

AN ANALYSIS OF THE ARGUMENTS FOR INTELLIGENT DESIGN CREATIONISM TO
BE TAUGHT IN SCIENCE CLASSES, IN THE PUBLIC EDUCATION SYSTEM OF THE
UNITED STATES

By

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CREATIONISM IN UNITED STATES PUBLIC SCHOOLS

Abstract

Teaching *creationism*, also called *creation science*, *intelligent design (ID)*, and *evidence against evolution*—a religious doctrine, holding that life and the universe were created by a supernatural actor out of nothing—contravenes the First Amendment of the U.S. Constitution, and is illegal in U.S. public science classes. Nevertheless many U.S. high school science teachers continue to teach creationist doctrine as part of an undocumented, or *hidden*, curriculum.

The arguments advanced in this study propose that creationism—as opposed to *evolution*—cannot be defined as *science*, and seeks to answer the following questions:

- (1) What arguments have been put forward by advocates of creationism, to make the case for creationist ideology in U.S. public school science classes?
- (2) What impact have the arguments of proponents of intelligent design creationism had, on American public education policy and the law?

Data has been collected from relevant U.S. court rulings and associated texts, e.g., expert witness testimony under oath, cross-examination, and published works referred to in the proceedings. Testimony was analysed for its content—content analytic—to address specific creationist arguments with regard to scientific rigour, honesty and empirical reasoning. Judicial opinion proved to be more relevant in terms of commentary—context analytic. Judges as decision makers have given clear accounts of how creationist arguments have swayed their ruling, and thus U.S. law and government education policy, thereby directly addressing this study's second research question.

In addressing these questions, this research has provided a summative analysis of the arguments presented for ID to be taught in the science classrooms of U.S. public schools, and the counter arguments which have convinced U.S. judges to deny consistent attempts to include religious doctrine in science curricula. In doing so, this study provides a detailed *baseline* to

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which future arguments can be compared to highlight new—or simply recycled—points in the debate, and to identify any potential strategies for alleviating this on-going and costly dispute.

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As an immigrant to Canada who has only recently successfully taken his Canadian citizenship examinations, I am keenly aware that Canadian immigration, post-graduate study, and life in our adopted country would not have been at all possible without the love and support, in all ways practical and emotional of Lorraine's parents, John and Joyce Barber.

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Chapter 1

Introduction

Since the teaching of evolution in American public schools met its first legal challenge in the Scopes monkey trial of 1925 (*Scopes v. Tennessee*, 1927; Linder, 2008), an on-going debate has been in effect over the *manufactured controversy* as to whether theories of *creationism*—also called *creation science*, *intelligent design (ID)*, *abrupt appearance theory*, and *evidence against evolution*—can legally be taught as part of the United States science curriculum. I use the term *manufactured controversy* because at first examination it would appear that no such controversy should exist. My research aims to provide and analyze a summary of the arguments presented for ID to be taught in the science classrooms of U.S. public schools, and the counter arguments which have convinced successive U.S. courts to deny the inclusion of its doctrine in science curricula.

A Definition of Terms: Creationism and the Central Tenets of Evolution

Creationism has been defined as an inherently religious doctrine, or hypothesis, holding that life and the universe were created by a supernatural actor out of nothing (Superfine, 2009). The term *creationist* has been derived from this description and defined as “anyone who endorses the theistic creation of the universe and/or life within the universe” (Wendel, 2007, p. 1). Wendel further refined his definition by excluding those who accept evolutionary science, but still believe in a theistic cause for the beginning of life and the universe. He then sub-divided all remaining creationists into *old-earth creationists*—those that accept geological timescales for the origin of the universe and formation of the earth—and *young earth creationists*—those that believe in the biblical six days of creation and that the earth is approximately 10,000 years old.

ID, sometimes referred to as *intelligent design creationism*, is a subset of creationist belief, as are the concepts of *creation science*, *abrupt appearance theory*, and *evidence against*

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evolution; all seek to fit theological hypotheses into a scientific framework. Leading ID proponents, such as Professor of Biochemistry, Michael J. Behe of Lehigh University, Pennsylvania, argue that many aspects of molecular systems are too complex to be explained by current science and that “such systems were deliberately designed by an intelligent agent” (Behe, 2010, p. 1; Davis & Kenyon, 1993). However, Professor Behe’s notions of ID have been so strongly disputed that his biographical entry on the Lehigh University web page contains an *official disclaimer*:

My ideas about irreducible complexity and intelligent design are entirely my own. They certainly are not in any sense endorsed by either Lehigh University in general or the Department of Biological Sciences in particular. In fact, most of my colleagues in the Department strongly disagree with them. (Behe, 2010, para. 2)

Throughout this study, the terms intelligent design, intelligent design creationism, or simply ID, will refer specifically to the subset of creationist belief that proponents have attempted to explain as science, or in scientific terms. The term creationism, will refer to an all-encompassing view of the origins of life, literal to Judeo-Christian biblical teachings which predate any notions of ID.

Evolution can be defined as a “change in the properties of groups of organisms over the course of generations” (Futuyma, 2005, p. 2), and its predominant mechanism—*natural selection*—is definable as “a deterministic difference in the contribution of different classes of entities to subsequent generations” (Futuyma, 2005, p. 550). As Futuyma explains, natural selection is a complex concept. *Entities* can be one of several forms of a particular gene (an *allele*), they can be a collection of genes possessed by an organism (a *genotype*), they can be populations or even an entire species, and the differences they confer are most usually inherited.

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It is these inherited differences which mean that natural selection is the only process which can produce *adaptation* (Coyne, 2009). *Adaptation* is the genetic change within a population that results in the average state of a character becoming “improved with reference to a specific function, or whereby a population is thought to have become better suited to some feature of its environment” (Futuyma, 2005, p. 545). It is important to note that the *phenotype*—an observed characteristic, or function—is different from the *genotype*. Environmental effects on an organism’s phenotype, will not affect genes passed on to subsequent generations—a female mouse that loses its tail, will not give birth to tailless offspring. The environment does not *cause* adaptation, but genetic change may result in some measure of increased *survivability* of an organism within the environment—the adaptation may be said to be *selective*.

Non-selective mechanisms of genetic change—*genetic drift*—are the result of random changes in the frequencies of two or more alleles within a population. As Coyne (2009) pointed out, “[t]his leads to evolutionary change that, being random, has nothing to do with adaptation. The influence of this process on important evolutionary change, though, is probably minor, because it does not have the molding power of natural selection” (p. 32).

One of the central tenets of evolution is that of *gradualism*, the incremental steps that are required for many—possibly millions—of generations to produce substantial change, such as that from aquatic to terrestrial organisms (Coyne, 2009; Dawkins, 1996; Futuyma, 2005). Evolution describes how—in a graduated manner—life has arisen from, ultimately, one ancestral organism. Illustrating the duality of *common ancestry*, or *coalescence*, where the genetic material of one or more populations is derived from a single ancestral source (Coyne, 2009; Futuyma, 2005), and *speciation*—where changes result in reproductive *isolation* for a population *within* a species, resulting in two or more descendant species. As Coyne (2009) stated:

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Speciation doesn't happen very often. But each time one species splits into two, it doubles the number of opportunities for future speciation, so the number of species can rise exponentially. Although speciation is slow, it happens sufficiently often, over such long periods of history, that it can easily explain the stunning diversity of living plants and animals on earth. (p. 26)

As has been described, evolutionary science encompasses some of the fundamental principles of modern biology (Coyne, 2009; Dawkins, 1996; Futuyma, 2005), and has been termed the “unifying theory of the biological sciences” (Futuyma, 2005, p. 14). As such, I would contend that its importance in a modern biological science curriculum cannot be overstated.

Purpose

The overarching aim of this study is to examine why—given the weight of scientific evidence, government policy, and legal precedent—attempts are still made to teach Christian doctrine—in the form of creationism and ID—in United States public school science curricula (Berkman & Plutzer, 2011; Moore, 2000, 2004; National Centre for Science Education—NCSE, 2014a). In addition, this study investigates why—despite the illegality of teaching creationism as part of U.S. public school science classes—a large number of U.S. high school science teachers, administrators, and school board officials continue to make the deliberate effort to work creationism into U.S. public science classes as part of an undocumented, or *hidden* curriculum (Berkman & Plutzer, 2011; Davis & Kenyon, 1993; Donnelly & Boone, 2007; Long, 2011; Moore, 2000, 2004; Scott & Branch, 2006).

Despite the amount of debate and all of the work previously cited, very little academic study has focussed on the discourse, in an attempt to weigh the arguments presented (Bowman, 2007; Burt, 2008; Thomasson, 2011). The purpose of this study is to close such a gap in the

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literature, and assess the empirical evidence supporting the arguments for creationism to be included in U.S. public science classes. The outcome of this study is intended to provide a status point, a *baseline*, to which educators can compare future challenges from creationist proponents, and help to avoid the long and costly legal, administrative, and often social conflict (Lebo, 2008), which so often result.

Research Questions

To address the above aims, two main research questions guide this study:

1. (a) What arguments have been put forward by advocates of creationism, to make the case for creationist ideology in American public school science curricula? (b) Are these arguments scientifically plausible? (c) Do they withstand the assault of academic rigour and empirical reasoning?
2. (a) What impact have the arguments of proponents of creationism had on American public education policy and the law? (b) Have these arguments curtailed—or enabled—the overt, legalised teaching of ID in American public science classes? (c) What rationale could justify the denial of these arguments in successive court hearings?

By analyzing court material such as expert witness depositions, testimony, and judicial opinion, it is possible to extract the arguments that have been used to make the case for creationism in U.S. public education, thereby addressing research question 1. The results of these cases, their relative success in setting judicial precedent, and the detailed opinion of presiding judges, similarly contain the rationale being pursued in research question 2.

Creationist advocates have included expert witnesses in U.S. court cases, textbook authors, teachers, and school board representatives. Arguments from these sources are historically part of public record (e.g., expert witness testimony, minutes of school board

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meetings, journal articles, textbook content, and online discussion), and may be extracted from relevant documentation. Similarly, the impact of this discourse can be followed through legal precedent, judicial opinion, and the on-going status of public debate.

Decision Makers

The final arbiters of American public policy and the law, if not the final classroom practice of teachers, are the three branches of U.S. government: the Judiciary (e.g., judges, district, federal and Supreme Courts), the Legislature (Congress—the Houses of Senate and Representatives), and the Executive (the President and his Cabinet). Historically, the legislative branch of government has produced occasional—and unsuccessful—advocates of creationist teaching:

On November 5, 2012, Clayton Fiscus (R-District 46), a new member of the Montana House of Representatives, asked for a bill to be drafted that would “[r]equire public schools to teach intelligent design along with evolution.” As such, the bill would presumably conflict with the decision in the 2005 case *Kitzmiller v. Dover*, in which requiring the public schools to teach “intelligent design” was held to be unconstitutional.

(NCSE, 2012)

This example failed to become statute, but serves as an example of how the public controversy of teaching ID in U.S. science classes can be a feature of the current political landscape. However, as has been shown, the judiciary has consistently succeeded in preventing such advocacy becoming law. Therefore, it is in the judicial opinion of the U.S. legal system that the reasoned argument for the failure of such attempts shall be sought.

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A Summation.

This chapter has introduced the concept of the public—as opposed to *scientific*—controversy of creationism versus evolution, which is the illegal inclusion of creationism as a suitable subject for inclusion in U.S. public school science curricula. Key terms have been defined and a guide to how and where they shall be used has been provided. This chapter outlines the purpose of the study, its unique contribution to an existing pool of knowledge, and through a discussion of the history of the topic, has provided a rationale for using court documentation as the data source for this research.

In Chapter 2, I provide a detailed explanation of the history and nature of the controversy over teaching religious doctrine in U.S. public school science classes, in combination with a review of the literature surrounding the issue. Chapter 3 describes the methodology and methods used to collect the data for analysis in this research. Chapter 4 presents document analysis findings, broken down into the major themes that have emerged from the data. Finally, Chapter 5 discusses how research questions have been addressed and the implications of research findings.

Chapter 2

Rationale and a Review of the Literature

Why the Controversy?

In 1925, the 64th general assembly of the state of Tennessee passed house bill number 185—the Butler Act, which outlawed the teaching of “any theory that denies the divine creation of man and teaches instead that man has descended from a lower order of animals” (Butler Act, 1925, p. 1). The Butler Act was rapidly tested by the American Civil Liberties Union (ACLU) and defendant, Dayton county biological science teacher, John Scopes (*Scopes v. Tennessee*, 1927; Linder, 2008). Scopes and the ACLU lost the case, and although an appeal to the State Supreme Court upheld the Butler Act as *constitutional*, Scopes’ conviction was overturned on a legal technicality. This effectively prevented any further opportunity for the ACLU to take the case to the United States Supreme Court (Linder, 2008; *Scopes v. Tennessee*, 1927). Nevertheless, legal debate continued with regard to the constitutionality of the Butler Act for almost half a century (Larson, 1997; Linder, 2004).

The United States Constitution—Religious Clauses: History, Intent, and the Evolution of the Creationist Challenge

Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof... (U.S. Constitution, 1791).

The First Amendment to the United States Constitution (the *Establishment Clause*) is part of the Bill of Rights. Ratified in 1791, it specifically prohibits the establishment of any statute: (a) creating a national religion, (b) preventing the dominance of any one religion over another, (c) curtailing the freedom of speech of the press, (d) curtailing the freedom to peaceably assemble, and (e) curtailing the freedom to petition government for redress of grievances.

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The first test of the religious clauses came before the Supreme Court in 1878 (*Reynolds v. United States*), relating to a case of *polygamy*—a state of marriage where one spouse may have more than one partner at a given time—under federal jurisdiction. The Supreme Court upheld the conviction of George Reynolds, a member of the Church of Jesus Christ of latter-day Saints, for bigamy in the Utah Territory, stating “[l]aws are made for the government of actions, and while they cannot interfere with mere religious beliefs and opinions, they may with practices” (p. 166). This set the legal precedent that religious practices could not override federal law.

The Lemon Test

While the original intention of the religious clauses of the First Amendment can be interpreted as to protect the right of the individual to worship without fear of government intervention, a later case precedent has extended that intent to include secularism and education policy. This is exemplified by the three prongs of the *Lemon Test*, established in the case of *Lemon v. Kurtzman* (1971). The Supreme Court ruled that the Non-Public Elementary and Secondary Education Act 1968 of Pennsylvania, which allowed the state to pay faith-based, non-publically-funded schools for salaries and resources used to teach secular material, breached the First Amendment. What have been called *the three prongs* of the Lemon Test have since been used as an effective assessment of the violation of the First Amendment, these require that:

1. The government's action must have a secular legislative purpose.
2. The government's action must not have the primary effect of either advancing or inhibiting religion.
3. The government's action must not result in an excessive *government entanglement* with religion.

Originally, covering only acts of Congress, a Supreme Court ruling (*Everson v. Board of Education*, 1947) set the precedent for applying the First Amendment across all states. Later, the

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Supreme Court was to state that the core intent of the First Amendment was to not favour one religious faith over another or over a lack of faith (*Board of Education v. Grumet, et al.*, 1994).

As has been shown, the content of the religious clauses of the First Amendment of the United States Constitution, the federal law to which all state education policy must adhere, has evolved over time. The original intent to protect freedom to worship, has gradually changed through a series of legal precedents to its more complex status of today, involving interpretation of the Lemon Test and prior judicial opinion. Since *Scopes v. Tennessee* in 1927, consideration of the First Amendment and/or the Lemon Test has formed the basis—in whole or in part—of the rulings for each of 10 major creationism vs. evolution cases. These cases have been identified by the National Center for Science Education (NCSE, 2011), as follows:

1. *Epperson v. Arkansas* (1968),
2. *Edwards v. Aguillard* (1987),
3. *Freiler v. Tangipahoa* (2000),
4. *Kitzmiller v. Dover* (2005),
5. *LeVake v. Independent School District (ISD)*, (2002),
6. *McLean v. Arkansas* (1982),
7. *Peloza v. Capistrano* (1994),
8. *Seagraves v. California* (1981),
9. *Selman v. Cobb County* (2005), and
10. *Webster v. New Lenox* (1990).

The Endorsement Test

As an addendum to the Lemon Test, United States Supreme Court Justice Sandra Day O'Connor proposed the endorsement test in *Lynch v. Donnelly* (1984). Failure of the endorsement test shows that the Establishment Clause has been breached, if it can be said that a

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reasonable observer might perceive the government to be either endorsing or disapproving of religion. Justice O'Connor stated:

The Establishment Clause prohibits government from making adherence to a religion relevant in any way to a person's standing in the political community. Government can run afoul of that prohibition in two principal ways. One is excessive entanglement with religious institutions... The second and more direct infringement is government endorsement or disapproval of religion. Endorsement sends a message to nonadherents that they are outsiders, not full members of the political community, and an accompanying message to adherents that they are insiders, favored members of the political community... (*Lynch v. Donnelly*, 1985, § VI.I, para. 1)

The proper inquiry under the purpose prong of Lemon, I submit, is whether the government intends to convey a message of endorsement or disapproval of religion. (*Lynch v. Donnelly*, 1985, § VI.I, para. 2)

The term *reasonable observer* has been defined most recently as “an informed citizen who is more knowledgeable than the average passerby” (*Modrovich v. Allegheny*, 2004, § III.B.I). Here, the observer would have a knowledge of the history and context of a given dispute. For example, if students of a public high school were to observe a newly installed plaque at the front of the school, which read *In God We Trust*, they would have a knowledge of the history of the school—the plaque was a new installation and a knowledge of context, and as such, they would be aware of its religious theme. As a result, they might reasonably assume an endorsement of such a theme on the part of school administration. The endorsement test and the Lemon Test, therefore, have frequently been considered in a complimentary fashion in cases

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involving the Establishment Clause of the First Amendment (*Freiler v. Tangipahoa*, 2000; *Kitzmiller v. Dover*, 2005; *Selman v. Cobb County*, 2005).

Avoiding the prongs of purpose and effect. In order to meet the standards of both Lemon and the endorsement tests, it has been necessary for attempts to include creationism in U.S. public school science curricula to avoid appearing theistic in nature, and to at least appear to be based on science. The Lemon Test does not—and was never intended—to distinguish between theism and science. Many of these major cases have simply attempted to circumvent the First Amendment by fitting creationist beliefs to hypotheses that might be *analysed* by science, but include *answers* proposed by theistic hypotheses. Such *pseudoscientific* notions have been termed variously, *creation science*, *ID*, *abrupt appearance theory*, and *evidence against evolution*. For example, the argument for balanced treatment of *creation science* and evolution has been used (in chronological order) in *McLean v. Arkansas* (1982), *Freiler v. Tangipahoa* (2000), *LeVake v. ISD* (2002), and *Kitzmiller v. Dover* (2005). The argument that forbidding the teaching of creationism curtailed free speech, was used in *Seagraves v. California* (1981), *Webster v. New Lenox* (1990), and *Pelozo v. Capistrano* (1994)—where it was also argued (unsuccessfully) that evolution should also be termed a religion. Whilst each of the cases identified above also failed on the grounds of contravening the First Amendment, there were at least four cases where judicial opinion discussed the issue of whether ID could be considered science. These were: *Epperson v. Arkansas* (1968), *McLean v. Arkansas* (1982), *Edwards v. Aguillard* (1987), and *Kitzmiller v. Dover* (2005). However, despite a discussion of ID, the *Epperson* and *Edwards* ruling was based solely on the amendments to the U.S. Constitution.

***Epperson v. Arkansas* (1968).** In 1968, the U.S. Supreme Court ruled in favour of Little Rock, Arkansas, high school science teacher Susan Epperson, when she challenged a 1928 statute prohibiting the teaching of evolution in any state supported school or university. The

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Court held that “[t]he statute violates the Fourteenth Amendment, which embraces the First Amendment's prohibition of state laws respecting an establishment of religion.” (p. 1) *Epperson* established the precedent that a state does not have the right to prescribe a public school curriculum to “prohibit teaching a scientific theory or doctrine for reasons that run counter to the principles of the First Amendment.” (p. 2)

Edwards v. Aguillard (1987). In *Edwards v. Aguillard* (1987), the U.S. Supreme Court held that a Louisiana law, referred to as the “Creationism Act”, prohibiting the teaching of evolution in public schools, except when accompanied by the teaching of creation science, was unconstitutional. The Court found that by endorsing a specific religion, the act was in breach of the First Amendment (Establishment Clause). The Court found that “[f]orbid[ding] the teaching of evolution when creation science is not also taught undermines the provision of a comprehensive scientific education.” (p. 1)

The U.S. legal system has relied upon the Establishment Clause and the Lemon Test to provide useful precedent for such cases, but—as has been shown—creationist proponents have moved further away from theistic vs. scientific arguments. The more complex area of ruling upon what constitutes science, and what constitutes theology, has formed the basis of only two court judgements in more than 80 years of U.S. legal history—*McLean v. Arkansas* (1982) and *Kitzmiller v. Dover* (2005).

