Education, 2007, Alberts, 2005). Students are not usually given a choice between the two competing views of design and naturalism that have been battling for centuries.

Creationism

Creationism is the belief that the God of the Bible created the universe and every living thing out of nothing. Genesis 2:1 states: “So the creation of the heavens and the earth and everything in them was completed” (Bible, 2004, p. 7). According to this belief, God is the one responsible for creating things and setting in motion all laws governing the cosmos. Although there are several different creation theories, young earth, theistic evolution, progressive, etc. (Dewitt, 2007, pp. 50-71), all creationists agree that God is the origin of nature. Throughout the twentieth century creationism has been struck down time and time again in American public schools because it is a religiously based idea that, according to the law, is no longer appropriate for today’s science classroom.

Three of the landmark court cases involving evolution versus creationism are the Scopes trial (1925) *Arkansas State Standards Eliminate Creationism from the Curriculum* (1968), and *Edwards versus Aguillard* whose ruling disbanded Louisiana’s “Creationism Act” (1987) (National Center for Science Education, 2007). The Scopes trial had a divided and divisive response on this issue that continues to the present, as some school officials impose restrictions on teaching evolution while others ridicule them (Ferngren, 2002, p. 297). Two of the three cases, which also happened to be United States Supreme Court decisions, involved a ban against creationist views, which led to a debate in the intelligent design movement birthed in the 1990’s.

Before examining the two more recent Supreme Court decisions, it is essential to understand one of the main legal tests though which these rulings have been filtered through. Although *Epperson versus Arkansas* preceded the *Lemon versus Kurtzman* decision (1971), the “tripartite test”, as it is called, was applied in principle during the

1968 trial. The tripartite test considers the following criteria: Whether the purpose of the challenged governmental policy or practice is secular; if so, whether its primary effect is religious; and if not, whether it represents excessive entanglement between church and state (Zirkel, 2009, p. 14). Otherwise known as the "Lemon Test," this test has been used to assist court decisions in this arena of evolution versus creationism. This interpretation of the first amendment, which includes the establishment, free exercise, and free speech clauses, tells people that the primary purpose of public education is primarily for secular purposes. Therefore, any science teacher who provides instruction that may have religious implications may be in violation of the Constitution.

Many states during the time of the Scopes trial had limitations on teaching evolution because they favored a creationist viewpoint; however as time wore on, local, state, and federal laws enacted a complete reversal from creationism to evolution. The last of these states was Arkansas. In 1968, in *Epperson versus Arkansas*, the United States Supreme Court invalidated an Arkansas statute that prohibited the teaching of evolution (National Center for Science Education, 2007). This marked the end of creationism's place in public education for a time, but it sent the message across the United States that creationism was finally defeated as an acceptable theory of origins.

Nineteen years later in Louisiana, the courts ruled that it was unconstitutional to forbid the teaching of evolution except when accompanied by creationism (National Center for Science Education, 2007). Citizens in Louisiana wanted to bring creationism back into the public schools, but the Supreme Court struck down the "Creationism Act" with the backing of the current scientific establishment. The National Academy of Sciences has established science to only be associated with naturalistic ideas rather than

with a religious idea such as creationism. There were several other smaller cases involving the debate between evolution and creationism, but all in all, using the term creationism in public schools today is considered unscientific and inappropriate as a result of these landmark decisions.

The educational framework of California, Texas, and New York references evolution and follows the National Academy of Sciences in its strictly naturalistic view of science. “Analysis of the fossil record reveals the story of major events in the history of life on earth, sometimes called *macroevolution*, as opposed to the small changes in genes and chromosomes that occur within a single population, or *microevolution*” (California Department of Education, 2009, p.250). This excerpt from the California Science Framework in the area of biology is designed to educate students according to evolutionary theory that is thought to explain the “major events in the history of life on earth.” Texas references the definition of science according to the National Academy, “Science, as defined by the National Academy of Sciences, is the ‘use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process’” (Texas Educational Agency, 2010, p.1). “Evolution is the change of species over time. This theory is the central unifying theme of biology. This change over time is well documented by extensive evidence from a wide variety of sources” (New York State Education Department, 2010, p. 17). As shown by these quotes, evolution and naturalism are an integral part of public education in the United States.

Intelligent Design

To understand intelligent design theory one must first understand its roots in teleology. What is teleology? Teleology has to do with cause and effect. “What caused the plates on stegosaurus’ back to form, and what was their effect?” (Ruse, 2003, p. 5). A purely naturalistic explanation would hold that certain proteins and genetic information came to form them, but why did they form? Teleology is the study of understanding intentionality and purpose in nature that seeks to answer the “why” questions. Thus begins a metaphysical discussion based on empirical evidence. This line of thinking is foundational when arguing for design in the universe because there are usually questions regarding function rather than just description. Stepping back in time to ancient Greece, Plato (427-347 BC) was developing his argument for design. In the midst of Athenian philosophers and students, Plato argued that certain explanations are incomplete without mentioning purpose and intentionality. Simply explaining how a man grows cannot be fully detailed in the fact that a man grows only through eating and drinking, but that eating exists for the purpose of bringing about growth and development (Ruse, 2003, p. 14). Thus begins the teleological argument (the study of final causes) for design that emphasizes purpose in the universe.

There have been many philosophers and scientists throughout history who recognized the pattern of design seen in nature, but it has not been until fairly recently that modern science has seen exactly how complex the universe can be. In the 1950s scientists truly saw how complex a “simple cell” could be. Dembski argues that the DNA, mRNA, and proteins involved in the workings of a cell can be compared to an “automated city” (Dembski, 2010). Many scientists today, both secular and religious, are questioning how it could be possible to account for all of the complex workings of nature

without a designer. “If it could be demonstrated that any complex organ existed which could not possibly have been formed by numerous, successive slight modifications, my theory would absolutely break down” (Darwin, 2003, p. 162). Darwin himself recognized that certain levels of complexity would present problems for evolutionary theory through natural selection. Intelligent design recognizes that the complexity of nature could be best explained through a designer rather than through unguided natural processes.

Writing from a secular point of view intelligent design has also been nicknamed the *wedge* (Forrest & Gross, 2005, p. 15) by those who see this movement as a conspiracy threat against science education. This term comes from the founders of intelligent design, who stated that they planned to put a *wedge* in the scientific establishment by focusing on educating the world to think about science in a new direction. The main advocates of intelligent design first came on the scene publicly in 1992 at Southern Methodist University after P. Johnson, a UC Berkley law professor, published *Darwin on Trial* the previous year (Forrest & Gross, 2005, p. 17). Several other conferences resulted as intelligent design theory gained momentum. Intelligent design quickly gained acceptance from well-educated and influential people such as J. Wells, M. Behe, W. Dembski, S. Meyer, J.P. Moreland, P. Nelson, W. L. Craig, and many others interested in pursuing an active debate with evolutionists (Giberson & Yerxa, 2002, p. 202). Even though Forrest and Gross’s book *Creationism’s Trojan Horse* severely downgrades intelligent design as a conspiracy, they do a good job of bringing together a comprehensive list of personnel and achievements representing the *wedge* organization.

The intelligent design movement has run into similar court battles over public school curriculum, just as creationism faced in the past. The scientific establishment has

come against this new face of the design argument. The landmark case for this new era of debate was the *Kitzmiller versus Dover* decision. Judge Jones ruled that the Dover school board acted for clearly religious reasons rather than for a legitimate secular purpose (DeWolf, 2006, p. 11). It was a fairly easy case to determine through the use of such legal filters such as the *tripartite test*, but the judge decided to take things a step further.