Beyond the Lemon Test

McLean v. Arkansas (1982). In *McLean v. Arkansas*, a United States District Court ruled against the defendants (Arkansas Board of Education, including the Director of the Department of Education, and the State Textbooks and Instructional Materials Selecting Committee) that the 1981 Arkansas Balanced Treatment for Creation-Science and Evolution-Science Act violated the

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Establishment Clause of the U.S. Constitution. In a decision that gave a detailed definition of the word *science*, U.S. District Court Judge William Overton defined five essential characteristics:

- (1) It is guided by natural law;
- (2) It has to be explanatory by reference to natural law;
- (3) It is testable against the empirical world;
- (4) Its conclusions are tentative, i.e., are not necessarily the final word; and
- (5) It is falsifiable. (*McLean v. Arkansas*, 1982, § IV.C)

The court referred to the notion of teaching the *two model approach*, of creationism and evolution, as equal intellectual disciplines as a “fallacious pedagogy”. The judgement clearly placed *creation science* within the realms of theology with the statement, “[t]he conclusion that creation science has no scientific merit or educational value as science has legal significance in light of the Court's previous conclusion that creation science has, as one major effect, the advancement of religion.” (*McLean v. Arkansas*, 1982, § IV.D)

Kitzmiller v. Dover (2005). More recently, in October 2004, the Dover Area School District (Pennsylvania, defendants) added the following statement to their biology curriculum “[s]tudents will be made aware of gaps/problems in Darwin’s theory and of other theories of evolution including, but not limited to, intelligent design.” (*Kitzmiller v. Dover*, 2005, p. 1) Another statement was read to ninth grade biology classes offering ID as an alternative to evolution and referring students to an overtly creationist textbook held in the school library —*Of Pandas and People: The Central Question of Biological Origins* (Davis & Kenyon, 1993).

Eleven parents (Tammy Kitzmiller *et al.*, plaintiffs), represented by Pepper Hamilton LLP (attorneys), the American Civil Liberties Union (ACLU) and Americans United for Separation of Church and State (AU) sued the school board, alleging contravention of the Establishment Clause of the First Amendment to the United States Constitution. The National Centre for Science Education acted as *pro bono* consultants for the plaintiffs.

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In previous cases (e.g., *Edwards v. Aguillard*, 1987; *Epperson v. Arkansas*, 1968), the Supreme Court had ruled against teaching creationism in public schools on the basis that creationism was religious in nature. Decisions on these grounds have meant that courts did not have to provide a detailed breakdown of the religious nature of ideas such as ID, and why these differ from science. By avoiding such a discussion, this has allowed further challenges to policy and law, meticulously phrased to avoid the effect and purpose prongs of the Lemon Test. ID—and its proponents—for example, avoid making direct references to a specific *designer*, thereby attempting to circumvent the Establishment Clause.

In December 2005, Judge John E. Jones III, a conservative Republican appointed by George W. Bush, delivered his 139 page judgement in favor of the plaintiffs. His judgement was based partly on consideration of the First Amendment with reference to the Lemon and endorsement tests. In addition, and more importantly, for the first time in American legal history, a court ruling would consider, in detail, the nature of ID and evolutionary science. This judgement set a standard against which future cases of religious doctrine—masquerading as science education—would be measured, and provided an empirically-supported, legal-basis for educational policy-making. As then *David and Deborah Fonvielle and Donald and Janet Hinkle Professor of Law*, Stephen G. Gey of Florida State University College of Law, a specialist on religious liberties and free speech, stated:

“After *Kitzmiller*, the ID effort to recast creationism as serious science is effectively dead. The clear implication of this holding is that attempts to inject ID into public school curricula will always be unconstitutional, regardless of whether these attempts are accompanied by disingenuous assertions of a secular purpose by the relevant educational authorities...

(Gey 2005, para. 9)

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The same conclusions will apply to any other school board that buys into the ID project. Although these statements by the judge have been criticized by ID proponents, the truth is that for the first time a judge has uttered in a formal capacity what the scientific community has known all along: the ID claims for scientific legitimacy are not just a sham (as the Supreme Court once described an earlier argument for creationism), but also a scam.” (Gey 2005, para. 10)

Creation Science vs. the Science of Evolution: What is Science?

Creationist proponents have consistently sought to break down the *boundaries* between the *scientific theory* of evolution and the theology of creationism, often attempting to reduce the importance of the term scientific theory, whether through ignorance of its true definition or political expediency is difficult to judge. For example, one of the disclaimers in science textbooks in the case of *Selman v. Cobb County* stated that, “[t]his textbook contains material on evolution. Evolution is a theory, not a fact, regarding the origin of living things” (*Selman v. Cobb County*, 2005, § I). Others have sought to equate the science of evolution with theological belief, referring to a *religion of evolutionism* (*Freiler v. Tangipahoa*, 2000; *Pelosa v. Capistrano*, 1994). Whilst others have dressed creationism in a lab’ coat and called it *creation science*, *ID*, or similar pseudoscientific terms (Behe, 2006; Davis & Kenyon, 1993).

Creation Science is Not Actually Science

Professor of biochemistry Michael J. Behe, has appeared as an expert witness and advocate of ID, most notably in the case of *Kitzmiller v. Dover* (2005). Behe has argued that many molecular systems in the cell require multiple components in order to function. Behe further contends that traditional *gradualistic* Darwinian evolution does not explain these systems.

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He believes that all components of the system would have to be in existence simultaneously in order for the system to function. Behe has referred to such systems as *irreducibly complex* (Behe, 2006). Professor Behe has proposed that a better explanation is that such systems were deliberately designed by an intelligent agent. Of the myriad of biochemical systems existing in nature, Professor Behe has identified only three which he believes require such simultaneous functionality, and are thus inexplicable according to current science: (a) the bacterial flagellum, (b) the blood-clotting cascade, and (c) the immune system.

Behe discussed his claims of irreducible complexity for the immune system under cross-examination in the *Kitzmiller v. Dover* trial. In response, he was presented with 58 peer-reviewed articles, nine books, and several textbook chapters on the subject—all refuting his hypotheses—which, he simply stated, were not “good enough” (*Kitzmiller v. Dover*, 2005, p. 78). In addition, his claims for the rotating bacterial flagellar motor were comprehensively refuted by Dr. Kenneth Miller at Brown University, Rhode Island (Miller, 1999, 2004). Miller discussed the bacterial *Type Three Secretory System* (TTSS). The TTSS, whilst not used in rotatory movement, is one of several systems used by parasitic bacteria for pumping toxic substances through their cell walls, which poison their host organism. The TTSS works by pumping large protein molecules, with a specific three-dimensional structure, through a similarly shaped point of exit—analogueous to an automated machine dispensing specifically shaped objects—rather than a simple hole through which a substance might just *flow*.

This *dispenser* is made of a small number of protein molecules, each one comparable in size and complexity to the molecules being dispensed through it. These mechanisms are found to be similar across bacteria that are not closely related. Miller (2004), discussed the likelihood that the genes for making them have probably been co-opted—almost *copied* and *pasted*—from other bacteria encountered historically. The protein molecules that form the structure of the TTSS are

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very similar to components of the flagellar motor. Miller has shown that, when the flagellar motor evolved, the components of the TTSS were probably *commandeered* for the slightly different function. In addition, Miller's (2004) work has shown that, as the TTSS *pushes* molecules through itself, it uses a simpler version of the principle used by the flagellar motor, which *tugs* the molecules of its *axle* around in a circular, propeller-like motion. Thus, Miller had shown, prior to the *Kitzmiller v. Dover* (2005) hearing, and prior to Behe's (2006) publication, that a number of components of the flagellar motor were already in place and working before the flagellar motor evolved, and it was no great leap in logic to see how the rest could be advantageous as it built up in Darwinian *graduated* stages.

If it is Testable, then is it *Science*?

Science and *scientific theories*, as opposed to *hypotheses*, are based upon experience of the natural world, including: (a) systematic observation, (b) analysis, (c) consistent results of well-designed, controlled, double-blinded—where applicable—experiment, and (d) they are *tentative*, that is, they cannot be proven absolutely, but with every positive observation, the validity of the theory increases (Ben-Ari, 2005; Kuhn, 1996; Popper, 1959). Scientific theory has the ability to predict further observations and is falsifiable (Popper, 1959). That is, if the theory is incorrect, just one contradictory observation will show it to be false. For example, the much over-used, but equally succinct, response to the question of what could falsify the theory of evolution, credited to J. B. S. Haldane: "Fossil rabbits in the Precambrian!" by Dawkins (2009, p. 147). The interpretation of this statement, being that the discovery of evidence of a mammal existing in an era long before evolutionary science showed that even vertebrates were present, would render the theory to be false. It is a process—referred to by the philosopher David Hume (1711–1776)—as *methodological naturalism* (Hume, 2000), the product of which is open to

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peers—*peer reviewed*—and must be accurately repeated with consistent results—*replicable*—before a consensus can be reached, and a hypothesis declared a scientific theory.

As Wendel (2007) rightly points out, the terms *testable* and *falsifiable* are not identical. For example, it may be possible to test a hypothesis and return with a level of probability that does not completely guarantee that hypothesis to be false—the result is *tentative*. Testability is, therefore, a pre-requisite of falsifiability, but not *vice versa*. A thousand carefully crafted trials of prayer to cure cancer may indicate the probability of its success as an intervention, but one single positive or negative result could not falsify a *null hypothesis*. In contrast, more than 150 years of observation and successful experiment have not completely guaranteed the scientific theory of evolution by natural selection, but one fossilized, Precambrian rabbit would show it to be false. Therefore, I would contend that given the nature of probability, the scientific definition of *testability* also implies an inherent level of *predictability* from the results.

Testability

Creationists claim that given their arguments, which they may base in testable, falsifiable formats, there must have been an original theistic causation. Whilst some arguments, such as those made with regard to the *Type Three Secretory System* (Behe, 2006), may be testable and have been shown to fall at every hurdle of scientific explanation (Miller, 2004), the claim of a theistic cause is not. For example, Professor Behe (2000) argued that the details of ID were testable:

Now, one can't have it both ways. One can't say both that ID is unfalsifiable (or untestable) and that there is evidence against it. Either it is unfalsifiable and floats serenely beyond experimental reproach, or it can be criticized on the basis of our observations and is therefore testable.

The fact that critical reviewers advance scientific arguments against ID

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(whether successfully or not) shows that intelligent design is indeed falsifiable. (Behe, 2000, § I)

Later, Professor Behe was to state that his hypotheses for the details of ID could be answered if one believed that they were deliberately designed by an intelligent agent (Behe, 2006). As Superfine (2007) has stated:

Although the major proponents of ID often frame the theory as a legitimate scientific alternative to evolutionary theory, the historical origins of ID are firmly rooted in the fundamentalist cultural and religious movement that has supported the teaching of biblical creationism in schools. (p. 1)

This supports the argument that creationism is *ultimately* untestable and not falsifiable, because experimental protocol cannot control for a final conclusion based on the logical fallacy of personal incredulity—where a researcher that cannot conceive of a scientific explanation for a given phenomenon decides that the explanation must somehow be theistic in nature. Therefore, testability remains a telling criterion for the demarcation of science and non-science, firmly placing creationist hypotheses in the realms of non-science.

Is Creationism Even a Valid Area of *Knowledge* Production?

Gieryn (1983) used the term “knowledge-producing institution[s]” (p. 394) when referring to religion and other areas of study. The author stated that a form of demarcation existed which “denied the cognitive authority of these competitive providers of knowledge and that justified increased public support for scientific education and research.” (p. 394) I would question whether creationism—as a subset of Judeo-Christian religion—is in fact *knowledge-producing*. Can a collection of inherently untestable hypotheses, doctrine, and arbitrarily assigned value judgements, with no empirical evidence to support them, be called *knowledge*?

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Hilpinen (1970) discussed the concept of knowledge as being “defined in terms of three conditions, of which the first may be termed the condition of acceptance or belief, the second, the condition of justification or evidence, and the third, the condition of truth.” (p. 110). By this definition, knowledge is highly subjective and contextualized. Acceptance or belief can easily be achieved with a convincing anecdote or two, but anecdotes are not evidence. Similarly, the notion of truth has long been debated by a variety of respected authors (Russell, 2009; Walker, 1989; Putnam, 1970, 1975; Foucault, 1980; Foucault *et al.*, 2012; Foucault & Hochroth, 1997; Tarski, 1944). Therefore, sufficient evidence is a necessary requirement of the ability to *know* something. However, the *sufficiency* of evidence may itself be questioned, as discussed by Costa (2010): “[y]our evidence (justification) is sufficient for your knowledge of *p*, but it does not make *p* true” (p. 152). The extraordinary claims of religion (e.g., that life and the Universe were created by a supernatural actor out of nothing) would thus seem to fall within David Hume’s axiom that “[a] wise man, therefore, proportions his belief to the evidence” (Hume, 2000, p. 84). This quotation has since been re-phrased by the noted American astrophysicist and science communicator Carl Sagan (1934–1996) as, “[e]xtraordinary claims require extraordinary evidence” (Sagan, 2006, p. 47). In its requirement of faith, religion offers no evidence for its claims (Coyne, 2009; Dawkins, 2006; 2009, Harris, 2008; Russell, 1997; Shermer, 2006).

Is Evolution Science?

A consensus of modern scientific thought declares evolution to be a fact. As Professor Richard Dawkins, first holder of the Charles Simonyi Chair in the Public Understanding of Science at the University of Oxford, U.K., stated:

Evolution is a fact. Beyond reasonable doubt, beyond serious doubt, beyond sane, informed, intelligent doubt, beyond doubt evolution is a fact. The evidence for evolution is at least as strong as the evidence for

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the Holocaust, even allowing for eye witnesses to the Holocaust. It is the plain truth that we are cousins of chimpanzees, somewhat more distant cousins of monkeys, more distant cousins still of aardvarks and manatees, yet more distant cousins of bananas and turnips... continue the list as long as desired. That didn't have to be true. It is not self-evidently, tautologically, obviously true, and there was a time when most people, even educated people, thought it wasn't. It didn't have to be true, but it is. We know this because a rising flood of evidence supports it. Evolution is a fact... No reputable scientist disputes it.... (Dawkins, 2009, p. 9)

These sentiments were echoed, if not in such colourful language, by University of Chicago, Professor of Biology, Jerry A. Coyne (2009):

Evolution is a fact. And far from casting doubt on Darwinism, the evidence gathered by scientists over the past century and a half supports it completely, showing that evolution happened, and that it happened largely as Darwin proposed, through the workings of natural selection.
(p. 13)

Evolution is not only science, it is a robust and highly successful line of research and a powerful explanatory model (Freeman & Herron, 2004; Futuyma, 2005; Lenski & Travisano, 1994; Miller, 1999, 2004; National Academy of Sciences and Institute of Medicine—NAS, 2008).

Evolution is largely an historical science, and so a considerable amount of the hypothesis testing has been observational. Nevertheless, a large body of experimental investigation has also been carried out, all with consistent, testable, falsifiable, peer-reviewed, and replicable results that enable a degree of predictability of future observation and experiment (Avisé & Wollenberg, 1997; Coyne, 2009; Dawkins, 2009; Edwards & Cavalli-Sforza, 1963; Futuyma, 2005; Lenski &

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Travisano, 1994; Miller, 1999, 2004; Nei & Kumar, 2000; Rice, 2007; Wiley & Lieberman, 2011). Such a list of supporting citations is necessarily brief, given that the history of evidence for evolution as science dates back to the discovery of fossils before Darwin first published the *Origin of Species* in 1859. Evans (2010) for example, documents the routine collection of fossils, contributing to reptile paleontology in the United Kingdom as far back as the 17th century.

More recently, modern scientific disciplines such as *phylogenetics*—the study of the genetic divergence over time of a group of *taxa* (often different species), manifesting in physiological, biochemical, behavioural and other changes—and biogeography—the geographic distribution of organisms—have contributed significantly to evolutionary science (Awise, 2000; Awise & Wollenberg, 1997; Brown & Lomolino, 1998; Wiley & Lieberman, 2011). It should be remembered that throughout the history of scientific investigation, of gathering empirical evidence and analysis of experimental data, not one example of J. B. S. Haldane’s Precambrian rabbits has ever been observed.

So the Situation is...

Creationism and its pseudoscientific notions of ID and creation science, have been shown to be founded in theology, and as such are inherently non-scientific, by organisations such as the National Academy of Sciences and Institute of Medicine (NAS), and are not to the standards of evidence required by the United States legal system. By the same reasoning, evolution is held to be science (*Kitzmiller v. Dover*, 2005; *McLean v. Arkansas*, 1982; NAS, 2008). Given that the Establishment Clause of the American Constitution forbids the teaching of religion in U.S. public school science curricula, and there is ample legal precedent for rejecting its inclusion (*Epperson v. Arkansas*, 1968; *Edwards v. Aguillard*, 1987; *Freiler v. Tangipahoa*, 2000; *Kitzmiller v. Dover*, 2005; *LeVake v. ISD*, 2002; *McLean v. Arkansas*, 1982; *Pelozo v. Capistrano*, 1994; *Seagraves v. California*, 1981; *Selman v. Cobb County*, 2005; and *Webster v.*

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New Lenox, 1990), the issue of whether to teach creationism in U.S. public school science classes would appear to be self-evident.

The Debate Continues: An On-Going Problem for Legislators

Gieryn, Bevins, and Zehr (1985), stated that “[c]reation-scientists try to use the authority of science to pursue intellectual, political or religious agendas that do not coincide with agendas pursued by the professional scientific community” (p. 403). This is still very much the case, and despite the weight of scientific evidence—empirical argument, government policy, and established legal precedent—attempts continue to be made to deliver creationism in American science classes, as reported by the National Center for Science Education (NCSE):

On November 5, 2012, Clayton Fiscus (R-District 46), a new member of the Montana House of Representatives, asked for a bill to be drafted that would “[r]equire public schools to teach intelligent design along with evolution.” As such, the bill would presumably conflict with the decision in the 2005 case *Kitzmiller v. Dover*, in which requiring the public schools to teach “intelligent design” was held to be unconstitutional.

(NCSE, 2012)

The NCSE later described how the bill had been re-phrased to use the term “encourage critical thinking regarding controversial scientific theories” (NCSE, 2013a) in place of the previous “[r]equire public schools to teach intelligent design along with evolution” (NCSE, 2012), presumably because the previous wording so overtly challenged the ruling in *Kitzmiller v. Dover* (2005). The bill was defeated in a later hearing, where the NCSE described “[o]ver twenty people attending the hearing, including scientists, teachers, theologians, school board members, and concerned parents, testified against the bill; none testified for it” (NCSE, 2013b).

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An On-Going Problem for Educators

Five years on from the landmark case of *Kitzmiller v. Dover* (2005), Berkman and Plutzer (2011) examined the attitudes of high-school biology teachers to the teaching of creationism in American public schools. Between March and May 2007, the researchers surveyed 1,942 U.S. high-school biology teachers. Data were taken from two identical questionnaires sent to recipients, randomly selected from a database containing contact details for more than 80% of U.S. public school teachers. Response rate was high—estimated at 50%, with a total of 926 valid respondents from 49 states ($n=926$), excluding Wyoming and the District of Columbia. Berkman and Plutzer found that 18% of respondents advocated creationism either “in passing” or with at least one hour of class time (p. 404), 28% of respondents indicated that they were advocates of evolutionary biology, and approximately 60% of respondents were neither advocates for evolutionary biology nor its non-scientific alternatives. In addition, 29% of teachers advocating evolution stated that they had been “nervous at an open house event or meeting with parents” (p. 404), whilst only 19% of creationist advocates had felt the same—a statistically significant difference, $\chi^2 = 5.1, p = 0.024$.

Berkman and Plutzer (2011) suggested that the “the cautious 60%” (p. 404), by avoiding advocacy of either position, might be more of a hindrance to scientific literacy in the U.S. than advocates of creationism. They argued that such a “non-position” might undermine the teaching of evolutionary science and lend credence to opposing argument—although it should be noted, this is not an assertion supported by the available survey data. In answer, they suggested that courses in evolutionary science aimed at pre-service teachers might help address issues of confidence and competence in the topic. They reasoned that greater scientific literacy within the teaching profession might reduce creationist advocacy. Additional research and scientific

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commentators support this argument (Cavagnetto, 2010; Dawkins, 2006; Long, 2011; Moore, 2004).

Awareness of legal requirements. The degree to which professional practice of teaching has been informed by policy and law has been explored by Moore (2004), when he investigated the awareness of Minnesota biology teachers of the legal issues surrounding the teaching of evolution in U.S. public schools. Moore surveyed Minnesota high-school biology teachers attending a meeting of the National Science Teachers Association in Minneapolis, Minnesota, in November 2003 and later, those attending the Tenth Annual Biology–Life Sciences Teachers Conference in St. Paul, Minnesota, in December 2003. A series of twenty survey questions, each with a definite right or wrong answer, were provided—for example, “Is it still a crime to teach evolution anywhere in the United States today?” and “Has a court determined that creation science has no scientific merit?” (p. 862). Participants were instructed to ignore questions to which they did not know the answer and at least 91% of respondents answered each question.