Judge Jones wanted the publicity and remaking of the famous Scopes trial, and he carried things out above and beyond what was necessary. Was the intelligent design movement on trial? It is interesting to note that the judge acted as if he had the leading experts for intelligent design on trial rather than the Dover school board (Dewolf, 2006, p. 11). The judge wanted to try and extinguish the design movement, but he failed to make any real lasting impact because of his assumption that intelligent design relies on biblical evidence. Jones tried to link historical theologian and philosopher, Thomas Aquinas to the present day intelligent design movement (Dewolf, 2006, p. 17). The judge made many other attempts to subdue the intelligent design movement as being religiously motivated.

The two intelligent design experts to take the stand during this case were Michael Behe and Scott Minnich. Neither one of these witnesses to the design movement was shown to be a religious fundamentalist as Judge Jones tried to reveal (DeWolf, 2006, p. 40). These two witnesses rejected neo-Darwinism on a scientific rather than religious basis, but the judge ignored their testimonies (DeWolf, 2006, p. 44). The end result of this case was a defeated policy by the Dover school board and not a precedent set against the intelligent design movement. Nevertheless, the debate continues across the United States public school system.

Education

What is the purpose of education? While this question may be much larger than the scope of this paper, it is an essential starting point for this discussion of evolution versus intelligent design in K-12 education. Academic philosophy in this country began with pragmatism, whose main proponents (J. Dewey, W. James, and C. Pierce) rejected metaphysics (Gutek, 2004, p. 70). Metaphysics is the study of the reality that is beyond or above physics, the science that deals with the physical world (Moreland & Craig, 2003, p. 173). Although pragmatism relies primarily on empirical verification and scientific testing, there are many questions that students may ask regarding purpose which are not subject to scientific testing. Therefore a pragmatic view held in education is not complete when it comes to dealing with philosophical questions that form a students' worldview.

Pragmatism was replaced by the postmodern view. Postmodernism began with Nietzsche and Heidegger as they argued for a reality based on our experiences, while excluding metaphysics altogether; and continued with Derrida and Foucault and their rejection of universal truth, discoverable by metaphysical speculation (Gutek, 2004, p. 125). While these two philosophies agree that metaphysics should not play a part in education, they differ in the fact that postmodernism narrows the scope of science. Pragmatism is open to inquiry through objective investigations; whereas, postmodernism is not. Modern science in the United States is very selective on what qualifies as science; it is left up to the National Academy of Sciences generally determines what constitutes science. The postmodern view describes how one group, usually the educational elite, puts forth claims to truth that give them power and deny it to others (Gutek, 2004, p. 134). This is a good description of what has happened to education in the United States.

The academic philosophy in this country could shift back to a more pragmatic view that, although incomplete by denying metaphysics, allows students to investigate without the academic elite constantly monitoring what counts as science. This would maintain the possibility of a more objective education. While this may only seem to apply to public education, this educational philosophy can be applied to private education as well. The "educational elite" who establishes curriculum in private schools may also put forth truth claims that give them power and deny it to others. In this situation, they would be the equivalent of the National Academy, but on an individual school basis. If the academic philosophy shifts back to pragmatism, then the debate between evolution versus intelligent design might not be so controversial.

There are many different educational opportunities available these days; therefore, it is impossible to limit this debate to the public schools only. Is critical thinking occurring among K-12 students in regards to the evolution versus intelligent design debate in all arenas – public, private, and home schools? This is an important question for educators to address if we are going to raise critical thinkers for the future of their country. Because there are different educational environments available to K-12 students, it is essential to gather a sampling from all paths of K-12 education. There may be school situations that are more open to this debate than others. This study may provide a better view on how this debate can be approached effectively for the benefit of their students' critical thinking skills.

It may be that when comparing public to private or homeschool that students are taught only evolution or creationism without thinking through the evidence themselves. The purpose of this study is to identify how the various school environments allow

discussion of this debate, if at all, by interviewing the educators themselves. Even though the educator is only one small piece of the puzzle, it is arguably the most essential piece because the teacher the learning that takes place in the classroom. The late S. J. Gould, evolutionary biologist, said, "I don't think that any job in the entire world-and I include Popes, Presidents and Generals-could possibly be more important than teaching science to secondary school students" (Moore, 2007, p. 886). It is important to know how science teachers handle this debate because they are able to influence students in one direction or another.

Not only is the evolution vs. intelligent design debate a problem for American education, it is a problem for the Christian, Jewish, and families of faith that struggle with evolution versus intelligent design while maintaining a faith-based worldview at home. Should parents of faith send their children to public, private, or homeschool? Each family must make this decision for themselves, but this debate over scientific theories on origins has a lot to do with why many families of faith end up educating their children at private or in homeschools. While a child is forming their understanding of the world, many questions pertaining to how and why things came to be may be answered to the detriment of their faith in God if they are not presented with all of the scientific evidence. Which school environment does truly foster critical thinking regarding this debate?

The ideas of evolution, creationism, and intelligent design have been topics of discussion in science for a long time, and these ideas continue to be the source of much debate in the current academic arena. In order to fully grasp this debate, one should further investigate the extensive history surrounding these competing ideas. K-12 students are the ones who are caught in the middle of this ongoing dispute and are

currently and consistently not presented all sides in all educational settings and allowed to critically think through these ideas. However, there may be other school environments where students are afforded the opportunity to discuss this debate.

CHAPTER TWO

Literature Review

The evolution versus intelligent design debate continues to be a controversial topic as opposing organizations such as the National Center for Science Education and the Discovery Institute fill academia with literature to justify their arguments. Academic freedom has come into question when limitations in education exclude the design argument because it is supposed that design in nature leads to religious assumptions. The literature on this topic is extensive, so this is only a brief look into this heated debate.

Evolutionists

The main forum that evolutionists have to establish their views is in the public school system. 6,049,000 students (11% of all students in the United States) attended private schools in 2009 (National Center for Educational Statistics, 2010). This statistic shows that well over 80% of students in the United States are served in the public schools where evolution dominates the curriculum. Our public school system may need to be adjusted to accommodate a fair discussion on the evolution versus intelligent design debate so that students have a chance to exercise their critical thinking skills when presented with the scientific evidence.

Most of the current literature consists of the outcry of evolutionists against anyone who would question the tenets of evolution. *Not in Our Classrooms: Why Intelligent Design Is Wrong for Our Schools* by E. C. Scott and G. Branch describes their disapproval of "teaching the controversy." "Despite their many legal defeats and the overwhelming scientific evidence supporting biological evolution, anti-science activists will not stop trying to undermine science education" (Moore, 2007, p. 886). This quote

from Glenn Branch shows the disapproval that is felt by many evolutionists. He calls the leaders of intelligent design “anti-science activists.” Because there are such strong feelings about this topic, the researcher asked interviewees, “Is this debate is beneficial or detrimental for students to engage in?” (Hoodman, 2010, appendix). This question leaves the door open for someone on either side of the debate to respond according to how they see the issue.

Evolutionists see the intelligent design movement as a conspiracy by the creationists whom they already defeated in the past. “Fanatics have always been preoccupied with controlling education, especially that of children” (Forrest & Gross, 2005, p. 15). B. Forrest is referring to intelligent design proponents as religious “fanatics” in the quote mentioned previously to show how this new movement is trying to hide their religion and are trying to impress these views on children. Classrooms in America continue to be a significant source of conflict in the debate over evolution and intelligent design.

It has also been argued that this debate is essentially religious for both evolutionists as well as intelligent design proponents because it leads to metaphysical issues that form their worldviews. According to D. Dewitt, the five questions raised by a person’s worldview are: *Where did life come from?* (origins) *What does it mean to be human?* (identity) *What is the purpose of life?* (meaning) *How should I live?* (morality) *What happens after I die?* (destiny) (Dewitt, 2007, p. 29). These questions go beyond the realm of science but are essential when forming a worldview that affects how a person relates to science. The whole search for missing links demonstrates that evolution is really a very strong *faith-based belief system* or worldview, not strictly a scientific theory

(Parker, 2008, p. 171). Evolutionists begin with a worldview that drives them to look for certain things in nature even if they do not exist. “Virtually every chart of human evolution since 1990 has question marks or dotted lines at the most crucial point-the transition from australopithecines to true humans” (Lubenow, 2004, p. 326). When intelligent design challenges evolutionary thinking, it is essentially challenging everything an evolutionist believes in.

In addition to Dewitt’s questions, the researcher carefully crafted question number six to open the door into the underlying issues of a person’s belief system. “What larger ramifications, if any, exist because of this debate?” (Hoodman, 2010, appendix). This question gives interviewees an opportunity to respond according to their worldview. Evolutionists have a prior commitment to their belief in naturalism, which eliminates the possibility of supernatural explanations. J. Sloan-Lynch states, “ID violates the fundamental scientific commitment to *methodological naturalism*” (Sloan-Lynch, 2010, p. 18). This quote from Sloan-Lynch, professor at the University of Colorado at Boulder, makes the connection between evolution and naturalism.

Academic Freedom

One of the arguments of the intelligent design movement is the right to academic freedom. B. Stein has pursued this argument in the film entitled *Expelled: No Intelligence Allowed*, where he interviews several prominent scientists and philosophers involved with the evolution versus intelligent design debate. This movie addressed the relevance of academic freedom in the United States of America. “We are losing our freedom in one of the most important sectors of society . . . science” (Stein, 2008). The National Academy of Sciences establishes what qualifies as science, and intelligent design is seen as an

unacceptable compromise.

However, scientists who receive funding and recognition from the Academy do not entirely hold to evolution because of many problems that have arisen in modern scientific findings. Journalist L. Witham, who has been covering the controversy for over twenty-five years clearly states this as true: “I interviewed dozens and dozens of scientists and when they are amongst each other or talking to a journalist whom they trust, they’ll speak about, ‘It’s incredibly complex’ or ‘Molecular biology is in a crisis’ but publicly they can’t say that” (Stein, 2008). There does not seem to be academic freedom among the scientists mentioned in this documentary, and this filters down into many facets of education today.

There were many scientists who were upset at this documentary because they claimed it is fictitious and grossly fabricated. One article claimed that G. Gonzales, one of the featured scientists in the film *Expelled*, was blown out of proportion because he truly did not deserve to receive tenure at Iowa State University. According to L. Lebo, Gonzales brought in little grant money, failed to mentor students, and his publishing all but disappeared (Lebo, 2008, p. 56). Gonzales actually received multiple grants, maintained positive relationships with colleagues and students, and published an impressive amount of research (Discovery Staff, 2008). Gonzales was not just passed over; he was systematically forced out. There actually was a lawsuit brought against the University involving Guillermo, his attorneys, Senator Heartsuch, and the Discovery Institute (Lebo, 2008, p. 56). This is only one of several examples where a scientist was persecuted for relating to intelligent design.

Another example that was highlighted in the article by Lebo was Richard

Sternberg's exile from the Smithsonian. "That article, *The Origin of Biological Information and the Higher Taxonomic Categories* by Stephen Meyer, proved so embarrassing to the Biological Society of Washington (BSW) and to the Smithsonian itself that the BSW council publicly disavowed it and said that it never should have been published. And that is where this saga begins" (Lebo, 2008, p. 57). Richard Sternberg was the editor of that publication and was therefore responsible for letting a "design" article be published. Should a person lose their position as editor for allowing an article to say something that the scientific establishment does not promote? Richard Sternberg did lose his position at the Smithsonian and has voiced his displeasure over the matter. Many questions are being raised about academic freedom in America.

This is the academic atmosphere that is trickling down to children in K-12 education. The researcher addresses this issue in part by asking, "Is this an appropriate topic of discussion in your school setting?" (Hoodman, 2010, appendix). Most of the public school teachers are expected to respond that this topic is not appropriate because of the academic freedom limitations that have been set forth in the scientific establishment and the courts. However, private and homeschool teachers may have a different response as a result of a less restrictive environment.

Where is the intelligent design discussion allowed? Is it allowed in public, private Christian, private Jewish, or homeschool? The dynamics in each environment are very different, but this scientific debate permeates each educational environment in one form or another. In public schools, a recent study showed that 30% of recent public high school graduates knew about creationism (Bowman, 2007, p. 307). If there is a discussion happening in the public school classroom, then it is also reasonable to say that private

schools are also entertaining this debate. Allowing this debate to occur gives students the opportunity to identify the strengths and weaknesses of evolution and intelligent design.

Twenty states have advocated the right to teach intelligent design in science classes, including Michigan and New York; five states: Florida, Kentucky, Mississippi, Oklahoma, and Alaska—did not teach evolution in the science classroom at all during recent years (Sharpes & Peramas, 2006, p. 158). It is true that these statistics have changed and do change every year as a result of the continued legal battles over public school classrooms, but it does show that this debate is still relevant.

Religious Assumptions

History tells researchers that scientists who held religious assumptions made many scientific discoveries; this does not mean that science was ever free from conflict and religious problems, but scientists who believed in a designed universe, as their primary assumption, were able to move forward with incredible success. N. Copernicus, F. Bacon, J. Kepler, G. Galilei, R. Descartes, I. Newton, R. Boyle, M. Faraday, G. Mendel, W. T. Kelvin, M. Planck, and A. Einstein are only a few of the scientists from history's past that held religious views about a universe that had to be designed (Deem, 2007). These famous scientists believed that the universe displays such a complex and elegant design that it must have been the work of an intelligent designer.

Is there a clear line that separates science and faith? This well known philosophical argument is called the demarcation problem (Giberson & Yerxa, 2002, p. 209). Most of the current scientific literature on the evolution versus intelligent design debate mention, or at least imply, the demarcation problem. C. G. Hunter states in his book entitled *Science's Blind Spot*, "Science, like our everyday decision making, is a

combination of rationalism and empiricism. There are some assumptions made (rationalism), and observations are used (empiricism). But the assumptions could be false. They cannot be proved by science. Rather, the assumptions are above the science-they are metaphysical" (Hunter, 2007, pgs. 35-36). As a result of their assumptions, scientists seek to find data to support those assumptions. These presuppositions can be so deeply ingrained in people's minds that sometimes they are unaware that they exist.

Whether a scientist believes in evolution or intelligent design, both begin their investigations with certain assumptions. The evolutionist begins with the assumption that only purely naturalistic laws and processes govern the universe, while an intelligent design scientist will start with a belief that complexity is evidence of design and therefore conclude that there must be a designer. Meyer argues that the attempt to exclude intelligent design by using a single set of methodological criteria (such as falsifiablility, observablity, repeatability, and the use of law-like explanation) will fail because these criteria do not validate naturalistic assumptions (Giberson &Yerxa, 2002, p. 209). Both sides of the debate have certain assumptions; however, only evolution has received credibility from the scientific community. Naturalistic assumptions are acceptable, while theistic assumptions are no longer considered.

The current literature is filled with the ongoing debate between evolutionists and intelligent design proponents over public education; however, the literature does not intentionally address the gap in discussion to this debate as it relates to public, private, *and* home schools. This is the gap that this thesis seeks to fill. The United States court system is set up to provide guidance on difficult issues, but this debate continues in light of strong opinions on both sides about what constitutes an appropriately approved science

curriculum. This becomes complicated when academic freedom and religious assumptions are questioned in secular society.