Moore observed that 29% of participants wrote unsolicited notes on their completed questionnaires. Approximately 20% of these were pro-evolutionary science and another 20% expressed dissatisfaction with the [then] status of evolution education. The remaining 60% of unsolicited notations were pro-creationist, with comments such as:

- “I’m a creationist and I plan my schedule so that I run out of time and don’t have to cover evolution”
- “I talk a lot about the holes in evolution; students need to know this information more than [that] they came from monkeys”
- “I refuse to teach evolution, but I talk about creationism whenever I can” (p. 861).

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Moore found: (a) approximately 75% of respondents had an understanding of some key points of legislation, (b) 27% of respondents still believed that science teachers teaching evolution could give equal time to creationism, (c) 29% either did not know, or believed that it was a crime to teach evolution in U.S. public schools, and (d) 65% either did not know, or believed that it was legal for administrators to require them to read aloud a disclaimer, saying that their teaching of evolution is not meant to dissuade students from accepting the biblical version of creation. Moore argued that despite understanding some points, many public school teachers were misinformed with regard to some of the most powerful resources in defending scientific literacy in public schools—court decisions.

Moore (2004) concluded by recommending that clear public policy statements and unambiguous state educational standards be communicated to all policy stakeholders, and suggested pre-service training and in-service workshops in both evolution and the legal issues surrounding its teaching for educators. Such recommendations have consistently been made by researchers in the field (Berkman & Plutzer, 2011; Cavagnetto, 2010; Dawkins, 2006; Donnelly & Boone, 2007; Linder, 2008; Long, 2011 and Moore, 2000), yet to date, remain largely unaddressed.

An On-Going Problem for Society

Continuing support for creationist ideology—a socio-political perspective. Apple (2008) explored the evolution versus creationism debate in U.S. education, examining its political context and discussing the destructive nature of its continuance. He discussed the growing right-wing movement—*authoritarian populism*—arguing that its popularity may have been due to millions of people feeling “economically and culturally threatened” (p. 329). He drew a connection between the socio-political ideologies of authoritarian populism to the use of ID, to circumvent the American Constitution and teach creationism in public schools, citing

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Kitzmiller v. Dover (2005). A connection still apparent in the anti-science rhetoric of right-wing political activists seven years later (Gorski, 2012).

Apple (2008) examined publications which focused on justifications for ID, and possible caveats of the popularization of evolutionary science. Apple explored ways for theists and non-theists to achieve common ground, in an argument he believed would have no clear resolution. He warned that without a strategic method of progressing the debate, “where progressive educators and activists may be able to build alliances with those for whom religion provides key grounding elements for their lives” (p. 334), there would likely be serious consequences for American education, resulting in parents withdrawing their children from public schools to avoid confrontation with a contradictory worldview. Consequently, Apple warned of a “very real breakdown in public understanding and in the ways in which claims to knowledge are debated” (p. 334).

An On-Going Problem for Students

The importance of acknowledging a theistic worldview, to move forward with this costly and intransigent debate, is supported by the ethnographic research of David Long (2010a, 2010b, 2011, 2012). Long (2011) has argued that creationism is part of the world-view for many biological science teachers, and ignorance of the law would only be one aspect of professional practice influencing the teaching of evolution. Long discussed what he believed to be the faulty premise of many science educators, that for a student to accept evolutionary science, it would be “a matter of being shown discrete points of Truth and adding these bits to our respective *Truth-piles*” (p. 14), and the idea that, as a result, “there simply would be no societal issue over evolution” (p. 14). Similarly, he criticises the “deficiency model” (p. 15), which essentially blames the student and their upbringing for resistance to evolutionary science.

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Long (2011) argued that evolution educators such as Dawkins, have not sufficiently considered the level of *existential anxiety* imposed on some creationist students when asked to accept evolutionary science. Long suggested we...

Consider a student who spends 3 hours a week for a semester being talked at by a biology Professor who only occasionally mentions evolution. At the same time, this same student has spent 20 years of their life building lifelong familial and community bonds with their country pastor who knows and professes that evolution is “the work of the Devil.” (p. 15)

Throughout the prior experience of this student, is the belief in creationism as a normative aspect of their culture. A student's learning, their internal self-analysis of the curriculum of their lives, is necessarily steeped in the dominant religious doctrine of a given community. It would therefore be impossible to entirely divorce a student's creationist worldview—a normative aspect of their community for many years—from any imposed theories of science.

To recognize the contrast of a creationist worldview with imposed scientific theory requires a sufficiently mature internal dialog, an analysis of the *hidden* and *explicit* curriculum that makes up the experiential sum of the student. This self-analysis of educational experience, described by Pinar (2012) as *currere*—an on-going, complicated conversation with oneself as the private intellectual, contributing to intellectual growth and enabling interaction with the public sphere of pedagogy—may provide a personal approach to pedagogical analysis and critique necessary to articulate connections between academic and personal knowledge, which merge the explicit and the hidden curriculum (Kissel-Ito, 2008). Self-analysis of educational experience may help to identify internal processes by which a creationist student may accept or reject the teaching of evolution. Long's (2011) ethnography goes some way to giving voice to these

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processes, but further research, more focussed on students' internal reconciliation of such conflicting notions as creationism and evolution, are required.

In his interviews with creationist students attending biological science classes at a university in the Ohio River valley of the U.S., Long (2011) found that most students experienced considerable existential anxiety when challenged by evolutionary science to move beyond the absolutism of theological dogma. When questioned about how they would respond to the idea that evolution was a fact, Long quoted his interviewees as follows:

It would be a complete crisis. It would be really tough. I've asked people this. Some people don't believe evolution because the Bible says so. I'm like, 'You have to have some rational reason'. People believe the Qur'an and all that stuff. We don't believe that. So then it would be a big crisis.

The Bible teaches evolution is not true. If the Bible is not true, then there is no afterlife. I don't know why I should be good in the first place.

There's a lot of conflict there. I'd have to try to find some other evidence. If there was no evidence, I'd either give it up, or I'd be too lazy to give it up because I want to keep my friends. (p. 41)

I have a fear of dying...and so...when I think of death, and everything... I just want there to be something more... you know, I don't want to just die... and life just keep going on... and the earth just keep going on without me... I want to go somewhere else, so... (*Julie trails off*) (p. 48)

Long (2011) argued that, for some, accepting evolution as fact would have far greater implications than altering, for example, a political stance. It would be a paradigmatic shift in worldview. Frequently the student chose what would appear to be the "positive, commonsensical, and affirmed" (p. 47) decision to reject the evidence for evolution. One subject

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stated, that accepting evolution as fact would require “a lot of work for me to change my worldview, a lot of time, a lot of alienation from friends.” (p. 41)

Long (2011) came to the conclusion that whilst science education rarely affected a complete change in the worldview of his subjects, in a minority, it did provide cause for doubt. In his fifth chapter, Long focused on three specific participants, finding that whilst pre-set conditions influenced by family and community can be highly influential, individuals can change their ontological position, as illustrated by one interviewee:

I did ask my mom one time, ‘What do you think about evolution’? And she just told me, ‘Don’t want to talk about it. Can’t believe you’re even thinking about it’. I mean well—she just told me that if I get into that, and believe in that, that I’m pretty much going to hell—to put in bluntly.

(p. 74)

The participant went on to explain what evolution meant to her:

I feel that it’s true. I mean, you know, growing up in my community, I was taught to not believe that at all, but I mean I can see the science behind it. So I guess that I’m just kind of questioning it all. (p. 74)

Statements provided by these interviewees illustrate the difficulties experienced by creationist students, the necessity for advanced self-analysis of their academic and personal knowledge—thereby returning to the idea of *currere* (Pinar, 2012)—and the articulation of the internal discourse of a paradigmatic shift in personal worldview.

By choosing an ethnographic methodology, Long (2011) has provided a unique perspective on the process by which creationist students accept or reject the evidence for evolution. Such resistance to a fundamental aspect of the biological sciences therefore represents far more than just a question of curriculum content, akin to the question of teaching certain

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mathematical topics in grade 6 or grade 7. Rather, simply considering that evolution might be a reality, calls into question a cultural “norm” and the central tenets of the Judeo-Christian faith. It is therefore not difficult to understand Long’s assertion that, despite the numbers of students educated in evolution, U.S. social structures have continued to influence individuals to believe in creationism.

Whilst Long (2011) argued against teaching creationism in the science classroom and approached the topic from a declared evolutionist standpoint, he remained practical and less judgemental—in comparison to other recent commentators (Dawkins 2006; Dawkins & Menon, 2003; Gould, 1999, 2002; NAS, 2008; Scott & Branch, 2006). Practical in terms of recognising the normative aspect of religion in American society, and that regardless of the level of tolerance for religiosity within the realms of science education, a science teacher at any level may be challenged (possibly frequently so), with the student statement “I didn’t come from no stinkin’ monkey!” (Long, 2011, p. 13). If so challenged, an effective teacher must be ready and willing to engage in the topic in a manner which does not alienate the student. Such engagement requires the teacher to imitate Long, in setting aside the evaluative judgments identified early in his work, namely creationists are stupid, have misconceptions about science, and are intrinsically antiscience (p.16).

Despite such a balanced argument, Long’s (2011) narrative plainly criticises a lack of commitment to either creationism or evolution, itself a subjective stance that—given the nature of the debate—would be almost impossible to avoid. This highlights the difficulty of adopting a truly objective stance with regard to primary research and data collection, especially relating to such a hotly-contested debate, comparing faith with more than 150 years of replicable and falsifiable evidence.

In closing, Long (2011) argued:

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A robust evolution education stands to gain by explicitly historicizing and philosophically orienting students...

Explicitly teaching more students not only the nature and limits of science, but the nature and limits of religious faith, from their mutual roots in philosophy would at least enrich our ability to negotiate difference. (p.179)

This echoes part of the judgment in the previously cited case of *Kitzmiller v. Dover* (2005), where Judge John E. Jones III accepted that creationism and evolution might be discussed in a science class, as an exercise in critical thought—the essence of scientific investigation.

Whilst this at first appears a laudable goal, and prior research has indicated that college students gain a better understanding of why evolution is accepted science—and why creationism, creation science, and ID are not scientific topics—when given an opportunity to examine antievolutionist claims (Verhey, 2005), difficulties may arise where the teacher is a proponent of creationist ideology and an exercise in critical thought turns to misrepresenting evolutionary science (Berkman & Plutzer, 2011; Moore, 2004; Sapin, 1996). Whilst “presenting all sides of a controversial issue appeals to popular values of fairness, openness and equality of opportunity” (Scott & Branch, 2003, p.499), evolution is not a scientifically controversial subject and it would be “scientifically inappropriate and pedagogically irresponsible to teach that scientists seriously debate the validity of evolution.” (Scott & Branch, 2003, p.499)

Long’s (2011) work provided a valuable reminder that, whilst scientific literacy is a necessary and laudable goal, the belief systems challenged by evolutionary science, must be considered carefully when planning education research, curricula, policy, and related law, at the risk of alienating the recipients of such education. As Long stated, “[w]e must start with the

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training of our future science teachers, but this is likely no less an issue for training in the sciences in general.” (p.179)

Such sentiments regarding teacher-training, both pre-service and in-service, have been consistently recommended by other researchers for more than 10 years (Berkman & Plutzer, 2011; Cavagnetto, 2010, 2011; Dawkins, 2006; Donnelly & Boone, 2007; Linder, 2008; Moore, 2000, 2004; NAS, 2008; Scott & Branch, 2006), yet to date, teacher training in either the technicalities of evolutionary science, or the manufactured controversy surrounding creationism vs. evolution in U.S. public high school science curricula, remains largely unaddressed.

A Further Problem for Educators in the Classroom

Michael Reiss, Professor of Science Education at the Institute of Education, University of London, previously Director of Education at the Royal Society, London, England, an evolutionary biologist and Church of England priest, has written extensively on the creationism versus evolution debate, with a rare scientific and ecumenical insight (Reiss, 2008, 2009, 2010, 2011, 2012). He has examined the difficulties of dealing with ID in *the classroom* (Reiss, 2011). Focussing on the United Kingdom, Reiss acknowledges that not all international *classrooms* will address creationist doctrine in a similar manner. Nevertheless, the author began his 2011 paper by painting a somewhat misleading picture of the nature of ID and its history in the U.S. legal system:

Allied to creationism is the theory of intelligent design. While many of those who advocate intelligent design have been involved in the creationism movement, to the extent that the US courts have argued that the country’s First Amendment separation of religion and the State precludes its teaching in public schools (Moore, 2007), intelligent design

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can claim to be a theory that simply critiques evolutionary biology rather than advocating or requiring religious faith. (Reiss, 2011, pp. 399–400)

Whilst many of the advocates of ID may have been involved in the creationist movement, this would only influence judicial opinion, in so far as it might speak to the three prongs of the Lemon Test or to the endorsement test. In the cases of *McLean v. Arkansas* (1982) and *Kitzmiller v. Dover* (2005), judicial opinion clearly stated that although the teaching of ID breached the First Amendment, the ideas which comprise ID are clearly theological in nature and are not science. The phrase “... intelligent design can claim to be a theory that simply critiques evolutionary biology rather than advocating or requiring religious faith” (Reiss, 2011, p. 400), is also highly debatable and—as will be discussed in more detail—has been disputed by successive U.S. courts. ID cannot be claimed to be a critique of evolutionary biology, because it has been shown to be a religious proposition and not of the realm of science (*Kitzmiller v. Dover*, 2005). The phrase “creationist critique of [science]” (Reiss, 2011, p. 400), is akin to saying *a magician’s critique of the laws of physics*. Such fundamental misconceptions on the part of professional analysts call for a baseline of creationist arguments to be established.

Controversy? What controversy? Reiss (2011) analyzed the nature of *controversy* in considerable detail. Unfortunately, what controversy exists within the creationism versus evolution debate is a contrived notion, employed to support an artificial dichotomy of religion versus science. As the foremost body of scientific knowledge in the United States—the National Academy of Sciences—has stated, “[s]cience can neither prove nor disprove religion” (NAS, 2008, p. 54), and there is no controversy amongst those who understand the science, “... there is no controversy in the scientific community about whether evolution has occurred. On the contrary, the evidence supporting descent with modification, as Charles Darwin termed it

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(Darwin, 1888), is both overwhelming and compelling.” (NAS, 2008, p. xiii) Other scientists working in the field have summarized the status of the *social controversy* as follows:

A new slogan in the fight against evolution education in the USA and elsewhere is ‘teach the controversy’. Although there are scientific controversies about the patterns and processes of evolution that are appropriate topics for the science classroom, and there is a continuing social controversy in certain circles about the validity of evolution, it is scientifically inappropriate and pedagogically irresponsible to teach that scientists seriously debate the validity of evolution. (Scott & Branch, 2003, p. 499)

Whilst Reiss (2011) may be correct in analyzing the *manufactured, social* aspect of the creationism versus evolution debate, he fails to point out that no *scientific* controversy exists.

Controversy in the classroom. Scott and Branch (2003), went on to suggest five factors for determining whether a controversy would be appropriate for teaching in a U.S. public school science class:

1. The controversy ought to be of interest to students (p. 499)
2. The controversy ought to be primarily scientific, rather than primarily moral, social or religious (p. 499)
3. The resources for each side of the controversy ought to be comparable in availability (p. 500)
4. The resources for each side of the controversy ought to be comparable in quality (p. 500)
5. The controversy ought to be understandable by the students (p. 500)

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Whilst factors 1 and 3 may be met, particularly with recourse to digital material, factors 2, 4 and 5 are plainly not met by the nature of the creationism and evolution debate. Factor 2 is not met because the debate is not primarily scientific. ID is fundamentally a religious concept, and the controversy between it and evolution is socially contrived (Dawkins, 2009; NAS, 2008; Scott & Branch, 2003). Factor 4 cannot be met because resources for evolution consist of more than 150 years of replicable, falsifiable, testable, and peer-reviewed observation and experimental evidence, which has never been contradicted with empirical evidence, and has served to accurately predict future observation and experimental results (Avisé & Wollenberg, 1997; Coyne, 2009; Dawkins, 2009; Edwards & Cavalli-Sforza, 1963; Futuyma, 2005; Lenski & Travisano, 1994; Miller, 1999, 2004; Nei & Kumar, 2000; Rice, 2007; Wiley & Lieberman, 2011). Resources for ID contain no empirical evidence, and consist of pseudoscientific reasoning requiring supernatural causation (Behe, 2000, 2006; Miller, 1999, 2004; Superfine, 2007). Lastly, factor 5 states that any controversy needs to be understandable by the students. Whilst the *phenomenon* of evolution is not in dispute within the scientific community, the *processes* of evolution and their details at the molecular level are often hotly contested. For example, the relative contributions of different forms of *speciation*—the evolution of new species (Avisé, 2000; Avisé & Wollenberg, 1997; Nei & Kumar, 2000; Wiley & Lieberman, 2011). For example, *sympatric speciation*—new species formed by exploitation of different resources within the home range of a population; *allopatric speciation*—where new species are formed due to geographically isolated populations; *parapatric speciation*—new species formed from the gradual distribution of a population along a geographical continuum or resource gradient; and *peripatric speciation*—new species formed as a result of a small population being isolated at the edge of a larger population. All are complex processes, which require advanced background

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knowledge to fully understand, and whilst appropriate for *graduate* biological sciences courses, they would not be appropriate for the level and time constraints of a high school curriculum.

Thus, where legitimate scientific controversy does exist, it is not suitable for the high school curriculum, and where *manufactured social or religious controversy* exists, it is not relevant to—or appropriate for—a science curriculum.

Creationism and ID in the science classroom. Reiss (2011) focussed on the United Kingdom guidelines for dealing with ID creationism, guidelines published by the Department of Children, Schools and Families (DCSF) in a 2007 booklet entitled *Guidance on Creationism and Intelligent Design* (DCSF, 2007). Reiss raised a key point, from the U.K. guidelines:

[T]here is a real difference between teaching ‘x’ and teaching about ‘x’.

Any questions about creationism and intelligent design which arise in science lessons, for example as a result of media coverage, could provide the opportunity to explain or explore why they are not considered to be scientific theories and, in the right context, why evolution is considered to be a scientific theory. (DCSF, 2007, p. 2)

Reiss rightly states that this strategy can be valuable in whatever country or curriculum—be it science, religious education, or citizenship—in which it arises. Reiss stressed that how the issue is approached is entirely *context-specific* (according to the curriculum being discussed), and that a students’ *worldview*—described by Long (2011, 2012)—should be treated seriously and with respect. Once again, the DCSF guidelines discuss this point:

Some students do hold creationist beliefs or believe in the arguments of the intelligent design movement and/or have parents/carers who accept such views. If either is brought up in a science lesson it should be handled in a way that is respectful of students’ views, religious and

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otherwise, whilst clearly giving the message that the theory of evolution and the notion of an old Earth/universe are supported by a mass of evidence and fully accepted by the scientific community. (DCSF, 2007, p. 5)

A non-scientific worldview. Reiss (2011) did not believe that a creationist worldview was likely to be changed by scientific discourse. Reiss stated that a “student who believes in creationism can be seen as inhabiting a non-scientific worldview—that is, a very different way of seeing the world. One very rarely changes one’s worldview as a result of a 50-minute lesson, however well taught.” (Reiss, 2011, p. 412) However, he believed that engaging students with creationist beliefs in a science classroom (or elsewhere), might increase scientific literacy by:

[Enabling] students to understand the scientific worldview with respect to origins, not necessarily to accept it...

Effective teaching in this area can not only help students learn about the theory of evolution but help them better to appreciate the way science is done, the procedures by which scientific knowledge accumulates, the limitations of science and the ways in which scientific knowledge differs from other forms of knowledge. (Reiss, 2011, p. 412)

Yet engaging in such a hotly contested debate, even by senior figures such as Professor Reiss, can have serious consequences. Following a largely misunderstood speech given at the Liverpool Festival of Science in 2008 and organized by the British Association for the Advancement of Science, an association which provoked newspaper headlines accusing Professor Reiss of supporting creationism in science education, Reiss resigned from his position as Director of Education at the Royal Society (Baker, 2010; Foster, 2012; Sample, 2008). I would suggest that such a reaction is unlikely to encourage the idea of engaging students with

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creationist beliefs in active discussion by a classroom science teacher. Yet, Professor Reiss was not alone in his position. Foster (2012) argued that to be “in favour of discussing creationism in science lessons is not to be in favour of promoting it; on the contrary, creationism’s demise will inevitably follow from its careful examination” (Foster, 2012, p. 2176).

Foster (2012) makes the point that students who accept evolutionary theory on the basis of the authority of their science teacher, “might be presumed to be more vulnerable to being talked out of it at some future point than those who feel the weight of evidence for themselves” (Foster, 2012, p. 2176). If such a student comes to the science class with a well-established creationist worldview, it is difficult to imagine how that worldview might be altered without actively engaging the topic, quite possibly in a public science classroom.

This would, of course, necessitate—on the part of teachers—a thorough understanding of evolutionary science and the arguments for creationism; a willingness to engage the creation versus evolution debate; an awareness of relevant legislation; and the support of school administration. As has been discussed, one or more of these requirements are often lacking (Apple, 2008; Berkman & Plutzer, 2011; Bowman, 2007; Burt, 2008; Dawkins, 2006, 2009; Donnelly, & Boone, 2007; Downie & Barron, 2000; Long, 2011, 2012; Moore, 2000, 2004; Sapin, 1996; Scott & Branch, 2003, 2006; Superfine, 2009).