CHAPTER THREE

Methods

Currently there are several choices in educating your children. Many people take advantage of the public school system, which is free to all and supported by taxpayers, and those who can afford to send their children to private school pay thousands of dollars each year to the institution of their choosing. Homeschool is another option that also costs a considerable amount of money and is an enormous time investment, although not as much as private school. Usually private and homeschool is religiously based; whereas, public school does not include faith-based education. How do these education options compare in regards to the evolution versus intelligent design debate? It is because of this question that a study was conducted in public, private, and homeschools. The private schools have a large variety of curriculum and beliefs, so this pilot study included convenience samples from interviews conducted at Christian, Jewish, and orthodox Jewish educational institutions.

Traditionally, science seeks to observe the evidence in nature and then draw conclusions, whatever they may be. Many students do not question the accepted scientific paradigm, whether evolution in public school or intelligent design (creationism) in private or homeschool, but this could be limiting students' ability to think through all of the evidence and theories. Students could be presented with evolution the way that an evolutionist would present it, and they could also be presented with intelligent design the way that an intelligent design proponent would teach it. Each view could get a fair hearing while presenting the best evidence each has to offer. This would allow students to evaluate the strengths and weaknesses of each theory according to Bloom's Taxonomy

(Woolfolk, 2008, p. 530). Higher levels of thinking would be exercised through a fair treatment of this debate.

The participants identified for this study were K-12 science teachers because they are responsible for student learning. Although most of this debate is occurring at the high school level, the researcher also included elementary school because children begin forming their worldview slightly earlier than the crucial teenage years. According to Piaget's stages of cognitive development, a child will begin to understand and solve abstract problems in a logical fashion as early as age eleven (Woolfolk, 2008, p. 39). Teaching eleven and twelve year olds for seven years in the public school has given the researcher ample time to reflect on students' abilities to comprehend abstract concepts and become more scientific in their thinking.

Public School Participants*	**Private School** Participants*	**Homeschool** Participants*
Nigel (Grades 9-12) *High School*	Klein (Grades 6-12) *Orthodox Jewish*	Clyde (Grades K-12)
Fulton (Grades 7-8) *Middle School*	Abraham (Grades 7-9) *Jewish*	Wilson (Grades K-12)
Jones (Grade 6) *Elementary*	Tate (Grades 6-12) *Christian*	Feinberg (Grades K-12)
Varlie (Grade 5) *Elementary*	Baye (Grades 9-12) *Christian*	Danbury (Grades K-5)
Doolittle (Grades 9-12) *High School*		
Johnson (Grades 9-12) *High School*		*Names have been changed to preserve confidentiality.

Public School Teachers

Public school was identified in the current literature primarily because this is where all of the legal battles have taken place. "The American dilemma over church-state issues and the more specific quandary over the role of evolution in public education are

reflected in the crucible of the courts" (Zirkel, 2009, p. 13). Three of the public school teachers identified themselves as religious, and three of them as non-religious. All of them have taught for at least 12 years or more and have held California teaching credentials. Two of the teachers interviewed are in elementary education, but the rest described their junior high and high school teachers. The participants all teach in suburban Orange County public schools; all the names have been changed to preserve confidentiality.

Nigel is currently finishing 36 years of teaching high school science. This person has taught primarily life and earth science in grades nine through twelve. Nigel is of European descent. This educator claims to be an atheist and is not religious; however, this person practiced Mormonism until the age of 16. The student demographics have been primarily European descent and English speaking, with more Latino Spanish speaking students comprising the population in recent years; socioeconomics among these students are generally middle-class.

Fulton is currently retired after teaching seventh and eighth grade science for over 40 years. This person claims to be religious and is of European descent. Students were mostly European descent and English speaking, but included a heavy Indian descent and Hindi speaking population in later years. Students came from primarily middle to lower class socioeconomic status.

Jones is a sixth grade, multiple-subject teacher with 14 years of elementary school teaching experience. This person said that she does not regularly attend religious services, but was brought up in the Buddhist faith. Jones reports having taught grades three, four, and six. Student demographics include a variety of Caucasians, Hispanics, and Asians

living in middle-class families. Jones is first generation Cambodian who arrived in the United States at age six.

Varlie has been in elementary education for 12 years and is also not religious. This educator currently teaches fifth grade, and students come from middle-class families; they are primarily English speaking with a diversity of ethnicities represented: European, Hispanic, Asian, African, and Pacific Islander. Varlie has taught fourth, fifth, and sixth grade and is of European descent.

Doolittle has taught biology, anatomy, and physiology at the high school level for 22 years. Students are from middle to lower-class socioeconomics with a diversity of ethnicities. Doolittle is of European descent and is of the Christian faith.

Johnson has been teaching biology and chemistry for 26 years at the high school level. Johnson practices the Christian faith and is of European descent. Students have been mostly European descent and English speaking, with more Latino Spanish speaking and other ethnicities being present in recent years. Socioeconomics are middle to lower class.

Private School Teachers

Klein teaches at an orthodox Jewish private school teaching science to grades six through twelve. This person is of African descent and is a Christian; Klein has been teaching for nine years in a variety of school settings including inner city, college, and private. Student population consists of Jewish children of European and Middle-Eastern descent. Student families consist of middle to upper class socioeconomics.

Abraham has been teaching for eight years in seventh, eighth, and ninth grades. This educator teaches physics at a liberal Jewish private school and student demographics

are Jewish children of European and Middle-Eastern descent with English being their primary language, but this private school is situated in a very wealthy community with high socioeconomic status. Abraham is not religious and is of European descent.

Tate teaches in the life and earth sciences at a Christian private school for grades six through twelve. This person is a Christian and has been teaching for three years to students who are primarily European descent and English speaking. Students come from middle to upper class families.

Baye teaches science at a Christian private school to grades eight through twelve in earth science, physics, and chemistry. This person is a Christian and holds to a young earth creationist viewpoint. Baye is of European descent, and student population is primarily European descent and English speaking with some students of Asian descent. Socioeconomics include middle to upper class families.

Homeschool Teachers

Clyde has been teaching two students for the past 12 years, which has included science. This educator has taught using a biology curriculum called *Exploring Creation With Biology* published by Apologia Educational Ministries, Inc. This middle-class, European descent English speaking, family is Christian and attends church regularly.

Wilson has been homeschooling two students for about four years, but has taught public, private school, and homeschool for the past 17 years. This middle class Christian family is of European descent and speaks English as their primary language. Wilson has a master’s degree in education and has held a California teaching credential.

Feinberg has been homeschooling for 21 years and has a graduate degree in Spanish. This person educated teachers in a local public school district for four years,

training them in Spanish, prior to homeschooling children. This middle class Christian family attends church regularly. Feinberg is of South American descent and is bilingual, speaking both English and Spanish. Feinberg has educated six students in all subject areas.

Danbury has been home schooling two students for four years and holds a California teaching credential. This upper class Christian family is of European and Vietnamese descent and speaks English as their primary language. Danbury teaches her children, grades pre-school to third, in all subject areas.

Instrumentation

The interview questions were designed to help evaluate how educators value the discussion of evolution versus intelligent design in their classrooms. To begin with, the researcher wanted to understand what type of teaching experience interviewees were able to offer their students. Teaching experience could possibly give insight into how a controversial debate such as this is handled in the classroom. An experienced teacher will recognize effective ways to handle controversy by asking three questions: “What is the nature of controversy? How do teachers determine when to engage students in a controversial issue? How should teachers conduct themselves when teaching a controversial issue?” (Malikow, 2006, p. 106). Experienced teachers might handle this controversy in a more appropriate way than an inexperienced teacher would if they feel that it is a permissible discussion in their school setting.