Theoretical Framework and the Contributions of this Research

Constructivism—two worldviews built from the same evidence. Proponents of creationism have argued their position:

- in textbooks (Behe, 2006; Davis & Kenyon, 1993; Dembski, 2004, 2009; Dembski & Ruse, 2006; Fuller, 2008; Meyer, 2010, 2013; Poole, 2012)
- in academic journals (Baker, 2010; Behe, 2001)

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- in the mass media (Allen & Harned, 2006) and
- on the internet (Behe, 2000, 2010; Discovery Institute, 2013).

Evolutionary scientists have countered these arguments in an equally large array of media, presenting a huge amount of empirical evidence to support the case for evolution in:

- academic volumes (Dawkins, 1996, 1997, 2005, 2006, 2009; Brockman, 2006; Coyne, 2009; Forrest & Gross, 2004; Gould, 1999, 2002; Kitcher, 1984, 2007; Pennock, 1999, 2001; Shanks, 2004; Young & Edis, 2004)
- journal articles (Apple, 2008; Avise & Wollenberg, 1997; Berkman & Plutzer, 2011; Dalrymple, 1984; Donnelly & Boone, 2007; Downie & Barron, 2000; Lenski & Travisano, 1994; Loehle, 2004; Long, 2010a, 2010b, 2011, 2012; McCalla, 2007; Moore, 2000, 2004; Reiss, 2008, 2009, 2010, 2011, 2012; Scott & Branch, 2003, 2006; Superfine, 2009; Wendel, 2007)
- television broadcasts (Kidd & Barnes, 2006), and
- internet web log posts from reputable scientists (Brauer, 2005; Brawley, 1992; Gorski, 2012; Henke, 2006; Levitt, 2006).

Organisations such as the NCSE have kept detailed records of the creationism vs. evolution debate in news headlines (NCSE, 2014a) and in the U.S. legal system (NCSE, 2011). In addition, the mandated U.S. government scientific policy advisors, the National Academy of Sciences and Institute of Medicine, have contributed their support for evolutionary science (NAS, 2008).

Constructivism and worldview. Both *sides* of the creationism and evolution debate have presented their own arguments, and with them, constructed their own *ontological reality*—determined by their own interpretation of what they consider to be *fact* or *truth*. This is the definition of *social construction*, or *constructivism*, as discussed by Patton (2002), where “two

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people can live in the same empirical world, even though one's world is haunted by demons, and the other's, by subatomic particles.” (Patton, 2002; Sagan, 1997)

In the world constructed of empirical evidence occupied by evolutionary biologists, the fossil record reaches back more than 3 billion years (Schopf, 1999; Noffke, Christian, Wacey & Hazen, 2013). During this immense period of time from ancient fossilized bacteria to the more recent hominin fossils of only 5-10,000 years ago, there are understandable gaps in the fossil record; ancestors of organisms today which we have yet to find. Evolutionary science predicts that we will find fossilized common ancestors of groups such as reptiles and birds. And scientists have, according to prediction, found fossils such as *Archaeopteryx* which fit in such a gap (Dawkins, 2006; Pojeta & Springer, 2001; Schopf, 1999). Yet creationist interpretation of their construction of the fossil evidence evolution calls for more *intermediate forms* to fill the gaps (Luskin, 2008; Meyer, 2013), created by a fallacious argument. One species does not *evolve from another*. Species are distinct and different—most often to the point where they cannot interbreed—species simply share common ancestry:

[H]umans are not descended from monkeys. We share a common ancestor with monkeys. As it happens, the common ancestor would have looked a lot more like a monkey than a man, and we would indeed probably have called it a monkey if we had met it, some 25 million years ago. But even though humans evolved from an ancestor that we could sensibly call a monkey, no animal gives birth to an instant new species, or at least not one as different from itself as a man is from a monkey, or even from a chimpanzee. That isn't what evolution is about. (Dawkins, 2009, p. 155)

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Thus has evolved the construction of the creationist worldview, based on one interpretation of empirical evidence, gathered and constructed to form an entirely different interpretation and worldview by evolutionary scientists. One person's demons are another's subatomic particles.

Historically, religion has constructed a worldview which has “aspired to *explain* our own existence and the nature of the universe in which we find ourselves. In this role it is now completely superseded by science” (Dawkins, 2006, p. 347). Proponents of both sides therefore represent a *worldview*, “a knowledge about reality, not reality itself” (Patton, 2002, p. 96), filtered through social context, as discussed by Long (2012). By identifying the arguments used to promote the teaching of ID in U.S. public schools, and the influence of these arguments on law and education policy, science educators may better understand the existential anxiety inflicted upon creationist students and their families (Long, 2012) when confronted by the teaching of modern evolutionary biology.

What would it take to change a worldview? On February 4th, 2014, Emmy Award-winning science educator and CEO of the Planetary Society William “Bill” Nye (popularly known as “Bill Nye the Science Guy”; <http://www.billnye.com>), debated young Earth creationist Ken Ham, former high school science teacher, president of Answers in Genesis (AiG; <http://www.answersingenesis.org>), a Christian apologetics ministry which operates the Creation Museum in Petersburg, Kentucky. The debate posed the question, Is creation a viable model of origins in today's modern, scientific era? (AiG, 2014).

At approximately the 2-hour, 4-minute and 35-second point of the debate, the protagonists are asked the question, “[w]hat, if anything, would ever change your mind?” Creationist proponent, Ken Ham responded, “[w]ell, the answer to that question is, I'm a Christian... the Bible is the word of God... and no one is ever going to convince me that the word of God is not true.” Whilst Bill Nye replied, “[w]e would just need one piece of evidence.

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We would need the fossil that swam from one layer to the next. We would need evidence that the universe is not expanding. We would need evidence that the stars appear to be far away, but they're not... Bring on any of those things and you would change me immediately.” Whilst obviously not generalizable, these opposing interpretations of the same empirical world, exemplify the constructivist positions described by Patton (2002), and the nature of the debate analyzed by this study.

A Baseline of Creationist Argument

In all of the work previously cited, it is only in the arena of the U.S. legal system that arguments made by expert proponents of ID, can be countered by similar experts in evolutionary science. In addition, legal testimony occurs under binding conditions of accuracy and cross-examination, providing a highly controlled source of data collection. Further, very little academic literature has sought to analyse this discourse and weigh the arguments presented (Bowman, 2007; Burt, 2008; Thomasson, 2011). In the light of the first U.S. court ruling to analyse both sides of this contentious issue and pass detailed judgement on the nature of these arguments (*Kitzmiller v. Dover*, 2005), this research aims to provide a summative analysis of the arguments presented for ID to be taught in the science classrooms of U.S. public schools, and the counter arguments which have convinced successive U.S. courts to deny the inclusion of its doctrine in science curricula since 1968 (*Epperson v. Arkansas*, 1968). In doing so, I seek to provide a detailed *baseline* to which future argument can be compared to highlight new—or simply recycled—points in the debate, and to identify any potential strategies for alleviating this on-going and costly dispute.

A Summation.

This chapter has considered the rationale behind the public debate between proponents of religion and science in the U.S. public education system. The history of the debate has been

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outlined, in terms of legal precedent and changes in the debate itself, from the historical aspects of including religion in state education, to more recent attempts at making religion appear to be science (e.g., ID). The debate has been considered from the perspectives of legislators and policy makers, educators, students, and society in general. The difficulties of maintaining a faith-based worldview when confronted by contradictory evidence and the resultant existential anxiety (Long, 2011), and possible rejection of that evidence (AiG, 2014), have been highlighted and provide the basis of a constructivist theoretical framework. Chapter 3 outlines the methodology and method used to extract the data required to answer the research questions posed by this study.

Chapter 3

Methodology and Method

This research relied on a qualitative research methodology, specifically discursive research, to collect and analyse publically available documentation. Given the contentious nature of the evolution versus creationism debate in American education, it was felt that it would be unlikely that many school boards, administrators, or teachers would welcome an investigative analysis of this kind. Thus, an unobtrusive method of data collection was sought, of which document analysis has been referred to as a “particularly interesting and innovative strategy for collecting and assessing data” and that such methods “provide access to aspects of social settings and their inhabitants that are simply unreachable through any other means” (Berg, 2001, p. 189). Further, document analysis has been identified as a highly valuable method of qualitative research, which has the potential to “explore multiple and conflicting voices, differing and interacting interpretations” (Hodder, 2000, p. 705).

Document Selection

Documentation addressing both research questions were selected from a shortlist of ten major United States court rulings from 1968 to the most recent of 2005. Documentation included judicial opinion, expert witness testimony, and published works referred to in direct questioning and cross-examination of witnesses. Triangulating interpreted relevance of documentation to my primary research questions with *third-party* assessment of case importance, content, and context, acted as an additional method for improving research validity.

Third-party assessment of relevance and importance in legal value is readily available from independent organisations such as the NCSE, which maintain a reliable online database of legal cases examining this issue from 1968 to the present day (<http://ncse.com/creationism/legal/major-cases>). The NCSE database also indicates precedent-setting cases where applicable and

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provides a freedom of access to documentation that can sometimes pose a challenge to research (Yin, 1994).

Online court archives were also used (e.g., Judicial Opinions, U.S. District Court for the Middle district of Pennsylvania—www.pamd.uscourts.gov/opinions.htm; Leagle, Inc., online supplier of primary case law—www.leagle.com), which also include publically available transcriptions of expert witness testimony, judicial opinion, and supporting documentation referred to within such discourse (e.g., published material used to support technical argument).

Relevance to research questions. Ten major legal cases were identified as suitable for initial investigation on the basis of relevance to the research questions (as shown in Table 3.1). The significance of these cases has been identified by a number of sources (Bowman, 2007; NCSE; 2011; Luskin, 2009; Scott, 2009), and discussed elsewhere in this study. Three criteria were set for inclusion in this analysis, these were that all cases should:

1. Include expert witness testimony from both creationist adherents and proponents of evolutionary science. Testimony should be examined in detail and a judicial opinion reached on the validity of those arguments.
2. Be finalized, including all relevant appeal stages.
3. Be at the U.S. District Court level or higher, with decisions ruling on the scientific merits of the case.

As can be seen in Table 3.1, all 10 cases were deemed to violate free speech or religious endorsement clauses of the First Amendment. However, only three of these cases discussed the relevant scientific merits of the case. Listed chronologically, these were *McLean v. Arkansas Board of Education* (1982); *Freiler v Tangipahoa Board of Education* (1997); and *Kitzmiller v. Dover* (2005).

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Table 3.1

Summary of the Ten Major Court Decisions on the Teaching of Evolution Versus Creationism in United States Public Schools.

Case Reference	Level of Court	Ruling
<i>Epperson v. Arkansas</i> (1968) 393 U.S. 97, 37 U.S. Law Week 4017, 89 S. Ct. 266, 21 L. Ed 228	Supreme Court	Breach of the Establishment Clause of the First Amendment.
<i>Seagraves v. California</i> (1981) Sacramento Superior Court #278978	Superior Court of California	Requirement to teach evolution <i>did not</i> violate freedom to practice religion rights, conferred by the First Amendment.
<i>McLean v. Arkansas Board of Education</i> (1982) 529 F. Supp. 1255, 50 U.S. Law Week 2412	District Court	Balanced treatment statute breached the establishment Clause of the First Amendment. Court declared that creation science is not science.
<i>Edwards v. Aguillard</i> (1987) 482 U.S. 578	Supreme Court	Breach of the Establishment Clause of the First Amendment.
<i>Webster v. New Lenox School District #122</i> , 917 F. 2d 1004	Court of Appeal	Prohibition of teaching creationism <i>did not</i> violate free speech rights of the First Amendment.
<i>John E. Pelozo v. Capistrano Unified School District</i> , (1994) 37 F. 3 rd 517	Court of Appeal	Requirement to teach evolution <i>did not</i> violate freedom to practice religion rights, conferred by the First Amendment.
<i>Freiler v Tangipahoa Board of Education</i> , No. 94-3577 (E.D. La. Aug. 8, 1997	District Court	Failed the Endorsement Test. Breach of the Establishment Clause of the First Amendment. Intelligent design is the equivalent of creation science.
<i>LeVake, R. v. Independent School District #656</i> , 625 N.W.2d 502 (MN Ct. of Appeal 2000), cert. denied, 534 U.S. 1081 (2002)	Court of Appeal	Requirement to teach evolution <i>did not</i> violate freedom to practice religion rights, conferred by the First Amendment.
<i>Selman et al. v. Cobb County School District and Cobb County Board of Education</i> 390 F. Supp. 2d 1286, 1313 [N.D. Ga. 2005]	District Court	Breach of the Establishment Clause of the First Amendment.
<i>Tammy Kitzmiller, et al. v. Dover Area School District, et al.</i>, Case No. 04cv2688	District Court	Breach of the Establishment Clause of the First Amendment. Intelligent Design is creationism and religious.

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Of the 10 cases listed, only one has addressed the relevant scientific merits of ID in a U.S. public school science class (*Kitzmiller v. Dover*, 2005). As a result, the *Kitzmiller v. Dover* (2005) case (emphasized in table 3.1), and all of its corresponding documentation was chosen as the case which best represented each of the criteria required to answer both research questions.

By analyzing this material, it is possible to extract arguments that have been used to make the case for creationist ideology (research question 1), and reasons provided in attempts to move U.S. legal opinion and thus *overt*, documented education policy (research question 2). Such testimony has the advantage of cross-examination by legal counsel under oath to enhance the clarity and validity of the argument. As this documentation is a matter of public record and openly available, ethical considerations with regard to data collection are not applicable to this study. Appendix B provides a detailed list of the 24 lay witness and 9 expert witness testimonies, closing arguments for plaintiffs and the defense, plus the final judicial opinion of Judge John Jones III in *Kitzmiller v. Dover* (2005)—a combined total of approximately 4955 pages of text—which comprised the data sources analyzed for this study.

Each of the documents comprising the testimony and judgment of *Kitzmiller and Dover* (2005) were assigned a unique identifying code, indicating the day of the trial (01–21), morning (AM) or afternoon (PM) session, and witness number for that session. For example, document code KD01AM1, indicates *Kitzmiller v. Dover* trial day 01, morning session, first witness. Appendix B provides a full list of all documents analysed and their corresponding codes.

Content and Context Analysis

A framework for the analysis of documentation for its contents has been discussed by Miller and Alvarado (2005), consisting of content and context analytic approaches. Testimony will mostly be analysed for its content (content analytic). This is pertinent to my first research question, and can address specific creationist arguments with regard to scientific rigour, honesty,

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and empirical reasoning. Judicial opinion may be more relevant in terms of commentary (context analytic).

The importance of documents as actors—a context analytic approach (Miller & Alvarado, 2005)—outlining the production and operation of policy has been discussed by Prior (2003) and Miller (1997). Judges as decision makers have given clear accounts of how creationist arguments have swayed their ruling, and thus U.S. law and government education policy, thereby directly addressing my second research question. Documentation relating to these decisions and influencing policy from federal to school level can then be seen as an *actor*, to be interpreted through the lenses of politics and culture.

Data Handling and Analysis

As Weitzman (2000) stated, computers cannot “read the text and decode what it all means” (p. 805). Therefore, documentation was read and re-read before data was *coded* using qualitative data analysis (QDA) software. ATLAS.ti (<http://www.atlasti.com>) v. 7.1.8 was selected for this purpose. Using ATLAS.ti, data was sorted into themes with textual sub-categories which *arose* from the data, e.g., conceptual categories such as a critique of Darwinian evolution, with sub-categories of direct criticism, the logical fallacy of personal incredulity, and the mistaken representation of evolution as *just a theory*.

Qualitative research methods literature has provided little definitive guidance on building categories (see, for example, Charmaz, 2006). The notion of *fit* is typically researcher-identified through a process of simultaneous engagement with data collection and analysis (Charmaz, 2006; Dey, 2004). Others argue that categorization may be the “most important part of content analysis because it reflects the purposes of the research and the theories underlying it” (Anderson, 1997, p. 341). Data analysis has been based on categories and sub-categories emerging from multiple readings and interpretations of documentation—an *inductive* process.

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Consistent application of this methodology throughout the analysis of all testimony and judgment documentation has provided an enhancement of validity in data collection.

Coding process. Each document was read and statements within were assigned to a sub-category, such as *Criticisms of Darwinian Theory*, when the statement contained or implied an issue within that sub-category. For example, the statement that “evolution is a problematic theory even in the field of science” (*Kitzmiller v. Dover*, 2005, p. 134), is both a criticism of Darwinian theory and a misrepresentation of that theory. As a result, such a phrase would be *cross-coded* under two sub-categories: (a) *Criticisms of Darwinian theory*, and (b) *Nature of Science—Incorrect definition or misrepresentation of a scientific theory*. When first engaging with the data, it became apparent that many such quotations would fit multiple sub-categories in the manner described. It was therefore decided that whilst one quotation might be assigned to multiple themes/sub-categories, such cross-coding should be kept to a minimum (see Appendix C for examples of this process).

The context of quotations such as this must also be considered, the above phrase might be used by either proponents of creationism or evolutionary biology, in a longer sentence that might be attacking or defending evolutionary theory. I believe this contextual engagement with data collection and analysis to be a working example of the notion of fit, as previously discussed (Charmaz, 2006; Dey, 2004).

Where explicit definitions of which quotations would fit a given sub-category were required, the rationale for the decision-making process was recorded in abbreviated notations within an electronic personal reflex journal. For example, it is possible to argue that all attempts to include creationist doctrine in U.S. public science classes, can be interpreted as part of an overarching, conspiratorial strategy (see Chapter 3, The Wedge Strategy). To avoid such large-scale cross-coding, the Wedge Strategy theme was restricted to quotations which explicitly discussed the existence, the purpose, or method by which the strategy was intended to achieve its

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goals. Appendix C contains a detailed list of quotations from five pages of the final judicial opinion of *Kitzmiller v. Dover* (2005, pp. 134–138), the sub-categories to which each paragraph was assigned, and corresponding notations from my personal reflex journal, as exemplar material representing the coding process.

Relevance to research questions has been interpreted according to the principles addressed within the data, e.g., where empirically-based, the data may be compared to scientific consensus, or where theologically-based, statements may be recorded as deistic or theistic belief. For example, a combination of multiple lines of evidence such as radiometric dating and the decay of uranium to lead over time, has resulted in a scientific consensus that the age of the earth is approximately 4.5 billion years old (Dalrymple, 1986). Alternatively, the hypothesis of *irreducible complexity* contends that biological organisms must be designed in the same way that a mousetrap or a clock is designed—that in order for the device to work properly, all of its components must be available simultaneously. If one component was missing or changed, the device would fail to operate properly (Behe, 2006). Such a concept of design implies deistic causation and thus belief (Dawkins, 2006). Behe (2006) argued that a suitable example of irreducible complexity would be the bacterial flagellar motor, which would be rendered useless as a means of bacterial motility if any one component was missing. Such a hypothesis, however, has been shown to be entirely fallacious (Miller, 1999, 2004).

Trustworthiness

Triangulating sworn statements, judicial opinion, and technical argument such as the creationist case for irreducible complexity with multiple, peer-reviewed sources of definition or explanation of terms used, has helped to ensure “a confluence of evidence that breeds credibility” (Eisner, 1991, p. 110).

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McMillan and Schumacher (2009) have suggested that a *reflex journal*—an organised record of reasoning, methodological activities, interim results, and conclusions—may provide documented justification for reasonable modification of research problems and strategies, according to any dynamic variables of the study. Therefore, as a method of enhancing validity I have kept a personal reflex journal over the duration of the study.

Reflexive Stance

My stance as a researcher is unavoidably affected by the curriculum of my own development. As Pinar (2012) would assert, my *currere*, made up of a self-analysis of educational experiences from childhood to the present—a deeply personal, on-going, complicated conversation with myself as the private intellectual. My position, with regard to education and specifically research, is influenced by the overt and hidden curricula of prior experience. Key aspects of this experience were my undergraduate degree in zoology. Specialising in behavioural ecology, my degree necessitated considerable reading in evolutionary biology. This reading was conducted under the supervision of an academic staff which included the great, great grandson of Charles Darwin. At least partially due to this academic history, my intellectual position may be termed pro-evolutionary science.

I am also an atheist, who fervently believes that any given subject should be understood to the best of our current abilities before accepting or rejecting its theories and developing them in the field of education. It is this belief that has helped phrase the research questions of this study. I am fully aware of the implications of my intellectual position with regard to my proposed study, thus the personal reflex journal of research activities kept as part of my research methodology has helped to make the research process transparent, and clarify any decisions based on personal judgement.

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A Summation.

This chapter has reviewed the rationale to use qualitative research methods to meet the purpose of this study, detailed the stages of document selection and described the process used for document analysis. Chapter 4 reports on the findings of this document analysis, discussing and summarizing each emergent theme in turn.

Chapter 4

Document Analysis Findings

Themes Emerging from the Data

This chapter discusses those themes which have arisen from the analysis of the *Kitzmiller v. Dover* (2005), documentation. Relevant citations of which comprise these themes, have identified those arguments put forward by advocates of creationism, to make the case for creationist ideology in the American public science classes. Cross-examination and expert witness testimony go further, examining testimony for credibility, scientific plausibility, academic rigour, and empirical reasoning, thereby addressing the first research question.

Themes arising from the courts' judgment of the case show a historical perspective of the effects of these arguments on existing law and public education policy, thus addressing the second research question. These effects show how past U.S. court cases have influenced the most recent decision-making process, and either curtailed—or enabled—the overt, legalised teaching of ID in American public science classes.

Addressing research question 1. Four main themes relating to the arguments put forward to promote creationist teaching in U.S. public schools—this study's first research question—arose from analysis of the trial documentation, and are presented in Table 4.1. The first theme listed in Table 4.1, is balanced treatment. This theme encompasses arguments for the teaching of ID and evolution to be equal in time and resources in public schools. This theme was represented by arguments for ID as a valid and equivalent scientific theory to evolution. As an equivalent scientific theory, ID was argued to have a legal entitlement to equal time and resources. Pedagogical arguments for teaching the controversy, rather than each distinct topic, and keeping an open mind to alternative theories are fundamental to the balanced treatment theme. Arguments are made to provide alternative textbooks as part of the science curriculum,

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which promoted the central tenets of creationism and ID instead of evolution (i.e., Of Pandas and People—referred to as *Pandas*—by Davis & Kenyon, 1993).

Table 4.1

Summary of Themes and Sub-Categories Arising from the Analysis of Arguments for Intelligent Design to be Taught in Public School Science Classes, as Documented in the Case of Kitzmiller v. Dover (2005).

Theme 1: Balanced Treatment	Theme 2: Criticism of Darwinian Theory, The Nature of Science, and the Scientific Method	Theme 3: Creation Science/Intelligent Design is not Religion, it's Science	Theme 4: Legal Tests—Appropriate Selection of Legal Tests
ID—As science and an equivalent of Darwinian evolution	Criticisms of Darwinian theory	ID—As science and an equivalent of Darwinian evolution	ID—is a scientific theory and the Endorsement Test is not appropriate
Legal—ID is a scientific theory and therefore entitled to equal time with evolution	Evolutionary science does not speak to the existence of a divine creator	ID—Does NOT fail the Lemon test	ID—Lemon Test is appropriate
Teach the Controversy—Equal time to biblical creationism	Logical Fallacy—Criticism of evolution therefore supports creationism	Textbooks— <i>Pandas</i> * promoted by the board as an alternative biology textbook	Legal—ID policy does not violate rights under the U.S. Constitution, because it is a valid scientific theory
Teach the Controversy—Keeping an open mind to ID	Logical Fallacy—Evolutionary science denies a divine creator		
Textbooks— <i>Pandas</i> * promoted by the board as an alternative biology textbook	Logical Fallacy—Personal incredulity		
	Nature of Science—Incorrect definition or misrepresentation of a scientific theory		

* *Pandas*—Davis, P., & Kenyon, D. (1993). *Of pandas and people: The central question of biological origins*. (2nd ed.). Richardson, Texas: Foundation for Thought and Ethics (FTE).

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The second theme listed in Table 4.1, is criticism of Darwinian theory, the nature of science, and the scientific method. Many of the arguments made by creationist proponents did not argue for creationism *per se*, but instead criticized evolutionary science. As a result, this theme contains a sub-category of overt criticism of Darwinian theory. Another sub-category, criticising evolutionary science for not discussing the existence of a divine creator, appears to contradict a third, where creationists argue a false dualism—that a belief in evolutionary science denies a divine creator and rules out acceptance of evolution. The fallacious nature of creationist criticism of evolutionary science is further seen in the theme of the logical fallacy of personal incredulity. In creationist argument, this fallacy arises where a scientific explanation for a given phenomenon cannot be immediately envisaged, and a supernatural causation is then assumed. This is exemplified by ideas such as Michael Behe’s notions of irreducible complexity (Behe, 2006). The final sub-category of creationist argument within this theme, is criticism of the nature of science itself. A criticism that the requirements of testability, falsifiability, and methodological naturalism—amongst other criteria detailed elsewhere in this study—are somehow unfair to the notions of creationist argument, and need to be relaxed in some way, to allow hypotheses with little or no supporting evidence to be referred to as science.

The third theme detailed in Table 4.1, is the denial that creation science or ID is theistically based, and that it is science. Extensive arguments were made during the *Kitzmiller v. Dover* (2005) trial that ID was science, and an equivalent theory to Darwinian evolution. This sub-category would frequently be recorded in this theme, and as an argument for balanced treatment. In a further crossover of themes, this sub-category would also have legal ramifications, i.e., if ID could be successfully argued to be science, the fallacious dualism previously discussed would mean that it could not be religion, and therefore would not fail the Lemon or Endorsement tests. The selection of the Pendas textbook by the Dover Area School

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District Board of Directors, as an alternative textbook for the school science curriculum, was also interpreted as an argument that creation science and ID should be considered science.

The final column and fourth theme in Table 4.1, lists the appropriate selection of legal tests in the Court's analysis of creationist argument. For example, if ID is to be considered a valid scientific theory, then the Endorsement test (as previously discussed), would not be valid. Similarly, certain aspects of the Lemon Test would not be appropriate, and if ID were to be considered a scientific theory and both the Endorsement and Lemon Tests considered to be inappropriate, then the Board of Directors' ID policy would not violate rights under the religious clauses of the U.S. Constitution.

Balanced treatment. The term balanced treatment refers to arguments for the teaching of ID and evolution to be equal in time and resources. In his judgment of *Kitzmiller v. Dover* (2005), Judge John Jones III, discussed the argument for balanced treatment and its place in the legal history of the creationism versus evolution debate:

In 1968, a radical change occurred in the legal landscape when in *Epperson v. Arkansas*, 393 U.S. 97 (1968), the Supreme Court struck down Arkansas's statutory prohibition against teaching evolution. Religious proponents of evolution thereafter championed "balanced treatment" statutes requiring public-school teachers who taught evolution to devote equal time to teaching the biblical view of creation; however, courts realized this tactic to be another attempt to establish the Biblical version of the creation of man. (p. 8)

Post-Epperson, evolution's religious opponents implemented "balanced treatment" statutes requiring public school teachers who taught evolution to devote equal time to teaching the biblical view of creation; however,

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such statutes did not pass constitutional muster under the Establishment Clause. (p. 20)

Judge Jones clearly drew attention to the *balanced treatment tactic* as a failed effort to endorse religious teaching in public schools, and stated that its failure to alter U.S. law and education policy was due to the Establishment Clause of the First Amendment to the U.S. Constitution.

Yet despite the balanced treatment being a previously failed method of introducing creationism into the public school science classroom, creationist proponents on the Dover Area School District Board of Directors used this as an argument prior to instigating curriculum changes. This is confirmed by a number of testimonies. Firstly Aralene Joan Callahan, witness for the plaintiffs, was questioned about notes she had taken during a board meeting in March 2003:

[Attorney] And is there anything written on this document about what Allen Bonsell said at that meeting in March of 2003?

[Aralene Callahan] It has, “Allen – American history, founding fathers.” Then “50/50 evolution versus creationism,” and then an arrow from evolution, “Does not believe in evolution.” (KD02AM3, pp. 127–128)

Jeffrey Brown, a member of the Board of directors for the Dover Area School District, testified for the plaintiffs that the President of the board, Alan Bonsell, had stated that he believed creationism should be taught alongside evolution, “[Bonsell] mentioned, again mentioned creationism. He felt it belonged in biology class alongside evolution.” (KD04PM2, p. 51)

Board Science Department Chair, Bertha Spahr, also testified to a discussion she had with Assistant Superintendent Michael Baksa:

[Spahr] Mr. Baksa, as he often did, stopped, if he was in the building, to contact department chairs on various issues. He said, I would like to

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inform you or give you a heads up that there is a member of the school board who is interested in having creationism share equal time with evolution.

[Attorney] Did you respond to what Mr. Baksa said?

[Spahr] Yes, I responded by asking him, which board member are you referring to, may I ask?

[Attorney] What did he tell you?

[Spahr] He told me it was Alan Bonsell. (KD07PM2, p. 73)

Michael Baksa himself confirmed this exchange:

[Attorney] I told Mrs. Spahr that what I heard last night at the retreat was that Mr. Bonsell was looking for a 50/50 split with Darwin and some alternative.

[Attorney] That's what you told her?

[Baksa] Yes.

[Attorney] And Mr. Bonsell had actually been expressing concerns about the teaching of evolution to you since the fall of 2002. Correct?

[Baksa] Correct. (KD19PM1, p. 55)

Both testimonies indicated a history of the discussion of teaching creationism alongside evolution, which Baksa had stated had run for approximately two years prior to the Boards' curriculum changes of October 2004. It should be noted that Michael Baksa disputed that Bonsell (or any other member of the Board) specifically mentioned the word *creationism* as the subject with which they wanted to share equal time with evolution. Yet the weight of evidence had established that such was not the case:

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Trudy Peterman, then principal of Dover High School, sent a memo to Assistant Superintendent Baksa and Science Department Chair Bertha Spahr with a copy sent to Dr. Nilsen on April 1, 2003. This memo reports that Peterman learned from Spahr that Baksa said on March 31, 2003, that an unidentified Board member “wanted fifty percent of the topic of evolution to involve the teaching of Creationism.”

... Although defense witnesses testified that Peterman was known to exaggerate situations, the weight of the evidence reveals that the essential content of the memo was indeed accurate. (*Kitzmiller v. Dover*, 2005, p. 95)

The court stated, however, that “we do not find [Michael Baksa’s] testimony on this point to be credible. We accordingly find that Bonsell is clearly the unnamed Board member referred to in Peterman’s memo who wanted fifty percent of the topic of evolution to involve the teaching of creationism. (*Kitzmiller & Dover*, 2005, p. 96)

In addition, documentation showed that several members of the Board had discussed the issue and were aware of its contentious nature. The testimony of Christy Rehm (plaintiffs) underscored this point: “And also I recall Alan Bonsell making a comment about, you know, there are only two theories, there’s this theory evolution and there’s this theory creation, and if you’re teaching only those two theories, then there’s not a problem.” (KD03PM2, p. 65)

At least one Board member denied some statements attributed to them. William Buckingham, Chairperson of the Board Curriculum Committee, was reported by two separate witnesses, to have stated the Boards’ intention to change the curriculum to include creationism alongside evolution. Heidi Bernhard-Bubb, a freelance writer with the local newspaper The York Dispatch, testified as follows:

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[Attorney] It is inexcusable to have a book that says man descends from apes with nothing to counterbalance it, Buckingham said of the book.

And he's referring to Miller and Levine. So, now, that is in quotes and attributed to William Buckingham. So what does that mean that it's in quotes?

[Bernhard-Bubb] That means that it was taken verbatim from what he said and nothing was omitted, there was – all of the language was his.

(KD16PM2, pp. 77–78)

Joseph Maldonado, a freelance writer with the York Daily Record/Sunday News independently testified in a similar manner:

[Attorney] In that second column, it says, “Board member William Buckingham, who sits on the curriculum committee, said a book had been under consideration, but was declined because of its one-sided references to evolution.” Did I read that correctly?

[Maldonado] Yes.

[Attorney] And then there is a quote attributed to him, “It's inexcusable to teach from a book that says man descended from apes and monkeys. He said we want to book that gives balance to education.” Did I read that correctly?

[Maldonado] Yes, you did.

[Attorney] Is that an exact quote of what you heard Mr. Buckingham say that evening?

[Maldonado] Yes, sir. (KD17AM2, pp. 59–60)

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A third witness, another member of the Boards' Curriculum Committee, Carol Brown, also testified with regard to Buckingham's statements during Board meetings:

[Brown] Basically Mr. Buckingham presented a list of his objections to the text, and we then reviewed them one by one... (KD04AM1, p. 45)

[Brown] All of the objections, all of the page numbers that he objected to were listed in the index under Charles Darwin or Darwin's theory of evolution. (KD04AM1, p. 45)

[Attorney] Did he say anything about what was missing that deprived the book of balance?

[Brown] The theory of creationism with God as creator of all life. (KD04AM1, p. 48)

Buckingham consistently denied these statements, often despite conflicting evidence:

[Attorney] Let's look at the next paragraph. It says, actually the article says, it's quoting you, "'It's inexcusable to teach from a book that says man descended from apes and monkeys,' he said. 'We want a book that gives balanced education.'" "Do you see that?

[Buckingham] I see it.

[Attorney] Now, that's a true statement. You did say that at the June 7th board meeting?

[Buckingham] I don't remember saying that.

(Brief pause.)

[Attorney] So your testimony is not that you didn't say it. It's that you don't remember saying it, isn't that right?

[Buckingham] That's my testimony.

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[Attorney] Then the next paragraph says, “Buckingham and other board members are looking for a book that teaches creationism and evolution.”

Do you see that?

[Buckingham] I see it.

[Attorney] Now, you said that, didn’t you?

[Buckingham] No, I didn’t. (KD16AM1, p. 50)

Balanced treatment—a summation. Balanced treatment, as an argument for including creationism in U.S. science lessons, is a failed construct. It does not pass the Endorsement test of the First Amendment to the American Constitution, and successive U.S. court cases have considered and rejected its argument (*Epperson v. Arkansas*, 1968; *Freiler v. Tangipahoa*, 1997; *Kitzmiller v. Dover*, 2005). Yet testimony shows that it was clearly used in this case, by more than one senior Board member, as an argument to sway other school board officials, if not the court. In addition, the weight of evidence from such testimony suggests that Board members arguing for such balance were fully aware of the contentious and unconstitutional nature of the topic (KD02AM3, pp. 127–128; KD03PM2, p. 65; KD04AM1, pp. 45, 48; KD04PM2, p. 51; KD07PM2, p. 73; KD16PM2, pp. 77–78; KD17AM2, pp. 59–60; KD19PM1, p. 55).

Criticism of Darwinian theory and the scientific method. This section discusses the arguments put forward by creationist proponents arising in the combined themes of criticism of the scientific theory of Darwinian evolution—including modern advances in disciplines such as phylogenetics—and a more general critique of the scientific method. The latter encompasses aspects such as testability, replicability, falsifiability, predictability, and methodological naturalism.

In November 2004, the Dover Area District School Board issued a press release announcing that, as of January 2005, all science teaching staff would be required to read the

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following disclaimer to ninth grade biology classes at the Dover Public High School. It was this disclaimer that resulted in the case of *Kitzmiller v. Dover* (2005):

The Pennsylvania Academic Standards require students to learn about Darwin's Theory of Evolution and eventually to take a standardized test of which evolution is a part.

Because Darwin's Theory is a theory, it continues to be tested as new evidence is discovered. The Theory is not a fact. Gaps in the Theory exist for which there is no evidence. A theory is defined as a well-tested explanation that unifies a broad range of observations.

Intelligent Design is an explanation of the origin of life that differs from Darwin's view. The reference book, *Of Pandas and People*, is available for students who might be interested in gaining an understanding of what Intelligent Design actually involves.

With respect to any theory, students are encouraged to keep an open mind. The school leaves the discussion of the Origins of Life to individual students and their families. As a Standards-driven district, class instruction focuses upon preparing students to achieve proficiency on Standards-based assessments. (*Kitzmiller v. Dover*, 2005, pp. 1–2)

The disclaimer makes a number of criticisms of Darwinian evolution and the nature of science. The first stands out as the misinterpretation of the term *scientific theory* as simply a theory. The definition offered is insufficient at best, not taking into account previously described facets (Ben-Ari, 2005; Dawkins, 2009; Kuhn, 1996; Popper, 1959). Evolution is as near to a fact as scientific theory allows (Coyne, 2009; Dawkins, 2009). Associate Professor of Education at McGill University, Brian

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Alters, called by the plaintiffs as an expert in education and pedagogy, discussed this section of the disclaimer:

[Alters] Well, that's just dead wrong. Evolution is a theory and fact. It is both. It is a theory because it explains the diversity of life on the planet you understand. It's a fact because its confidence level is so extraordinarily high in the scientific community, they no longer debate it, they no longer publish papers, there's no significant body of literature in the scientific journals about saying the occurrence of evolution whether it happened or not. It's not there. It's considered factual in the scientific community, extraordinarily well accepted. (KD08AM2, pp. 112-113)

Expert witness for defendants, Steven William Fuller, Professor of Sociology at University of Warwick, U.K., agreed with this opinion, stating in his own evidence that the disclaimer was misleading (KD15PM1, pp. 4–5). Expert witness for the plaintiffs, Kevin Padian, Professor of Integrative Biology at the University of California, Berkeley and Curator of the Berkeley Museum of Paleontology specializing in paleontology and evolution, was more blunt in his condemnation of the school boards' statement:

[Attorney] And from your perspective as a scientist, what's the problem with this one-minute statement?

[Padian] I think it makes people stupid. I think essentially it makes them ignorant. It confuses them unnecessarily about things that are well understood in science, about which there is no controversy, about ideas that have existed since the 1700's, about a broad body of scientific knowledge that's been developed over centuries by people with religious

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backgrounds and all walks of life, from all countries and faiths, on which everyone can understand. (KD09PM1, pp. 51-52)

The *gaps* referred to which supposedly lack evidence have been shown to amount to the logical fallacy of personal incredulity. Coyne (2009) and Dawkins (2009), amongst others, refer to this as the *God of the gaps* argument, which may be compared to saying that the pieces of a multi-billion-year-old story which have not—as yet—been read and understood, and therefore must be evidence for supernatural creation.

ID, which has been demonstrated to use a similar line of reasoning (Miller, 1999, 2004), is then erroneously compared to evolutionary science. As has been discussed by many expert scientific commentators, ID explains nothing regarding the origins of life (Coyne, 2009; Dawkins, 2009; NAS, 2008; Scott, 2009). Students are then encouraged to approach the topic of evolution with an *open mind*, erroneously suggesting that an alternative to evolution might be considered to be an equivalent explanation. Associate Professor of Education at McGill University, Brian Alters, called by the plaintiffs as an expert in education and pedagogy, criticized this statement as it “engender[ed] misconceptions” (KD08AM2, p. 117) and constituted poor pedagogy, requiring students to “ignore the leading organizations in the United States, if not the world.” (KD08AM2, p. 119)

Judicial opinion observed the following with regard to creationist criticism of evolutionary science: “ID proponents primarily argue for design through negative arguments against evolution, as illustrated by Professor Behe’s argument that “irreducibly complex” systems cannot be produced through Darwinian, or any natural, mechanisms.” (*Kitzmiller v. Dover*, 2005, pp. 71–72) In making such a broad statement, Judge Jones cited the supporting argument of expert witness testimony for the plaintiffs of Kenneth R. Miller (KD01AM1, pp. 31–143; KD01PM1, pp. 2–113; KD02AM1, pp. 1–111); Robert Pennock (KD03AM1, pp. 4–

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109); Barbara Forrest (KD06AM1, pp. 4–149; KD06PM1, pp. 3–115; KD07AM1, pp. 3–93); and Kevin Padian (KD09AM2, 42–148; KD09PM1, pp. 6–139).

Robert Pennock, Associate Professor of Science and Technology Studies and Associate Professor of Philosophy, Michigan State University and expert witness on the philosophy of science for the plaintiffs, discussed the work of William A. Dembski, who, at the time of the trial was an Associate Research Professor at Baylor University and fellow of the creationist Discovery Institute:

[Pennock] Dembski writes, “The view that science must be restricted solely to purposeless naturalistic material processes also has a name. It’s called methodological naturalism. So long as methodological naturalism sets the ground rules for how the game of science is played, is to be played, IDT has no chance,” Hades, I assume no chance in Hades.

[Attorney] What do you understand Dr. Dembski to be conveying in that passage?

[Pennock] What he’s saying here is pretty clear, that if you take science as science, that intelligent design theory has a snowball’s chance, and they need to change the ground rules. They need to change what science is, that, you know, science is hard. It requires that one test things.

(KD03AM1, pp. 36–37)

[Pennock] “What is to be done?” Design theorists aren’t at all bashful about answering this question. The ground rules of science have to be changed. (KD03AM1, p. 38)

In his testimony as an expert witness for the plaintiffs, Steven William Fuller confirmed Pennock’s position, criticising the nature of science:

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So special efforts have to be made. And in one of my earlier books, *The Governance of Science*, I actually talked about this as an affirmative action strategy with regard to disadvantaged theories. It's not obvious in the normal system of science that these theories will get a fair hearing.

(KD15AM1, p. 134)

In the *normal system of science*, that requires testability, replicability, falsifiability, predictability, and an adherence to *methodological naturalism*, hypotheses will need to be peer-reviewed and closely scrutinized for more than 150 years before they can become as accepted as the scientific theory of evolution. Any *disadvantaged theory* competes in the arena of science, and stands or falls by the strength of its empirical evidence. In such an arena, if there is a lack of evidence, then to repeat Dr. Robert Pennock, the theory, deservedly, "has a snowball's chance" (KD03AM1, p. 37).