The researcher did not want to assume that every teacher was aware of this debate, so the second question was designed to investigate if the teacher knew of the evolution versus intelligent design debate before the interview was given. After it had

been established that the teacher was, in fact, aware of the debate, the next question allowed interviewees to respond to its appropriateness in their school environment. The fourth question asked about the benefits for students to engage in this discussion because curious students might bring it up even if the subject is controversial (Malikow, 2006). Along with benefits, there might also be detrimental aspects to this discussion as well because of its controversial nature.

The next two questions evoked strong opinions regarding this topic, so great care was taken in selecting the appropriate words. Question five was written to investigate the teacher's opinion on students' critical thinking skills in regards to current scientific theories. This question was the main focus of the study because it addressed critical thinking in science education. Question six reaches for the philosophical consequences of this debate and was designed to expose the interviewee's worldview. Whether a teacher ascribes to agency in nature will determine a broader worldview that can "leak" into a science teacher's vocabulary (Cleaves & Toplis, 2007, p. 33). The last question simply asks if the interviewee knows of any other educators who discuss this debate. This last question would reveal any other interaction regarding this controversial issue in the educational community at large.

Initially, the researcher used an audio recording device, but most of the data was collected only through writing down teacher responses. The audio recording seemed to make interviewees uncomfortable and less willing to be completely honest in their responses, but it did preserve the authenticity of the responses when carefully transcribed. One interview was conducted through e-mail because of schedule conflicts.

The educators providing the qualitative data for this study represent public, private, and homeschool environments in which K-12 students are enrolled. Through use of the interview questions, the researcher was able to gather teachers' opinions on the controversial subject of evolution versus intelligent design. These questions were designed to gain knowledge of how much critical thinking is occurring in the various classroom settings.

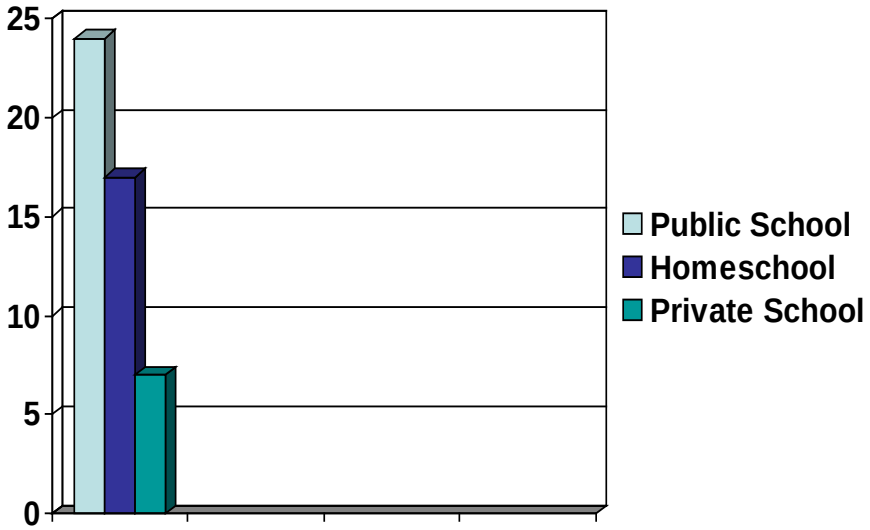
CHAPTER FOUR

Analysis

Question One: Briefly describe your teaching experience?

After analyzing the overall teaching experience from public, private, and homeschool, the interview responses clearly show that the public school teachers had the higher average teaching experience than private and homeschool. The public school teachers interviewed displayed a mean of 24 years experience, while private school teacher experience was seven years on average, and homeschool teachers had an average of 17 years experience. There were six public school teachers interviewed; four private school teachers were interviewed; and four homeschool teachers were interviewed. The least experienced teachers from each category were: 12 years in public school, three years in private school, and five years in homeschool.

Average Teacher Experience (in years)



Question Two: Are you aware of the evolution/intelligent design debate?

All educators (100%) interviewed were aware of the debate; however, 50% of public school teachers had additional comments. Generally the comments made were to express "strong feelings" on the topic. Mr. Fulton and Mr. Nigel considered the debate a "distraction" to the curriculum because there is too much science to teach; however, Ms. Doolittle proposed strong feelings in welcoming the debate. Private and homeschool teachers did not make any additional comments.

Question Three: Is this an appropriate topic of discussion in your school setting? Why or Why not?

Most (67%) of the public school teachers reported that this was not an appropriate topic, but two out of the six (approximately 33%) said that it was permissible if students initiate the discussion. Most of the private school teachers stated that this topic was appropriate, but one out of the four (25%) said that it was not an approved topic of discussion. All of the four (100%) homeschool teachers reported that this was an acceptable debate in their home setting. Nine out of 14 teachers interviewed (64% of the entire sample) said that the evolution versus intelligent design debate was appropriate. This majority within the sample, however, does not speak for public school teachers.

Question #3	Appropriate	Not Appropriate
Public	2	4
Private	3	1
Home	4	0

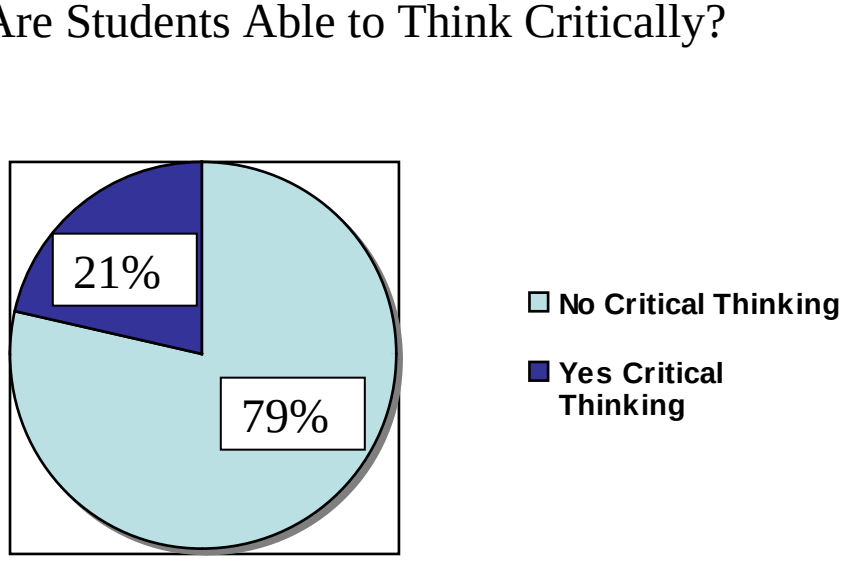
Question Four: How is this debate beneficial or detrimental for students to engage in?

The majority of the sample (71%) agreed that debating these ideas was mostly beneficial, while only four teachers reported that this topic might have detrimental results for their students. The public school teachers responded with a majority (67%) saying that they would welcome this debate if the curriculum allowed for it. Half of the private school teachers (50%) said that it was more detrimental than good, while all of the homeschool teachers (100%) agreed on the benefits of this discussion with their students.

Question #4	Beneficial	Detrimental
Public	4	2
Private	2	2
Home	4	0

Question Five: Are students today able to critically think about current scientific theories and ideas? Why or Why not?

The interview results show that 79% of all the educators interviewed felt that K-12 students were not able to critically think in today's science classrooms; conversely only 21% reported that students were able to critically think through today's scientific theories. Four out of six public school teachers (67%) reported that their students were not able to think critically. None of the private school teachers (0%) felt that students were able to critically think through current scientific theories. Most of the homeschool teachers (75%) reported that there was a lack of critical thinking happening, not in their school environment, but in the public schools because of the acceptance of evolutionary theory.