In combination with the theme of criticising established science and the scientific method, I have included data that illustrates the distortion and/or misrepresentation of scientific knowledge in order to make an anti-evolution argument. Professor Kevin Padian was the only testifying expert witness at *Kitzmiller v. Dover* (2005) with any expertise in paleontology. His testimony, therefore, was unrebutted during the trial and contained scathing criticism of the basic science contained within the Dover School Board's recommended text *Of Pandas and People* (Davis & Kenyon, 1993). Further, the Court noted that none of the expert witnesses called by the defendants "or any other ID proponents, including Pandas' authors, have such paleontology expertise as we have been presented with no evidence that they have published peer-reviewed literature or presented such information at scientific conferences on paleontology or the fossil record" (*Kitzmiller v. Dover*, 2005, p. 84).

Professor Padian went on to discuss in detail, with the aid of slide exhibits, how the Davis

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& Kenyon (1993) textbook misrepresented well-established scientific knowledge on:

- Cladistics (KD09AM2, pp. 87–97). The primary form of classification of living organisms, which allows for an illustration of the relationships between all branches of life.
- Homology (KD09PM1, pp. 31–41). A major concept of comparative biology, that allows the analysis of comparable parts of different organisms, in order to classify organisms in relevant kingdoms, groups, families and species.
- Speciation, (KD09AM2, pp. 81–86), where “populations diverge from each other geographically and genetically to the point where they become different species.” (KD09AM2, p. 76)
- Exaptation, (KD09AM2, pp. 146–148), where specific features of an organism may change function over time, such as fish fins becoming fingers or the *phalanges* of bat wings. Professor Padian testified that “ID proponents fail to address exaptation because they deny that organisms change function, which is a view necessary to support abrupt appearance.” (*Kitzmiller v. Dover*, 2005, p. 85)
- Pre-Cambrian era fossils, the evolution of fish to amphibians, the evolution of small carnivorous dinosaurs into birds, the evolution of the mammalian middle ear, and the evolution of whales from land animals, were all misrepresented, or their existence flatly denied (KD09AM2, pp. 107–145, KD09PM1, pp. 6-16, 18–27).

Padian was joined in his criticism of the Davis and Kenyon (1993) textbook by Dr. Kenneth Miller, who stated, “I think the treatment of biology by Pandas is inaccurate and in many respects downright false in every section of the book.” (KD01AM1, p. 29) Miller went on to

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criticize in considerable detail (KD01AM1, pp. 31–143; KD01PM1, pp. 2–113; KD02AM1, pp. 1–111). Above all, Miller refuted the claim in the Davis and Kenyon textbook that evolutionary science cannot account for new genetic information, citing a review paper which “references more than three dozen scientific studies showing the origin of new genetic information by these evolutionary processes.” (KD01AM1, p. 35)

Criticism of Darwinian theory and the scientific method—a summation. As Judge John Jones III stated, creationist arguments for the rationale of ID throughout the *Kitzmiller v. Dover* (2005) were mostly a critique of *perceived* flaws in evolutionary science. Yet these criticisms were met and thoroughly refuted by expert witnesses for the plaintiffs. As stated by Kevin Padian, “[T]he fallacy is that if we don’t have enough evidence for evolution, we must therefore conclude that these things had a supernatural origin.” (KD09PM1, p. 27) The dualism was deemed a “contrived dualism— which has no scientific factual basis or legitimate educational purpose” (*McLean v. Arkansas*, 1982, § IV.A)—and was identified more than thirty years previously, whereby only two explanations for life were possible, the scientific theory of evolution and biblical creationism. If one was not accepted, then the other had to be true.

In addition, the criticism of evolutionary science and the scientific method would often be that a change in what *defined* science was required in order for *alternatives* (such as ID) to be considered as science (e.g., Steven Fuller’s reference to *disadvantaged theories*).

Nature of science—testability, falsifiability and methodological naturalism. General discussion of the nature of science including testability, replicability, falsifiability, predictability and methodological naturalism, and their applicability to the arguments for teaching creationism as part of a U.S., public school science curriculum have been discussed by expert witnesses for both plaintiffs and defendants in the *Kitzmiller v. Dover* (2005) case. Here, whilst the differences between the two sides consider testability, falsifiability, and predictability as key factors of

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scientific investigation, differences exist in how and what can be tested, and what may constitutes each of these factors. The testimony of sociologist Steven Fuller exemplifies this position:

[Attorney] A commitment to natural causation is a ground rule of science?

[Fuller] Well, actually, the ground rule of science is testability. Okay? I mean, so – and that is metaphysically neutral.

[Attorney] And how do you test the supernatural?

[Fuller] Well, that’s an age-old question, but there have been paranormal experiments...

[Attorney] Well, how would you design a test to test for the intelligent designer, the affirmative test?

[Fuller] Well, I take it that – and this refers to what I meant of the sense in which I meant changing the ground rules of science... (KD15AM1, p. 27)

Fuller continues and argues that his position would not mean “changing the ground rules of science in the sense of replacing our normal modes of testability with entirely new modes of testability” (p. 29). However, he does not clearly state exactly how the *ground rules of science* might need to be changed, nor how it would alter *normal modes of testability*.

Biochemistry Professor, Michael Behe suggested a change in the definition of a scientific theory, such that it would cover more loosely formed ideas, *hypotheses* as well as the classic scientific theory:

[Behe] [W]hile it does include ideas that are synonymous or in fact are hypotheses, it also includes stronger senses of that term.

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[Attorney] And using your definition, intelligent design is a scientific theory, correct?

[Behe] Yes.

[Attorney] Under that same definition astrology is a scientific theory under your definition, correct?

[Behe] Under my definition, a scientific theory is a proposed explanation which focuses or points to physical, observable data and logical inferences. There are many things throughout the history of science which we now think to be incorrect which nonetheless would fit that – which would fit that definition. Yes, astrology is in fact one....

(KD11PM1, p. 38)

Unfortunately, an idea which promotes the notion of astrology as a scientific theory in order to justify the proposition of other, similarly weak hypotheses as scientific theories, does not appear to be a *step forward* in the scientific method.

The inclusion of the term *methodological naturalism*—the systematic, empirically-based investigation of the natural world (Hume, 2000)—as a guiding principle of the scientific method is a more significant argument. In his testimony, Steven Fuller rejected the rule of methodological naturalism out of hand:

[Attorney] Do you have an opinion concerning whether methodological naturalism is an essential element of science?

[Fuller] It is not an essential element of science. (KD15AM1, p. 35)

[Fuller] [T]his idea of methodological naturalism as being the nature of science is just complete rubbish from a historical standpoint. (p. 76)

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[Fuller] [T]he tendency nowadays in methodological naturalism, as it's being used in this trial and elsewhere, is trying to give you the impression that the way you test a scientific theory is by the terms of the dominant theory, right.

So if you're intelligent design, the test gets conducted by the evolutionists on the evolutionists' terms, and you got to pass those first.

But that's not the spirit in which the criteria of testability was meant. (p. 91)

Without the rule of methodological naturalism, this systematic investigation of the *natural world*, with its implications for testing against natural phenomena and the ability to *apply* its results to natural phenomena—such as vaccine testing in medicine, science becomes open to a pursuit of *supernatural* phenomena for explanations of the natural world.

Philosopher of science, Robert Pennock, saw methodological naturalism as a basic tenet of scientific inquiry and rebutted Fuller's ideas as follows:

[Attorney] So methodological naturalism is basic to the nature or science today?

[Pennock] As I said, I could not find an exception to that.

[Attorney] And the rule is well accepted in the scientific community?

[Pennock] That's right.

[Attorney] Why is this methodological rule important for science?

[Pennock] ... [I]t's part of what it means now to be a scientist.

(KD03AM1, pp. 29–30)

[Pennock] What one expects in science is that one is going to be testing hypotheses against the natural world, and what methodological

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naturalism does is say we can't cheat. We can't just call for quick assistance to some supernatural power...

That's part of what it means to be able to give evidence for something.

You've undermined that notion of empirical evidence if you start to introduce the supernatural. (KD03AM1, pp. 30–31)

Pennock supports the counter-argument that, without methodological naturalism, science is free to resort to the *supernatural* explanation whenever a phenomena appears to be inexplicable to our current understanding—*God did it*. What triggered the Big Bang? *God did it*. Explain the Grand Canyon? *God did it*. Explain why, in the standard model of physics, some fundamental particles have mass when the symmetries controlling their interactions should require them to be massless? And why the weak force has a much shorter range than the electromagnetic force? *God may have done it*, or more probably the Higgs Boson particle (Carroll, 2012; Lederman & Hill, 2013).

Nature of science—a summation. Gieryn et al. (1985) remarked that creationist proponents try to use the trappings of science for their own agendas, which are not those pursued by the professional scientific community. This is clearly exemplified by the manner in which creationist academics have been shown to protest against the very nature of scientific inquiry in order to allow their own *disadvantaged theories* to be included amongst others that have the sole advantage of being supported by more evidence. In Steven Fuller's discussion of the scientific method, he referred to scientists as a cloistered hierarchy of specialists that predominantly ignore those theories which do not fit their classic model of observation or experimental protocol. This is similar to the ideas proposed by Gieryn (1983), when he proposed that a demarcation existed between different providers of knowledge, with scientists using that demarcation to increase public support and financial resources for scientific education. From the perspective described by

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creationist supporters such as Fuller, science maintains a prestige, an authority, and access to resources by intimidating what it portrays as lesser forms of knowledge production. Yet, as I have previously discussed, it is debatable whether ID creationism can even be termed *knowledge producing* (Costa, 2010; Hilpinen, 1970; Hume, 2000; Sagan, 2006). The question therefore, arises as to whether creation science/ID is science or religion.

Creation science/ID is not religion, it's science. Creationist proponents are keen to make the point that ID is not based on religion. It is not creationism *per se*, yet as Judge Jones stated in his ruling on *Kitzmiller v. Dover* (2005):

Notably, every major scientific association that has taken a position on the issue of whether ID is science has concluded that ID is not, and cannot be considered as such. (p. 69)

Defendants argued that ID was a scientific explanation for life and the universe having been created by a *designer*, whilst painstakingly avoiding any discussion of the nature of that designer. It should be remembered that, from a legal perspective, this is critical because any admission on the part of the defendants that the designer equates to God—or any other religious aspect—would mean that ID would constitute a violation of the Establishment Clause of the First Amendment.

In February 2005, the Dover Area School Board sent a specialized newsletter to every household in the Dover area community, irrespective of whether they had children that attended the high school. Formatted to resemble a standard board newsletter and produced with the legal consultation of the Thomas More Law Centre (*Kitzmiller v. Dover*, 2005, p. 128)—a national conservative Christian, public interest, and non-profit practice—the Court described the newsletter as “an aggressive advocacy piece denigrating the scientific theory of evolution while advocating ID” (p. 52). The newsletter was the first public occasion on which the school board

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had clearly argued that ID was a scientific theory and not religious in nature, “[t]he theory of intelligent design (ID) is a scientific theory that differs from Darwin’s view, and is endorsed by a growing number of credible scientists.” (*Kitzmiller v. Dover*, 2005, p. 53)

Throughout the lay and expert testimony given in *Kitzmiller v. Dover* (2005), witnesses for the defendants declared that ID was not religion, rather, it was a valid scientific theory.

Lehigh University, Professor of Biochemistry, Michael Behe discussed ID as follows:

[ATTORNEY] Sir, what is intelligent design?

[BEHE] Intelligent design is a scientific theory that proposes that some aspects of life are best explained as the result of design, and that the strong appearance of design in life is real and not just apparent.

(KD10AM1, p. 89)

[ATTORNEY] Is intelligent design creationism, whether you call it young-earth creationism, old-earth creationism, or special creationism?

[BEHE] No, it is not.

[ATTORNEY] And why not?

[BEHE] Creation – creationism is a theological concept, but intelligent design is a scientific theory which relies exclusively on the observable, physical, empirical evidence of nature plus logical inferences. It is a scientific idea. (KD10AM1, pp. 93–94)

The term *plus logical inferences* is worth noting here, because it allows for a wide interpretation of the nature of those inferences, not least of which, that they might infer a deistic influence as a designer. In addition, Behe later admits—as has been previously discussed—that for ID to be considered a valid scientific theory, the very definition of the term would have to be altered such that it would also include pseudoscientific notions of astrology (KD11PM1, p. 38).

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Scott Minnich, Associate Professor of Microbiology at the University of Idaho and fellow of the Discovery Institute confirmed Behe's testimony:

[ATTORNEY] Do you have an opinion as to whether intelligent design makes testable scientific claims?

[MINNICH] I do.

[ATTORNEY] And what is that opinion?

[MINNICH] It does. (KD20PM1, p. 45)

[ATTORNEY] Do you have an opinion as to whether intelligent design is a religious belief?

[MINNICH] I do.

[ATTORNEY] And what is that opinion?

[MINNICH] It is not. (KD20PM1, p. 46)

[ATTORNEY] Sir, what is intelligent design?

[MINNICH] ... Intelligent design is a scientific theory, and it holds that the deep complexity and clearly evident design in organisms is the result of an intelligent agent or cause. Given that even the simplest cells are comprised of nanomachines that currently defy our own intelligent capability to produce, yet have the general features of many machines we have made on a larger scale, intelligent design theory is simply an inference to the best explanation as to the origin of the design.

(KD20PM1, p. 48)

Minnich deviates from Behe somewhat in his brief description of ID. Where Behe limits himself to discussing exclusively *observable, physical, empirical evidence, plus logical inferences*

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(KD10AM1, p. 94), Minnich makes that inference and concludes the best explanation is an *intelligent agent* or *cause*.

Steven Fuller, testifying for the defendants, was more explicit in his remarks regarding the relationship between creationism and ID:

[Attorney] But clearly you are indicating that intelligent design is creationism in some sense? And then Mr. Gillen objects. And then your answer, if you could read your answer going through Line 1 of the next page.

[Fuller] It is – it does have roots in that. I mean, intelligent design is a way of interpreting creationism, that's true. Okay. I didn't say it was exclusively that, and I do think it's an unfortunate choice of words.

(KD15PM1, p. 93)

Fuller explains that these words were so unfortunate, because he believed they gave the impression that ID may only be understood in relation to creationism and not as an original area of research. Nevertheless, his statement is a clear affirmation of his position—as a major expert witness for the defense—that ID was a method for interpreting creationist ideas.

ID is not religion—because I was told it wasn't. Members of the Dover Area District School Board that voted for the curriculum change and to teach ID, whilst being vocal proponents of the arguments for ID, also testified during the trial that they had “utterly no grasp” of ID (*Kitzmiller v. Dover*, p. 121). This was exemplified by the testimony of board member Heather Geesey:

[ATTORNEY] Now, you said you voted for the October 18th curriculum change because you liked it.

[GEESEY] Yes.

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[ATTORNEY] You supported the change.

[GEESEY] Yes.

[ATTORNEY] It – because it gave a balanced view of evolution.

[GEESEY] Yes, I mean . . .

[ATTORNEY] It presented an alternative theory?

[GEESEY] Yes.

[ATTORNEY] And the policy talks about gaps and problems with evolution?

[GEESEY] Yes.

[ATTORNEY] Yes. You don't know what those gaps and problems refer to, do you?

[GEESEY] No.

[ATTORNEY] But it's good to teach about those gaps and problems?

[GEESEY] That – yes, that's our mission statement, yes.

[ATTORNEY] But you have no idea what they are?

[GEESEY] It's not my job, no.

[ATTORNEY] Is it fair to say that you didn't know much about intelligent design in October of 2004?

[GEESEY] Yes.

[ATTORNEY] And you didn't know much about the book Of Pandas and People either, did you?

[GEESEY] Correct.

[ATTORNEY] So you had never participated in any discussions of the book?

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[GEESEY] No.

[ATTORNEY] And you made no effort independently to find out about the book?

[GEESEY] No.

[ATTORNEY] And the administration had made copies of the book available to board members.

[GEESEY] Yes.

[ATTORNEY] But you never read the book.

[GEESEY] No. (KD17AM3, pp. 181–182)

Heather Geesey clearly admitted to knowing almost nothing about any of the issues involved in the pro-creationist arguments, nor about the textbook recommended to support students in the curriculum change for which she voted. Heather Geesey deferred completely to President of the Board of Directors Alan Bonsell and Chief of the Curriculum Committee William ‘Bill’ Buckingham’s arguments with regard to endorsing the ID curriculum change (KD17AM3, pp. 154–155, 161–162, 168, 184-87, 190). Further, Geesey was aware of the resistance to the curriculum change by the science teachers at the school, who were the only professional scientific guidance she had recourse to on the issue:

[ATTORNEY] And so the only people in the school district that you’re aware of that have a science background were opposed to introducing intelligent design; they thought it wasn’t science, they thought it was religion, and you ignored that?

[Geesey] Yes.

[ATTORNEY] And you voted for the proposal because Mr. Buckingham and Mr. Bonsell encouraged you to do so?

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[Geesey] I agreed with them, that's why I voted for the proposal.

(KD17AM3, p. 190)

Buckingham admitted that he had no basis to know whether ID amounted to good science at the time of his first deposition—two and a half months after the ID Policy was approved. In addition, prior to voting, he was fully aware of the resistance of the school's science teachers to the curriculum change and sought no further scientific advice, yet he voted for the change and—as discussed—played a key role in influencing others to do the same (KD16PM1, pp. 31–34).

Irreducible complexity—a defective argument. One of the key arguments for ID has been the central theory of *irreducible complexity*—as previously discussed. Whilst effectively discredited by the previous work of plaintiffs expert witness Kenneth Miller (1999, 2004), irreducible complexity was still a major component of creationist argument in *Kitzmiller v. Dover* (2005). Behe's definition of irreducible complexity was adapted from his work in an earlier edition of his book *Darwin's Black Box* (Behe, 1996):

By irreducibly complex I mean a single system which is composed of several well-matched, interacting parts that contribute to the basic function, wherein the removal of any one of the parts causes the system to effectively cease functioning. An irreducibly complex system cannot be produced directly by slight, successive modifications of a precursor system, because any precursor to an irreducibly complex system that is missing a part is by definition nonfunctional... Since natural selection can only choose systems that are already working, then if a biological system cannot be produced gradually it would have to arise as an integrated unit, in one fell swoop, for natural selection to have anything to act on. (KD12AM1, p. 59–60)

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However, the irreducible complexity is not an argument *for* a theory of design, rather it is simply an argument *against* evolution. This was confirmed by the testimonies of expert witness for the plaintiffs, Kenneth Miller, and defense expert witness, Scott Minnich:

[Attorney] Now this test [of irreducible complexity] actually is not a test of intelligent design, it's a test of evolution, isn't it?

[Minnich] Yes. (KD21AM1, p. 82)

Evolutionary science has already had its own well-documented explanation for such fully-working systems for a number of years—in the form of co-opting existing adaptations for alternative functions. This is a simplified term for a complex process known as *exaptation* (Gould & Vrba, 1982; Rice, 2007), also discussed by expert witness for the plaintiffs, Kevin Padian (KD09AM2, pp. 146–148).

Behe was fully aware of this defect in his work, when he wrote the following, in an article responding to critics of *Darwin's Black Box*:

[C]ommentary by Robert Pennock and others has made me realize that there is a weakness in that view of irreducible complexity. The current definition puts the focus on removing a part from an already-functioning system...

The difficult task facing Darwinian evolution, however, would not be to remove parts from sophisticated pre-existing systems; it would be to bring together components to make a new system in the first place. Thus there is an asymmetry between my current definition of irreducible complexity and the task facing natural selection. I hope to repair this defect in future work. (Behe, 2001, p. 695)

However, as Judge John Jones III stated, Professor Bee has “failed to do so even four years after elucidating his defect.” (*Kitzmiller v. Dover*, 2005, p. 74) Not only had Behe failed to repair this

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defect in his work, he had still put forward the argument of irreducible complexity as a credible scientific alternative to evolutionary science.

ID in peer-reviewed, scientific literature. The court in *Kitzmiller v. Dover* (2005) also stated that they had found “Professor Behe’s claim for irreducible complexity has been refuted in peer-reviewed research papers and has been rejected by the scientific community at large.” (p. 79) This was partially based on testimony provided by Drs. Padian and Forrest who stated that reviews of the scientific and medical literature—recent to the trial dates—had “disclosed no studies supporting a biological concept of ID” (pp. 87–88). This was confirmed by Behe’s own testimony:

[Attorney] Now you have never argued for intelligent design in a peer reviewed scientific journal, correct?

[Behe] No, I argued for it in my book.

[Attorney] Not in a peer reviewed scientific journal?

[Behe] That’s correct.

[Attorney] And, in fact, there are no peer reviewed articles by anyone advocating for intelligent design supported by pertinent experiments or calculations which provide detailed rigorous accounts of how intelligent design of any biological system occurred, is that correct?

[Behe] That is correct, yes. (KD12AM1, pp. 22-23)

Nevertheless, creationist proponents still argue for notions of ID and irreducible complexity to be given balanced treatment with evolution in U.S. science classes (NCSE, 2014b).