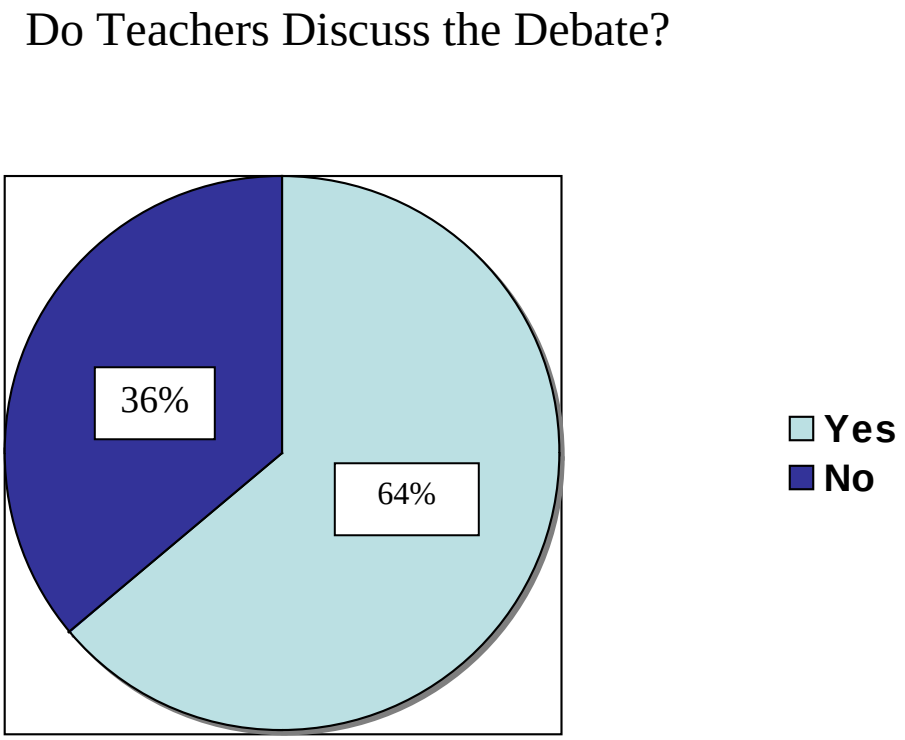
Question Six: What larger ramifications, if any, exist because of this debate?

It was reported by public school teachers that 50% commented on the issue of separation between science and religion as being the primary cause for this debate. Seventy-five percent of all private school teachers also realized this idea of science and faith being separate, while 25% of homeschool teachers also responded with comments about the ramifications between science and religion. Half of all respondents commented on various other ramifications that resulted from this debate of evolution versus intelligent design.

Question Six	Public	Private	Home
Science/Religion	3	3	1
Other	3	1	3

Question Seven: Are there any other educators that you know of who are aware of this debate?

A majority (64%) of all the teachers interviewed responded that they have had conversations regarding the evolution versus intelligent design debate. All (100%) of the homeschool teachers reported that this debate was an essential topic. Three out of four private school teachers (75%) also said that this was a big issue, and was discussed among faculty. A minority of public school teachers (33%) mentioned that they talked about it occasionally.



CHAPTER FIVE

Summary of Findings

There were several themes that the researcher noticed in the data, which were somewhat consistent with the current literature. *Appropriateness* was a theme that identified the teachers' opinions on whether to engage in the topic of evolution versus intelligent design or not. *Curriculum* was another area that became an essential component to this argument because this was what directed learning in the classroom. Separation between *science and religion* was a clear theme that the researcher identified in both the literature and the qualitative data of this study. The last theme discussed will be the aspect of *critical thinking* and how teachers reported on students' abilities in this area.

Appropriateness

Most of the public school teachers reported that this topic was not appropriate for discussion. Considering recent court cases such as the *Kitzmiller versus Dover* decision, this response was not surprising (Dewolf, 2006). It also was not surprising to find that most private school educators said this was not only an appropriate topic, but that many families choose to educate their children in an environment that would address the issue. Homeschool teachers were unanimous on the issue as well, saying that this debate was appropriate because they chose to educate their students in evolution and creationism.

The common thread among public school teachers in this response was that invoking a designer into a scientific discussion was not appropriate because "religion is a no-no" says Jones (sixth grade elementary). According to the public school teachers, this debate should take place, in the social studies or world religions setting because it is

important that students are exposed to a diverse learning forum. This debate could potentially "expand students' horizons." The main concerns regarding this topic in the public schools were the possibility of parent complaints and unprepared (lack of knowledge and developmentally not ready) students. Half of the public school teachers reported that, even though this discussion would benefit students, it should take place in a social studies rather than a science classroom.

Half of the private school teachers said that this debate was detrimental because students might be marginalized or have a "feeling of not belonging," and the discussions regarding origins sometimes get "too emotional" report Abraham and Klein (both Jewish private school teachers). The only concern in the homeschool arena was that children would be exposed to "lies" in regards to evolution. In contrast to the public school teachers, private and homeschool teachers did not identify this debate as solely religious, with the exception of the orthodox Jewish school where science was kept from turning into a religious discussion. Klein reports, "Science and religion is kept very separate here because some students will go on to become rabbis who only need training in religious pursuits."

One last idea that was consistent with the literature was the limited discussions that happen in the younger grades. Most of the K-8 teachers reported that they do not have discussions with students or colleagues very often. The current literature was relatively silent when it came to elementary school; high school was the focus of most literature. Many of the teachers (86%) interviewed in this study mentioned that students are generally not ready to engage in discussions on human origins because they do not have enough information or they are not developmentally ready. Varlie is quoted as

saying, “The whole debate, in general, can be controversial for elementary school children (because they are) too young.”

Curriculum

Most of the public school teachers mentioned or implied that there was not enough time for this discussion because it was not part of the state standards. If the curriculum does not allow for this debate, then it does not matter what teachers’ opinions are on the topic because their job is to teach the standards. Many of the court cases have been over the state standards which direct student learning (National Center for Science Education, 2007). Johnson responded, “Students bring it up, but public school has standards and I am not paid to teach the controversy.” The standards currently do not allow this discussion even though students sometimes ask about it. Doolittle reiterates the point by saying, “We are required to teach and stay focused on the California State Standards.” The standards are the boundary lines for teachers, and it is difficult to deviate from the curriculum.

Half of the public school teachers did mention that this discussion would better fit within a social or religious studies curriculum. Nigel reports, “I think it [evolution versus intelligent design] should be taught, but not in science!” Nigel’s view is consistent with the National Academy of Sciences (NAS) and most evolutionists. The president of the NAS wrote, “I write to you now because of a growing threat to the teaching of science through the inclusion of non-scientifically based “alternatives” in science courses throughout the country” (Alberts, 2005, p. 1). Other public school teachers agreed that this debate is not scientific, but religious.

Christian private schools were unanimous in teaching the controversy as a part of the science curriculum. Baye says, “I like to teach the truth of all sides.” This educator wants the evolution versus intelligent design debate to be a relevant discussion in science classes. Tate responds, “Our kids need to understand all the different views on origins.” This educator’s science curriculum includes this debate to expose students to the various theories so that they can understand what the debate entails.

This debate is also included in the home school science curriculum. All four (100%) homeschool teachers report that this is an essential debate. It is presented at most of the homeschool conventions each year; there are many available resources to teach the controversy. Feinberg states, “I’m glad there is a debate because I think for years, since Darwinism took over, people were taught only the theory of evolution as the truth; so if we can introduce another theory (then) it’s a good thing.” Other homeschool teachers had similar comments regarding the importance of this debate.