ID is creationism relabeled—literally. Barbara Forrest, Professor of Philosophy at Southeastern Louisiana University and plaintiffs’ expert witness on the goals and history of the *intelligent design movement* (IDM), presented her findings on the history of the Davis and

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Kenyon (1993) book *Of Pandas and People*. Specifically, her findings were aimed at changes in terminology over the different drafts of the book. As illustrated by Figure 4.1, from 1983 when the book was called *Creation Biology*, to 1986 when it became *Biology & Creation*, 1987 when it went through three versions, one known as *Biology & Origins* and the next two versions being the first drafts of *Of Pandas and People*. The first edition of *Pandas* was published in 1989, and the current version (purchased by the Dover Area School Board) in 1993. Forrest discussed her findings as part of her expert witness testimony for the plaintiffs (KD06AM1, pp. 123–126).

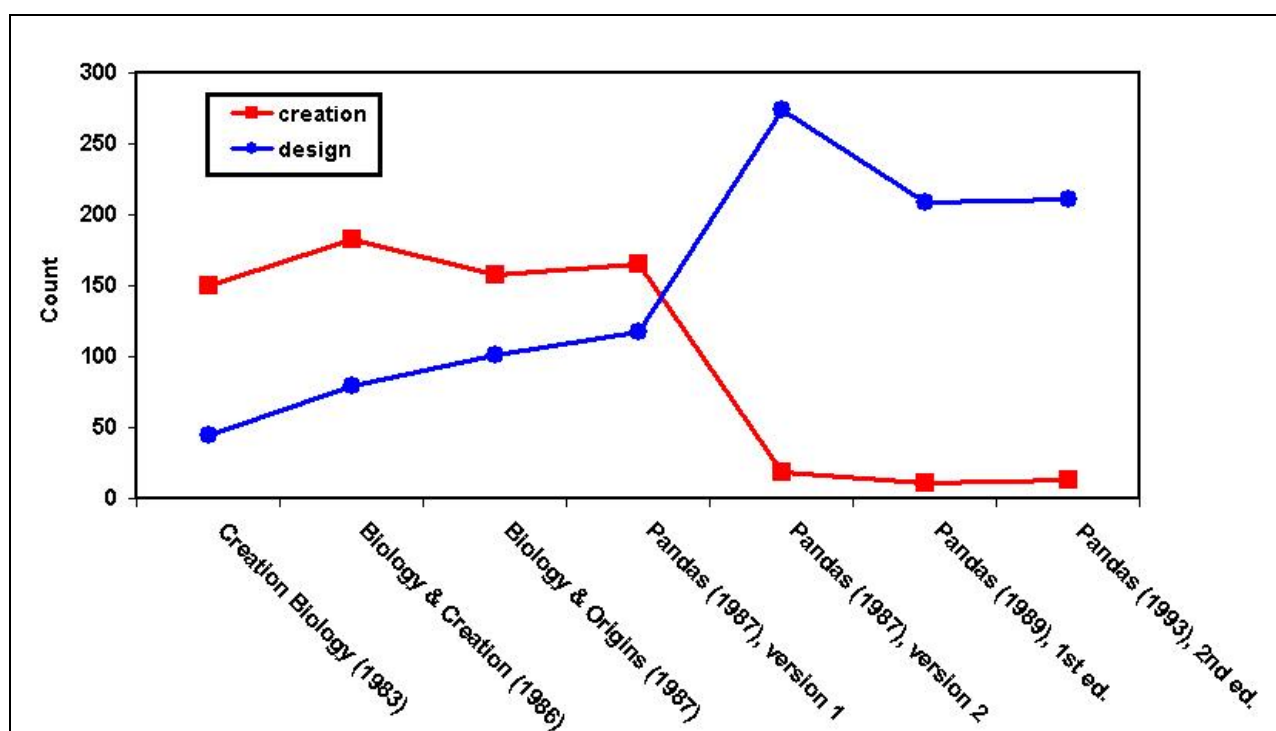


Figure 4.1. Illustrating word counts for *creation* and *design*, through different drafts of the book by Percival Davis and Dean Kenyon, *Of Pandas and People: The Central Question of Biological Origins* (1983–1993).

NOTE: This chart illustrates a count of the word *creation* used more than 150 times in each of the first four drafts of the book, whilst the word *design* is used mostly less than 100 times in each draft. Following the Supreme Court case of *Edwards v. Aguillard* (1987), where creationism was ruled to contravene the Establishment Clause of the First Amendment of the U.S. Constitution, there is an abrupt switch. The word *creation* drops to less than ten uses, whilst *design*, climbs to more than 200. Adapted from National Center for Science Education (NCSE). (2008, October 17). *Forrest's testimony: "Creationism" and "ID"*. http://ncse.com/files/pub/legal/kitzmiller/exhibits/origins_of_ID/Forrest_chart1.png.

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The chart displayed in Figure 4.1 illustrates the abrupt change in the use of the words *creation* and *design* over the different drafts of the textbook recommend by the Dover School Board as part of the curriculum change. In the original draft *Creation Biology* (1983), the word *creation* was used approximately 150 times, whilst the word *design* was used less than 50 times. An abrupt switch occurs in 1987 between *Of Pandas and People* versions 1 and 2, and by the second edition of *Pandas* (1993), where the word *design* was used more than 200 times, whilst *creation* was used no more than 10 times.

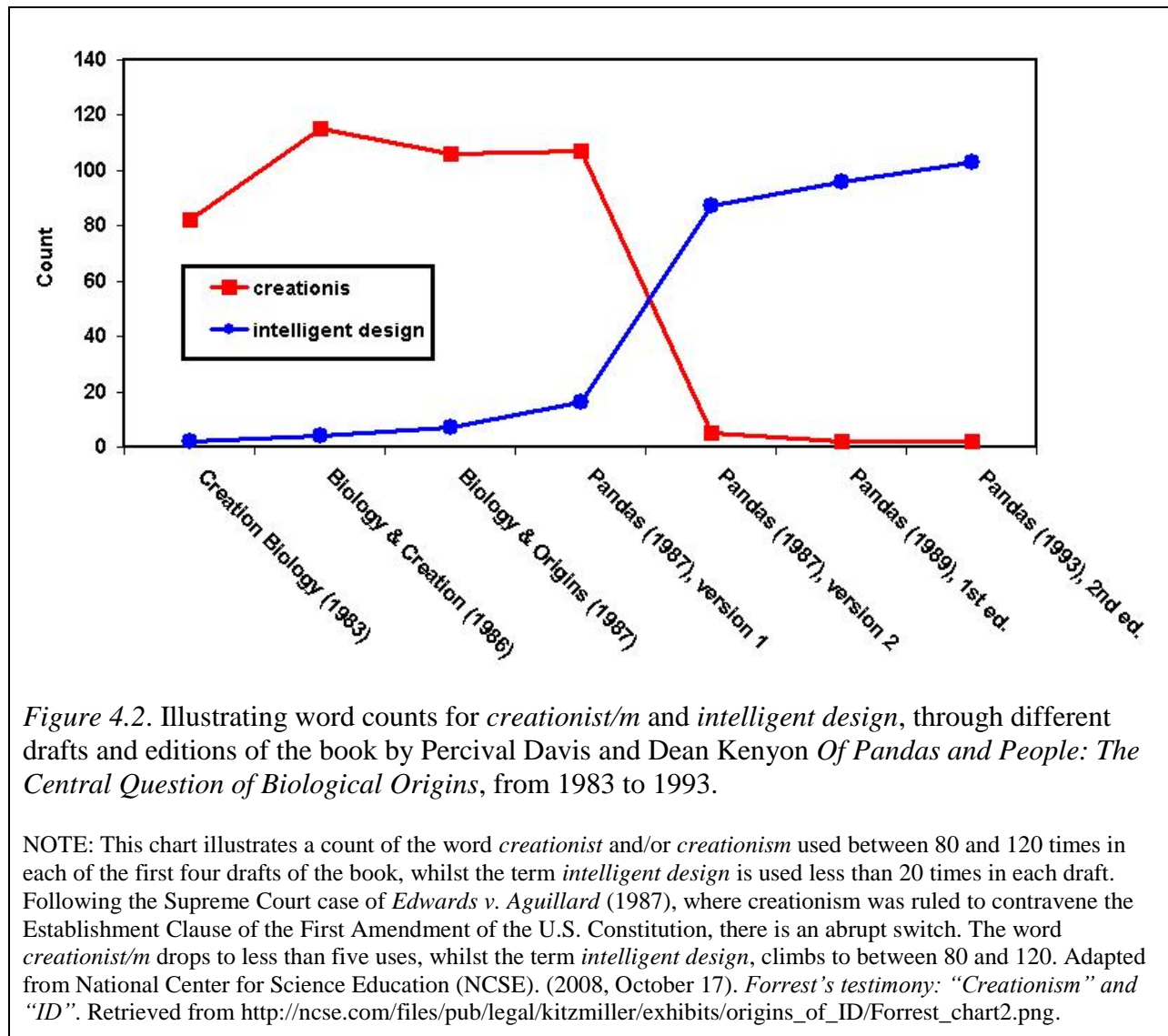
Figure 4.2 shows a similar pattern in the use of the words *creationist* and/or *creationism*, and the term *intelligent design*. Early versions of *Creation Biology* and *Biology & Origins*, use the words *creationist* or *creationism* between 80 and 120 times, whilst the term *intelligent design* was used less than 20 times in each book. Following the switch between *Pandas* versions 1 and 2 in 1987, the use of *creationist/creationism* drops to less than five uses per book, and *intelligent design* climbs to between 80 and more than 100.

As Judge Jones stated in his ruling:

This compelling evidence strongly supports Plaintiffs' assertion that ID is creationism re-labeled. Importantly, the objective observer, whether adult or child, would conclude from the fact that *Pandas* posits a master intellect that the intelligent designer is God. (*Kitzmiller v. Dover*, 2005, p. 33)

Clearly, from the perspective of the authors of these texts, Percival Davis and Dean Kenyon, the terms *creation* and *creationism* were synonymous with those of *design*, and the pseudoscientific *intelligent design*.

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Creation science/ID is not religion—a summation. Arguments for ID as science and not religion failed to sway judicial opinion during the *Kitzmiller v. Dover* (2005) trial for three major reasons. Firstly, ID proponents argued that ID constituted a valid scientific theory, without being able to show that it met the requirements of such a theory, as defined by the scientific community (*Kitzmiller v. Dover*, 2005, p. 79). Secondly, ID had no history of peer-reviewed work, published in reliable scientific journals (pp. 87–88). Lastly, ID supporters themselves had recognized the

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connections between ID and creationism, and had a history of using the terms synonymously (KD15PM1, p. 93; KD06AM1, pp. 123–126).

ID has been consistently argued to be science, as evidenced by the expert witness testimonies for the defendants, provided by Professor of Biochemistry Michael Behe (KD10AM1, KD10PM1, KD11AM1, KD11PM1, KD12AM1, KD12PM1); Professor of Sociology Steven W. Fuller (KD15AM1, KD15PM1); Associate Professor of Microbiology Scott Minnich (KD20PM1, KD21AM1) and many associated works (Behe, 2006; Dembski, 2004, 2009; Dembski & Ruse, 2006; Manson, 2003; Meyer, 2009, 2013; Poole, 2012). Yet these arguments have been soundly refuted by expert witnesses for the plaintiffs, Professor Kenneth Miller (KD01AM1, KD01PM1, KD02AM1); Associate Professor Robert Pennock (KD03AM1); Professor Barbara Forrest (KD06AM1, KD06PM1, KD07AM1); Associate Professor Brian Alters (KD08AM2, KD08PM1); Professor Kevin Padian (KD09AM2, KD09PM1), and their own associated literature (Alters, 2005; Alters & Alters, 2001; Alters & Nelson, 2002; Dawkins, 1996, 2005, 2009; Forrest & Gross, 2004; Horner, Padian, & de Ricqlès, 2001; Miller, 1999, 2004; Padian, 1999; Padian, & Chiappe, 1998; Padian, de Ricqlès, & Horner, 2001; Padian, & Horner, 2002; Padian & Rayner, 1993; Pennock, 1999, 2001; Ricqlès, Padian, Horner, & Francillon-Vieillot, 2000), literature acceptance by the scientific community not shared by the IDM.

Members of the Dover Area School Board voted for ID to share time in the high school science curriculum with evolution, because—*according to testimony*—they believed it to be a viable alternative to evolutionary science. They also argued under oath that they did not believe ID to be religion. Yet testimony revealed that some members of the Board did not understand

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what ID was, and simply *followed the lead* of Board leaders that they *believed* understood the issues involved (KD16PM1, pp. 31–34; KD17AM3, p. 190).

Even expert supporters of the IDM have been shown to acknowledge the relationship between ID the religious doctrine of creationism. Steven Fuller confirmed this relationship as part of his expert witness testimony (KD15PM1, p. 93). In addition, the authors of the Dover Area School Board’s recommended text by Davis and Kenyon (1993) have been shown to use the terms *creation* and *intelligent design*, interchangeably over the various editions of their work. And to systematically alter the content of their text in response to the ruling of *Edwards v. Aguillard* (1987), so as not to be seen to violate the establishment Clause of the First Amendment if the book was used in a public school science classroom (Forrest, 2004; KD06AM1, pp. 123–126).

Legal tests—appropriate legal tests and their results? Arguments on the appropriate application of legal tests such as the Lemon Test or endorsement test go to the heart of whether or not ID creationism can be legally taught in U.S. public schools. If the Court deems either the endorsement test or Lemon Test to be appropriate in a given case, and one side fails that test, then they will have violated the establishment Clause of the First Amendment and the case will have been lost. In *Kitzmiller v. Dover* (2005) both parties agreed that an applicable test in the case would be that of *Lemon v. Kurtzman* (1971)—the Lemon Test—to ascertain whether the challenged curriculum change was unconstitutional under the First Amendment of the United States Constitution and Article I, § 3 of the Pennsylvania State Constitution, which guarantees the right to worship “according to the dictates of their own consciences” (*Kitzmiller v. Dover*, 2005, p. 134).

However, defendants claimed that it was not appropriate for the Court to apply the endorsement test in this case because the Supreme Court had not applied that test to the

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precedent-setting rulings in *Epperson v. Arkansas* (1968), or *Edwards v. Aguillard* (1987).

Plaintiffs response included the observation *Lemon v. Kurtzman*, which all parties agreed was appropriate, had not come into effect until 1971. Almost four years after *Epperson*. Defendants then argued that the endorsement test applied only to *religious display* cases, and limited Establishment Clause cases, including:

[A] policy or practice in question that involves: a facially religious display, an overtly religious group or organization using government facilities, the provision of public funding or government resources to overly religious groups engaged in religious activity, or the permission of an overtly religious practice. (*Kitzmiller v. Dover*, 2005, p. 10)

Judge Jones responded to defendants arguments against the endorsement test, clearly stating his rationale for utilising both the Lemon and endorsement tests:

After a searching review of Supreme Court and Third Circuit Court of Appeals precedent, it is apparent to this Court that both the endorsement test and the Lemon test should be employed in this case to analyze the constitutionality of the ID Policy under the Establishment Clause. (p. 10)

... [T]he Supreme Court and the Third Circuit have consistently applied the test to all types of Establishment Clause cases, notably cases involving religion in public-school settings. (p. 10)

Culminating with...

It is readily apparent to this Court that based upon Supreme Court precedent, the endorsement test must be utilized by us in our resolution of this case. (p. 13)

Whilst defendants “consistently asserted that the ID Policy was enacted for the secular purposes of improving science education and encouraging students to exercise critical thinking”

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(*Kitzmiller v. Dover*, 2005, p. 130), this was not a legal defense. As has been discussed, if it could be shown that members of the audience would consider the Dover Area District School Board's behaviour to be endorsing religion—or a particular religious point of view—then the Board would be in violation of the Establishment Clause of the First Amendment. The results of plaintiffs' arguments for curriculum change to include ID, therefore hinged on whether ID could be considered science or religion, and thus violate the Establishment Clause.

Following evidence previously discussed, Judge Jones' opinion was that ID could not be considered science, for three main reasons (*Kitzmiller v. Dover*, 2005, p. 64):

1. ID permits or requires supernatural causation.
2. The argument of contrived dualism does not allow for the co-existence of evolutionary science, a failed argument from the 1980s (*McLean v. Arkansas*, 1982, § IV.A).
3. Negative attacks on evolutionary science—without any peer-reviewed publications, original research or testing to support its cause—have been thoroughly refuted by the scientific community.

Defendants' own expert witnesses declared a requirement, that the fundamental rules of what could be considered science would have to be changed, to allow for a supernatural causation of the natural world. Courts in *Edwards v. Aguillard* (1987) and *McLean v. Arkansas* (1982) had already recognized this as “an inherently religious concept” (*Kitzmiller v. Dover*, 2005, p. 67).

Judge Jones summarised the findings of the Court against ID and its proponents in the following manner:

ID, as noted, is grounded in theology, not science. Accepting for the sake of argument its proponents', as well as Defendants' argument that to introduce ID to students will encourage critical thinking, it still has

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utterly no place in a science curriculum.

Moreover, ID's backers have sought to avoid the scientific scrutiny which we have now determined that it cannot withstand by advocating that the controversy, but not ID itself, should be taught in science class. This tactic is at best disingenuous, and at worst a canard. The goal of the IDM is not to encourage critical thought, but to foment a revolution which would supplant evolutionary theory with ID. (*Kitzmiller v. Dover*, 2005, p. 89)

As a result of the court's opinion, the board's decision to include ID—as a theologically based argument—in the Dover high school science curriculum, was clearly shown to fail both the endorsement test and the Lemon test. In considering the Lemon test, the Court passed judgement on both the *purpose* and *effect* prongs of the test.

The Lemon test—purpose inquiry. Although as described previously, the defendants argued that the Board had in mind a secular purpose of improving science education and encouraging critical thinking skills, the Court found that their arguments were “simply irreconcilable with the record of evidence... [and their] asserted purposes are a sham” (*Kitzmiller v. Dover*, 2005, p. 130). The court supported this statement with the following points:

- The Board took none of the steps that school officials would take if their stated goals of a secular purpose had truly been their objective.
- The Board consulted no scientific materials, nor did they contacted any scientists or scientific organizations, to clarify any point during their deliberations.
- The Board failed to consider the views of the high school science teachers in their employ.

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- The Board relied on legal advice sought from only two organizations with overtly religious, cultural, and legal goals—the *Discovery Institute* and the *Thomas More Law Centre* (TMLC).
- The Boards’ supposed secular purpose of improving science education, is belied by the fact that most—if not all—of the Board members, who voted in favor of the biology curriculum change, admitted that they still do not know, and have never known, exactly what ID is, and have made no efforts to understand the subject.
- Throughout the trial, Board members had tried, unsuccessfully to distance themselves from their previous actions and statements. The Court recognized that this strategy had resulted in “repetitious, untruthful testimony” (p. 130), thereby providing further compelling evidence of a breach of the purpose prong of the Lemon test.

Judge Jones concluded his commentary with a damning indictment of the honesty of the Board’s testimony:

To assert a secular purpose against this backdrop is ludicrous...

Defendants’ previously referenced flagrant and insulting falsehoods to the Court provide sufficient and compelling evidence for us to deduce that any allegedly secular purposes that have been offered in support of the ID Policy are equally insincere.

Accordingly, we find that the secular purposes claimed by the Board amount to a pretext for the Board’s real purpose, which was to promote religion in the public school classroom, in violation of the Establishment

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Clause.” (*Kitzmiller v. Dover*, 2005, p. 130, 132)

Such a clear failure of the purpose prong of the Lemon test would, in itself be sufficient to conclude a violation of the Establishment Clause. However, Judge Jones continued his analysis by considering the second *effect* prong of Lemon.

The Lemon test—effect inquiry. Given the established religious nature of ID and the purpose of the Board’s change to the high school curriculum, the only real effect of the policy would be the advancement of religion. Judge Jones’ conclusion was that “The effect of Defendants’ actions in adopting the curriculum change was to impose a religious view of biological origins into the biology course, in violation of the Establishment Clause.” (*Kitzmiller v. Dover*, 2005, p.134) Thus, the behaviour of the Dover Area School Board failed both the first and second—*purpose* and *effect*—prongs of the Lemon test, thereby violating the Establishment Clause of the First Amendment, as well as plaintiffs’ rights under Art. I, § 3 of the Pennsylvania Constitution.

Legal tests—a summation. Both the endorsement and Lemon tests depended upon the Court’s decision regarding the nature of ID and its centrepiece idea of irreducible complexity. When Judge Jones concluded that irreducible complexity was little more than a criticism of evolution, that ID was not science “and moreover that ID cannot uncouple itself from its creationist, and thus religious, antecedents” (*Kitzmiller v. Dover*, 2005, p. 136), then the plaintiff’s case had failed the endorsement test and the second—*effect*—prong of the Lemon Test. Thus, the plaintiffs were seen to have violated both the First Amendment to the United States Constitution and the Pennsylvania State Constitution. The Judge had no legal requirement to pursue both *purpose and effect* under Lemon, but did so “in the interest of completeness” (p. 132).