Science and Religion

The most consistent idea supported by the literature was that science and religion were separate. Half of all the teachers (50%) interviewed expressed the idea that science and religion were separate. Both religious and non-religious teachers agreed on this point, even though they might not agree on the outcome of a discussion on the topic. This idea has been well documented in the literature for almost the past 150 years. Ferngren reports in his book *Science and Religion: A Historical Introduction* that J. W. Draper and A. Dickson wrote on this very topic (science and religion) during the nineteenth century (Ferngren, 2002, p. 4). Since this debate between science and religion has been going on for so long, it was further confirmation to hear what today’s teachers had to say about it.

The term “religion” was also reported by using terms such as “philosophy,” “theology,” and “ethics” in response to what larger ramifications existed because of this debate. Fulton’s reaction to this question was this: “There are basically three kinds of people: those who know much about the Bible and very little about science; those that know much about science and very little about the Bible; and those who know very little about either.” This identification coincides with ideas presented in I. G. Barbour’s *Religion and Science*, “how views of God and human nature were affected by the new methods of inquiry in science and the new scientific understanding of nature (Barbour, 1990).” There was a clear separation for many of the interviewees between science and religion, and this was revealed in the current literature as well.

The distinct separation between science and religion was reported among public and private school teachers. Varlie said, “There could certainly be a theology class or social studies type class where you might be able to discuss intelligent design.” Varlie recognized that a separate curriculum, that was not part of science, would be needed to have this discussion. Klein responded, “Faith and science become too distant or separate.” The orthodox Jewish school where Klein teaches intentionally kept the two separate.

In contrast, homeschool teachers held a consensus view on how intertwined faith and science can be. Danbury says, “It’s not just science. It’s faith and knowing that the Bible is true. Ethical problems exist, for example: the holocaust or abortion.” In this view, science and religion are combined and result in ethical problems for a society. Clyde says, “It’s the core. I think [that if] you look at a person whose belief is evolution, then that’s going to really affect that there’s no God.” Clyde is saying that a scientific

belief in evolution can result in a religious belief in Atheism; therefore, there is no separation between the two.

Critical Thinking

The majority of teachers in this study (79%) reported that students today lacked critical thinking skills in regards to this debate. It must be noted, however, that the homeschool teachers were referring to their view of public school students and not their own students. Wilson said, “My impression is generally in the public schools they are not [able to think critically] because they’re only presented with the theory of evolution; anything else that’s presented is usually mocked or frowned on.” This quote reveals the perception that homeschool teachers have of public education. The reason that a majority of teachers reported a lack of critical thinking was that students accept most of what they were taught.

Children are impressionable and will accept what they are taught at home and at school. Fulton reported, “Unfortunately, that’s the way some of them [students] approach it [taking the science book as fact], and our educational system is set up to encourage it.” Sometimes students will go along with any theory that is presented because it is in the textbook. Another strong influence in children’s lives is their family. Tate said, “Students are able to think up to a certain worldview: they are either limited in a ‘Christian bubble’ or they are limited in a ‘secular bubble.’ ” Johnson also agreed with this perspective when she reported, “They [students] struggle through what their family has taught them.” Students will be strongly established in the beliefs with which they are raised with, and this can also limit critical thinking skills.

The last issue in discussing critical thinking was the fact that there were so many concepts to teach that it left little time for anything else. Klein reported, “[I had] more time to think previously, in my childhood, and there is too much material today.” Klein recognized that in the past students had more time to think through scientific concepts. Doolittle said, “We have a pacing plan that is very tight time wise.” It is common for most schools today to have rigorous schedules that leave little time for reflection and evaluation of concepts.

These four themes of *appropriateness, curriculum, science and religion,* and *critical thinking* became evident to the researcher through the responses of the educators interviewed. Many of the teacher responses reflected what the current literature had to say in regards to the evolution versus intelligent design debate. Continuous debate in these areas will determine the opportunities for critical thinking among K-12 students. Popular opinion recognizes a separation between science and religion, and many teachers struggle with how to handle the “demarcation problem” appropriately. Science and religion have interacted in the past, but it remains to be seen if they can relate appropriately in today’s science curriculum.

CHAPTER SIX

Conclusion

There are important options which may foster critical thinking among K-12 students, such as creating new classes or curriculum to accommodate the evolution versus intelligent design discussion. Private and homeschool educators discussed the topic of evolution and intelligent design presenting both sides of the debate to educate their students on the current arguments and evidence. This chapter will also outline the various limitations of this pilot study, which were the interview process, limited access to educators, a lack of probing questions, and a lack in clarity among the questions asked. Results of this study may be a springboard for further research on this topic through focus on the teachers' religious and cultural background and curriculum.

Important Options

What are some options that may stimulate critical thinking among K-12 science students? One of the ideas presented by three public school teachers who were interviewed was that there might be open discussions on the topic of human origins in the social studies curriculum. This option was suggested because some feel that science and religion are two separate subjects. According to S. J. Gould, science and religion should not interfere with each other. "I propose that we encapsulate this central principle of respectful noninterference – accompanied by intense dialogue between the two distinct subjects, each covering a central facet of human existence – by enunciating the Principle of NOMA, or Non-Overlapping Magisteria" (Gould. 1999, p. 5). Should there be a separate curriculum to house the evolution versus intelligent design debate?

While having this debate within the social studies curriculum may be one option, it would not be acceptable for intelligent design proponents who argue that there is a scientific argument for design. “In determining whether biological organisms exhibit specified complexity, design theorists focus on identifiable systems – such as individual enzymes, metabolic pathways, molecular machines and the like” (Dembski, 2004, p. 35). If intelligent design were allowed into public school curriculum for science, would this create too much tension resulting in a culture war? The options for public school in regards to this debate seem limited, but this discussion is happening in private and homeschool with limited results in stimulating students’ critical thinking.

There is also concern regarding the appropriate age group to have this discussion. Is this debate more suited for grades nine through twelve rather than K-12 education? The literature was filled with examples coming from public high schools. Three of the most recent cases involving the evolution versus intelligent design debate were: “In 2000, *Rodney LeVake versus Independent School District 656,* in 2005*, Selman versus Cobb County School District,* and also in 2005*, Kitzmiller versus Dover*” (National Center for Science Education, 2007, p. 2). The researcher could find no examples of this debate happening in elementary school. However, homeschool educator Wilson stated, “They start having questions by at least second grade.” New York State Standards for grades five through eight are written as follows: “Evolution is the change in a species over time. Millions of diverse species are alive today. Generally this diversity of species developed through gradual processes of change occurring over many generations” (New York State Education Department, 2010, p. 19). Although most of the legal battles have occurred at

the high school level, the researcher found evidence that shows how this debate affects elementary age students as well.

Private and Homeschool

There was actually more discussion on the evolution versus intelligent design debate happening in private and homeschools rather than in the public schools. The limited discussion on this topic in the public schools was consistent with the literature. Public schools have tried unsuccessfully to question the weaknesses of evolution through alternative curriculum (*Kitzmiller versus Dover*), disclaimers that evolution is only a theory (*Selman versus Cobb County*), and open discussions on evolution's strengths and weaknesses (*Levake versus Independent School District 656*) (National Center for Science Education, 2007). However, the literature was silent when it came to describing private and homeschool discussions on the topic. The researcher was able to identify that private and homeschool teachers generally (75%) welcomed this debate. According to Tate (private school teacher), "Students need to understand all the different views on origins so they can determine the limitations of secular and Christian worldviews." Presenting different views on origins gave students the option to think critically through conflicts between science and religion. Wilson (homeschool teacher) states, "Students need to know both sides [of the debate] in order to make an opinion that means something to them." When students can personalize the debate for themselves, they can be more confident in their stance on the subject.

Limitations

A disadvantage within this study is the interview process itself and the few numbers interviewed, because this may only be a limited perception of what is really

happening in the classroom. Interviews only provide information "filtered" through the views of the interviewer and the interviewees (Creswell, 2008, p. 226). The interviewer may ask questions that lead the interview toward a biased way of thinking and responding, while the interviewee may give responses that are an inaccurate perception of reality. Although it is impossible to eliminate all bias from the interview process, the interviews were conducted as objectively as possible.

Another limitation to this study was that only fourteen interviews were conducted. To gain a better understanding of educators' perceptions on this topic, it would be essential to conduct at least 25-30 interviews in each venue of education – public, private, and homeschool. There were six public, four private, and four homeschool teachers interviewed that allowed the researcher to evaluate a limited perspective on the debate. The variety within private schools also needs to be addressed because only two evangelical Christian and two Jewish schoolteachers were interviewed.

The researcher could have probed with additional questions to get more feedback from the participants. These probes could have clarified points or helped interviewees expand on ideas (Creswell, 2008, p. 229). The researcher did not extensively test the questions prior to the interviews, and could have developed additional questions to help clarify interviewee responses. Additionally, some of the qualitative data collected was limited because the researcher moved too quickly from question to question without expanding on ideas brought up during the interviews.

One last problem that the researcher noticed was the lack of clarity in some of the interview questions. For example question five states, "Are students today able to critically think about current scientific theories and ideas? Why or Why not?" (Hoodman,

2010, appendix). Rather than commenting about their students' critical thinking skills, some of the home schoolteachers commented how they thought public school students were able to think critically. The question could have been rephrased to say, "Are your students able to think critically?" Clarity in the questions would provide the desired feedback without as much confusion.

Recommendations For Further Research

The majority of teachers interviewed (public, private, and homeschool) reported that their students lack critical thinking skills; therefore, it seems there is still a significant problem. How can critical thinking be stimulated in K-12 science education? This would be starting ground for further educational research. Anyone who is involved with education should be concerned with this problem because a lack in critical thinking will affect the future leadership of the country. Most of the teachers (86%) agreed that students should debate various ideas to stimulate critical thinking. Should there be consideration realigning our academic standards to include this debate on human origins? Including this discussion in all classrooms across the United States would allow students a choice as to the different possibilities; students could then analyze what side of the debate seems most reasonable to them by critically thinking through them. It may be true that there are strong arguments for evolution, and it may also be true that there are equally strong arguments for design.

One concern that the researcher noticed during this study was how important the religious and cultural upbringing of the educator turned out to be. There were interesting correlations between the educators' personal upbringing and their opinions on the debate of evolution versus intelligent design. Does a person's religious affiliation affect how

they view science and religion? Tate states, “What came first? Science or the Bible?” This educator was commenting on an observation he had made in regards to what came first in a person’s life . . . science or the Bible? According to Tate, if science came first, often times this would dictate a large separation between science and religion. It would be interesting to research how significant a person’s religious versus scientific background affects their view on this debate.

The significance of curriculum was another important topic that was identified in this study. If the debate between evolution and intelligent design were to be approved for discussion in the public schools, what curriculum would be used? Currently there are a variety of textbooks available on evolution, creationism, and intelligent design. *Principles of Human Evolution* by Lewin and Foley is a textbook that “helps students gain a perspective on human evolution in the context of modern biological thinking” (Lewin & Foley, 2005, back cover). This would be a text used to support an evolutionary standpoint. *Exploring Creation With Biology* by Wile and Durnell states, “If you learn nothing else in this course, learn to appreciate the wonder of God’s Creation” (Wile & Durnell, 2003, p. ii). Creationism is the primary focus of this text. *Of Pandas and People* by Davis and Kenyon claims, “*Of Pandas and People* is not intended to be a balanced treatment by itself. We have given a favorable case for intelligent design and raised reasonable doubt about natural descent” (Forrest & Gross, 2004, p. 286). This textbook would be used to present a case for intelligent design. What if students had access to all three of these textbooks and to the full scope of the debate? They would be able to evaluate the evidence for and against each presentation, and be able to dialogue through each theory.

Even though the issues of important options, limitations, and recommendations have been addressed, the researcher would be greatly encouraged to see further investigation on the debate between evolution and intelligent design because there are still many unresolved problems. This debate could be the source of new critical thinking opportunities that will benefit K-12 education in the future if students, teachers, administrators, and policy makers allow open discussion within this field.

Christians and people of faith should be concerned with this problem because it is an opportunity to stimulate critical thinking for the glory of God the Creator. Whether teaching in the public, private, or homeschool setting, educators can stimulate critical thinking through presenting evolution versus intelligent design by allowing students to reach conclusions based on evidence rather than on what the educators say is true. It is possible for anyone to recognize the evidence in creation and come to the reasonable conclusion that the Psalmist does in the 19th Psalm: “The heavens declare the glory of God; and the firmament shows His handiwork. Day unto day utters speech, and night unto night reveals knowledge” (Radmacher, 2007, p. 836). Day and night brings God’s glory through the intricately designed atmosphere and finely tuned cosmological display that should invoke our minds and the minds of our students to an endless array of wonder, posing the question, “Who is the Designer?”

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Appendix

Project: "The debate of Evolution v. Intelligent Design: Is critical thinking occurring among K-12 students?"

Time of Interview:
Date:
Place:
Interviewer:
Interviewee:
Position of Interviewee:

The purpose of this study is to examine what educational opportunities students are exposed to in regards to evolutionary theory and intelligent design theory.

You will be asked a series of closed and open-ended questions that will last approximately 15-20 minutes. I will record your responses on this interview protocol form and/or audio recording to be used for further investigation within this study.

Please read and sign the consent form.

Questions:

1. Briefly describe your teaching experience?

2. Are you aware of the evolution/intelligent design debate?

3. Is this an appropriate topic of discussion in your school setting? Why or Why not?

4. How is this debate beneficial or detrimental for students to engage in?

5. Are students today able to critically think about current scientific theories and ideas? Why or Why not?

6. What larger ramifications, if any, exist because of this debate?

7. Are there any other educators that you know of who are aware of this debate?

Thank you for your cooperation and participation in this interview! Your responses will be kept strictly confidential.

Informed Consent Form

Participant's name: _____

I authorize Kyle Hoodman student of the Education Department, Biola University, La Mirada, California, to gather information from me on the topic of evolution v. intelligent design.

I understand that the general purposes of the research are to examine what educational opportunities students (K-12) are exposed to in regards to the evolution v. intelligent design debate, and that I will be asked to respond to a seven question interview. The approximate total time of my involvement will be 15-20 minutes.

I am aware that I may choose not to answer any questions that I find embarrassing or offensive.

I understand that my participation is voluntary and that I may refuse to participate or discontinue my participation at any time without penalty or loss of benefits to which I am otherwise entitled.

I understand that if, after my participation, I experience any undue anxiety or stress or have questions about the research or my rights as a participant, that may have been provoked by the experience, Kyle Hoodman will be available for consultation, and will also be available to provide direction regarding medical assistance in the unlikely event of physical injury incurred during participation in the research.

Confidentiality of research results will be maintained by the researcher. My individual results will not be released without my written consent.

The potential benefits of the study are to contribute insight on a controversial discussion among educators and to allow students a clear perspective on the debate.

_____ _____

Signature Date

There are two copies of this consent form included. Please sign one and return it to the researcher with your responses. The other copy you may keep for your records.

Questions and comments may be addressed to Kyle Hoodman, of the Education Department, Biola University, 13800 Biola Ave., La Mirada, CA. 90639-0001. Phone: (562) 903-6000.