The result of the case was that no change to existing education policy and the law would

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be made. However, at the cost of a six-week trial, a judicial opinion had been reached. ID and irreducible complexity had, after all evidence had been heard and analysed, been found to be utterly lacking in science, and religious in its foundations, thereby, violating the U.S.

Constitution. This was the first decision that had addressed the “seminal question of whether ID is science” (*Kitzmiller v. Dover*, 2005, p. 136), and has therefore *set the bar* for future argument.

Addressing research question 2. Table 4.2 presents three themes and their sub-categories that emerged to address research question 2. The three themes were: impact on American public education policy and the law; social discord; and counter-arguments against creationism/ID. Theme 1, the impact of creationist challenges on U.S. public education policy and law, had sub-categories that fell within the area of legal discourse. Discussions of whether creationist theories presented as science, which were adjudged to have failed the religious clauses of the First Amendment to the U.S. Constitution, were included in this theme. Discussions relating to the Dover District School Board’s ID policy and its violation of the Pennsylvania State Constitution are also included, as are decisions relating to balanced treatment challenges and their constitutional success or failure.

Legal history, in relation to precedents set by argument in the public debate over teaching creationism and evolution in U.S. state schools, is also included in this theme. The relevance of this sub-category being of particular note where it informed the *Kitzmiller v. Dover* (2005) final adjudication, which also contributed to this theme. Further legal commentary included points raised in court opinion, with regard to the defense being represented by a national public interest law firm seeking a constitutional test case on ID, and the waste of resources represented by such hearings (*Kitzmiller v. Dover*, 2005).

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Table 4.2

Summary of Themes and Sub-Categories Arising from the Analysis of the Impact of Arguments for Teaching Intelligent Design in Public School Science Classes, on U.S. Public Education Policy, Law and the Local Community, Including Counter-Arguments as Documented in the Case of Kitzmiller v. Dover (2005).

Theme 1: Impact on American Public Education Policy and the Law	Theme 2: Social Discord	Theme 3: Counter-Arguments Against Creationism/ID
Legal—Creationism as science fails the Establishment Clause/First Amendment	Legal—Enacting ID policy violates rights under State Constitution	Evolutionary science does not speak to the existence of a divine creator
Legal—Enacting ID policy violates rights under the Pennsylvania State Constitution	School board—Coercion/intimidation of non-adherents to board creationist agenda	ID—Contravenes the First Amendment
Legal—Equal time statutes violate the First Amendment	Social Pressure—Boards actions caused conflict within the family unit and the community	ID—Creation Science/ID is NOT science (and therefore fails constitutional tests)
Legal—Final adjudication	Social Pressure—On non-adherents to religious endorsement	ID—Expert witnesses (for defense) acknowledge poor science or reasoning
Legal—History/precedent of opposition to teaching evolution		ID—Requires a change in the nature of science to be accepted
Legal—ID policy violates rights under the U.S. Constitution		ID—Science proposed is wrong
Legal—National public interest law firm seeking constitutional test case on ID		Legal—Enacting ID policy violates rights under the Pennsylvania State Constitution
Legal—Waste of resources		Legal—Equal time statutes violate the First Amendment
		Logical Fallacy—Inferring a designer is wrong
		Nature of Science—Incorrect definition or misrepresentation of a scientific theory
		School Board—Behavior fails constitutional Tests
		School Board—Credibility/honesty of testimony

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The second theme, listed in Table 4.2, has been called social discord. This theme arose from the data following successive readings. Each of the plaintiffs that gave evidence before the Court, was asked whether they felt that the Dover Area School District Board of Directors had caused them harm. The theme was not an argument for or against creationist instruction in public school science classes, although it could be construed as an illustration of how harmful the public debate can become, but a small number of sub-categories arose that supported an analysis of the issue. Violation of an individual's constitutional rights was included in the theme, but more overt instances of harm or discord were also seen, for example, coercion and/or intimidation of non-creationists to support the Board's agenda. In addition, sub-categories of social pressure where the Board's actions caused conflict within a family unit or the community at large, and pressurized non-adherents into religious endorsement both on the Board, and in the Dover area community.

The final theme listed in Table 4.2 details the counter-arguments found in the *Kitzmiller v. Dover* (2005), against the proposals for creationist instruction. The sub-categories were mostly direct contradictions of creationist arguments. For example, creation science and/or ID are not science, but are based on a religious premise and thus, violate the First Amendment of the U.S. Constitution. In addition, expert witnesses refute creationist assertions that ID can be considered science, by illustrating where creationist hypotheses have misinterpreted, misrepresented, or simply misunderstood established scientific theory.

The Wedge Strategy: A conspiracy theme? The final theme, which—debatably—runs through all pro-creationist argument, is *The Wedge Strategy*. Defined by The Wedge document (CRSC, 1998), the Discovery Institute sponsored strategy details, an ambitious plan to run from between 5–20 years, designed to “undermine public support for the teaching of evolution and other natural science supporting evolution, while at the same time cultivating a supposedly sound

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alternative: intelligent design theory.” (Forrest & Gross, 2004, p. 16) With such a wide-ranging brief, it is difficult to avoid categorizing all pro-creationist argument under the Wedge Strategy theme, yet this would also seem to indicate that the Dover Area School Board’s agenda was—intentionally or not—part of a broader long term plan. Documentation relating to this issue is presented later in the section that provides details for this final theme of this study.

Impact on American public education policy and the law. Judge Jones III began his ruling in *Kitzmiller v. Dover* (2005), with a historical overview of the major changes in U.S. education policy and law which had informed the opinion of the Court. The judge observed that the Supreme Court studies the historical context of court opinion and the specific sequence of events leading to its findings (p. 92). Jones stated that his rulings had looked to the history of Christian Fundamentalism in the United States, and to the “long history of official opposition to evolution” (p. 92) related to fundamentalist beliefs, specifically in Arkansas. Whilst this history may not represent the explicit impact of the trial analyzed as part of this research, the precedents upon which Judge Jones based his opinion form at least a partial response to my second research question.

The impact of legal decisions from Scopes to Kitzmiller. Riding on an increase in the popularity of fundamentalist religion in the 1920s, and fuelled by the success of *Scopes v. Tennessee* (1927), religiously motivated groups drove state legislatures to adopt laws prohibiting public schools from teaching evolution. As the Court observed (*Kitzmiller v. Dover*, 2005, p. 8), the legal landscape radically changed when the Supreme Court struck down Arkansas’s statutory prohibition against teaching evolution in *Epperson v. Arkansas* (1968) on the grounds of its violation of the First Amendment. Creationist proponents, thereafter, argued for *balanced treatment* of creationism and evolutionary science. These arguments met with no success, being

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defeated in *McLean v. Arkansas* (1982) and later in *Edwards v. Aguillard* (1987), on the basis of the *purpose* and *effect* prongs of the Lemon test.

In the early 1980s, creationist proponents, learning from cases that had failed against the Establishment Clause of the First Amendment, began to avoid overtly religious terminology. Cloaking religious beliefs in scientific-sounding language, then arguing that schools teach *creation science*, or *ID* as an alternative to evolution (*Kitzmiller v. Dover*, 2005, p. 21). The *creationism in a lab' coat* tactic was similarly unsuccessful and was rejected under the First Amendment in *McLean*:

“In the 1960’s and early 1970’s, several Fundamentalist organizations were formed to promote the idea that the Book of Genesis was supported by scientific data. The terms “creation science” and “scientific creationism” have been adopted by these Fundamentalists as descriptive of their study of creation and the origins of man.” (*McLean v. Arkansas*, 1982, § II, para. 6)

The District Court in *McLean v. Arkansas* found that “The creationist organizations consider the introduction of creation science into the public schools part of their ministry.” (*McLean v. Arkansas*, 1982, § II, para. 13) Whilst *McLean* was a District Court and therefore did not set national precedent, its judgement still had impact upon the Court’s decision in *Kitzmiller v. Dover* (2005, p. 21). In addition, both *Edwards* and *McLean* found *ID* to be a religious argument, and therefore in violation of the First Amendment:

Such a concept is not science because it depends upon a supernatural intervention which is not guided by natural law (*McLean v. Arkansas*, 1982, § IV C, para. 4).

The Act impermissibly endorses religion by advancing the religious

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belief that a supernatural being created humankind (*Edwards v. Aguillard*, 1987, § 1.b)

Subsequently, the rulings in both cases had impact upon the decisions of Judge Jones in *Kitzmiller v. Dover* (2005, p. 29).

The Board's disclaimer. The disclaimer read by administrators to ninth grade biology classes at the Dover high school encouraged students to keep an open mind with regard to evolution and the origins of life, whilst the only alternative offered was that of ID—a non-scientific and inherently religious option. As Judge Jones points out (*Kitzmiller v. Dover*, 2005, pp. 42–43), these are the same circumstances previously argued in *Freiler v. Tangipahoa* (1997) and later upheld by the Fifth Circuit Court of Appeals, who found that an educator reading a disclaimer which disavows evolution and urges only religious concepts as an alternative, implies School Board approval of those religious principles. The enactment of such a policy is, thereby, unconstitutional as it was held to violate the Establishment Clause of the First and Fourteenth Amendments of the United States Constitution.

Judge Jones also made the point that the *view* or *theory* of evolution expressed in disclaimers such as those discussed in *Freiler v. Tangipahoa* (1997) and *Kitzmiller v. Dover* (2005), when juxtaposed with an alternative *explanation* provided by the School Board, represents exactly the same *contrived dualism* that the court in *McLean* recognized as an educationally worthless tactic, with absolutely no scientific merit (*Kitzmiller v. Dover*, 2005, p. 42). In addition, the disclaimer could be said to support creationist notions of the origins of life, by suggesting that evolution was a controversial theory, even in the scientific community. An argument also seen—and rejected—in *Selman v. Cobb County* (2005, § I, para. 28–30).

Selective memories and outright lies. As the Court in *Kitzmiller v. Dover* (2005) discussed, when considering a violation of the Establishment Clause of the First Amendment, a

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court's first step is to ascertain whether the challenged policy had a suitable *secular legislative purpose*, as detailed by *Lemon v. Kurtzman* (1971). In addition, Jones cited the Supreme Court in the case of *Wallace v. Jaffree* (1985, § IV.64), that a secular purpose must be sincere and not merely a sham. Jones then observed, that it is the duty of the courts to distinguish between a false secular purpose and a sincere one (*Kitzmiller v. Dover*, 2005, p. 132). This clearly impacts the Courts' opinion in *Kitzmiller*, where Judge Jones commented:

Dover School Board members' testimony... was marked by selective memories and outright lies under oath (p. 46).

Their asserted purposes are a sham, and they are accordingly unavailing... (p. 130).

Any asserted secular purposes by the Board are a sham and are merely secondary to a religious objective... (p. 132).

Accordingly, we find that the secular purposes claimed by the Board amount to a pretext for the Board's real purpose, which was to promote religion in the public school classroom, in violation of the Establishment Clause. (p. 132)

As a result of the impact of the arguments listed above, and elsewhere in this analysis, Judge John Jones III found the intelligent policy, as instigated by the Directors of the Dover Area School Board, was "unconstitutional pursuant to the Establishment Clause of the First Amendment of the United States Constitution and Art. I, § 3 of the Pennsylvania Constitution." (*Kitzmiller and Dover*, 2005, p. 3) Defendants were permanently enjoined from, "maintaining the ID Policy in any school within the Dover Area School District, from requiring teachers to denigrate or disparage the scientific theory of evolution, and from requiring teachers to refer to a religious, alternative theory known as ID." (*Kitzmiller and Dover*, 2005, p. 138)

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Impact on U.S. public education policy and the law—a summation. None of the arguments used by creationist proponents to further their objective of including religious notions of the origins of life, in the Dover Area High School science curriculum, were without precedent. This section has shown that all arguments necessary to illustrate the violation of the First Amendment, including the idea of ID, had been proposed in earlier hearings: *Epperson v. Arkansas*, 1968; *Edwards v. Aguillard*, 1987; *Freiler v. Tangipahoa*, 2000; *Kitzmiller v. Dover*, 2005; *LeVake v. Independent School District (ISD)*, 2002; *McLean v. Arkansas*, 1982; *Pelozo v. Capistrano*, 1994; *Seagraves v. California*, 1981; *Selman v. Cobb County*, 2005; and *Webster v. New Lenox*, 1990; and *Wallace v. Jaffree*, 1985.

The only argument that had not been fully addressed in the U.S. Supreme Court, because that had been introduced in the district court of *McLean v. Arkansas* (1982), was that of whether ID was a valid scientific theory. However, *McLean* had rejected the argument for creation science as unscientific and religiously based more than two decades previously. Thus, after a six-week trial, and an expenditure estimated at \$2,067,226.00 (NCSE, 2006), U.S. education policy and the law remained unaltered—with one exception. ID was now ruled to be religious in foundation and without scientific merit. A decision which would have national impact, if not binding precedent (Gey, 2005).

Social discord—not an argument for creationism but an emergent theme. The inductive method of data analysis used in this study resulted in two, clear themes emerging from the data. Social discord, whilst not fitting the definition of the arguments of creationist proponents, was a consistent and well-supported theme arising from witness testimony. Parents and teachers of students attending the Dover High School testified that the actions of the school board had caused harm to themselves or their family, that “their children confront challenges to their religious beliefs at school because of the Board’s actions, that the Board’s actions have

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caused conflict within the family unit, and that there is discord in the community.” (*Kitzmiller v. Dover*, 2005, pp. 128–130)

A small encroachment on First Amendment rights. In February 2005, the Dover Area School Board sent a specialized newsletter to every household in the Dover area community, irrespective of whether they had children that attended the high school. Formatted to resemble a standard Board newsletter, the Court described it as “an aggressive advocacy piece denigrating the scientific theory of evolution while advocating ID.” (*Kitzmiller v. Dover*, 2005, p. 52)

The court criticized the February newsletter for demeaning plaintiffs in the eyes of the community at large, and for protecting their Constitutional rights, “A small minority of parents have objected to the recent curriculum change by arguing that the Board has acted to impose its own religious beliefs on students.” (*Kitzmiller v. Dover*, 2005, p. 53) The newsletter further stated, “[S]cientists engage in trickery and doublespeak about the theory of evolution... The word evolution has several meanings, and those supporting Darwin’s theory of evolution use that confusion in definition to their advantage” (p. 53). The Court found that the newsletter denigrated the scientific theory of evolution and advanced unproven, non-scientific claims.

The Court received 225 letters to the editor and 62 editorials from the local newspapers, the York Daily Record, and the York Dispatch, which illustrated that hundreds of individuals within a small community regarded the issue of such importance that their views should be published in a public forum. The community obviously held firm opinions on both sides of the debate, and responded to the Board’s actions accordingly. Frederick B. Callahan testified to one aspect of the Board’s actions, as he discussed the harm that he felt he had suffered because of the newsletter and its portrayal of the plaintiffs:

I think it goes to the heart of the complaint. It’s a constitutional issue. I’m a tax payer in Dover. I’m a citizen of Dover. I’m a citizen of this country.

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I think the heart of my complaint, my wife's complaint, is that, this is just thinly veiled religion. There's no question about that in our minds.

We've been called atheists, which we're not. I don't think that matters to the Court, but we're not. We're said to be intolerant of other views. Well, what am I supposed to tolerate? A small encroachment on my First Amendment rights? Well, I'm not going to. I think this is clear what these people have done. And it outrages me. (KD04AM1, p. 115-116)

Members of the Board of Directors that had not voted for the planned curriculum change were abused by senior members. Carol Brown, also referred to as Casey Brown, testified that Alan Bonsell—at the time President of the Board of Directors—had told her that she was “destroying the Board” and that she would be “going to Hell” (KD04AM1, p. 95), and William Buckingham—Chair of the Curriculum Committee—called her an atheist (p. 95). Cynthia Sneath testified that she had witnessed another member of the Board, Angie Ziegler-Yingling—who resigned from the Board on December 6, 2004—coerced into voting for the curriculum change by Board members, who accused her of being an atheist and un-Christian (KD08PM2, pp. 95–97). In addition, Sneath stated that she felt she had been personally harmed by the Board's actions, and the religious education of her child at least partially removed from her hands (pp. 100–101).

Faith precludes science—a contrived dualism. Aralene Callahan, also known as Barrie Callahan, testified that she felt the Board had harmed her and her family in a number of ways, highlighting how her ninth grade daughter “did not have a biology textbook to take home because there were board members looking for textbooks that included Darwinism or included creationism” (KD02PM1, p14–15). Mrs. Callahan also voiced concerns about her daughter meeting admission requirements for higher education if it was known that her science education

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had been based on creationism, and that her curiosity for the subject could be stifled by notions of ID. Callahan expressed further anxiety about the religious aspect of the curriculum change, “[I]ntelligent design is clearly religious. It’s not my religion. I am very upset about the idea of a public school trying to influence my daughter’s religious beliefs. And that probably is the most harmful” (KD02PM1, pp. 14–15). Parents of Dover High School students, Beth Eveland (KD03PM3, p. 106) and Tammy Kitzmiller, echoed Callahan’s concerns for their own daughters. Kitzmiller added:

I feel that they have brought a religious idea into the classroom, and I object to that... [M]y 14-year-old daughter had to make the choice whether to stay in the classroom and listen to the statement... or she had to be singled out, go out of the classroom and face the possible ridicule of her friends and classmates. (KD02AM2, pp. 118-119)

Julie Smith, another of the Dover High School parents, recounted the personal upset of discussing the issue with her daughter during the period of the Board’s introduction of the curriculum change:

[Smith] Late in ‘04 my daughter came home from school, and I was discussing kind of what was going on in the district with her. And she looked at me and she said, Well, Mom, evolution is a lie, what kind of Christian are you, anyway, which I found to be very upsetting.

[Attorney] Did you ask her why she said that?

[Smith] Yeah, I asked her why she said that, and she said in school what they had been talking about or amongst her friends and what’s going on. She seemed to be under the impression that as a Christian, she could not believe that evolution was a science that, you know, was true.

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[Attorney] And how did that harm you?

[Smith] Well, it goes against my beliefs. I have no problems with my faith and evolution. They're not mutually exclusive. (KD03PM1, pp. 38–39)

Smith's testimony illustrated the *contrived dualism*—Judges Jones' failed argument of the 1980s (*McLean v. Arkansas*, 1982, § IV.A)—and its unforeseen, personal effects on those involved when faith precludes fact.

Discord in the community and a secret science. Bryan Rehm, a Dover High School science teacher, parent, local resident, and active member of the Christian community, testified to the harm the Board's activities had cause him and his family on many levels. Professionally, he spoke of a lack of respect for teachers, specifically science teachers, and a fear for the safety of his employment in a hostile environment, which he had previously felt was welcoming and secure. On a personal level, he testified as to how he felt attitudes in the community had altered:

I live in the neighborhood, you know. I live within the school district where I taught. You used to be able to go out to any restaurant, sit down, not worry about who was next to you. You could walk down the street and say, hi, to everybody and get a nice pleasant return.

Now people stare. They know you're a Plaintiff or they know in this particular case that I'm a candidate opposing the school board, and you can't sit there and not worry about who's looking at you or what's going to happen, you know. You'll go out and regularly be called inappropriate things centering around the concept of atheist.

They don't know me. They don't know that I'm the co-director of the children's choir at church or that I run the music halfway at the second

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service, or that, you know, my wife and I run Vacation Bible School. Yet they have no problem going around calling me an atheist because my particular religious viewpoint doesn't agree with that of the school board, which is a public entity not a religious one. (KD02PM2, pp. 93–94).

Bryan Rehm's testimony reveals how the activities of the Dover Area District School Board caused great anxiety throughout the community. The heated public debate polarised attitudes with the false dichotomy of an already failed argument, fuelling religious prejudice, and forming its own hidden curriculum, as Rehm continued to discuss:

So there is a lot of issues and a lot of different ways in which it hurts me, not to mention now my daughter is in the biology course, and there are students in the class that want to know, well, what if you do come from monkeys? What's going on with this? Well, you know that evolution doesn't make sense. Why are your parents doing this?

So it has filtered down to the kids, and it's affecting my children directly. And that's a problem. And if the school board didn't pass the policy, it never would have occurred. Prior to their policy change, I never once had a student in class criticize another student for believing evolution, even when we were teaching it. It didn't happen. (KD02PM2, p. 96)

Steven Stough, plaintiff and science teacher, testified as to how he had received hate mail at his place of work (KD09AM1, p. 31), and had discussed the implications of the Board's curriculum changes with his daughter. Stough discussed how his daughter would opt out of any disclaimer of evolution read to her biology class, and was asked how this would harm her:

[Attorney] If she's going to step out of the classroom, or that's your view, how are you harmed by that?

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[Stough] I'm harmed by that, she's harmed by that because she's no longer part of the accepted school community. She's being told that she's being removed from the classroom. (KD09AM1, p. 30)

I would contend that the disclaimer and the Board's voluntary *opt out* policy for students who did not want to follow the creationist path, were creating an entirely separate *de facto* curriculum. The final section of the evolution disclaimer read by administrators to students, stated that "there will be no other discussion of the issue and your teachers will not answer questions on the issue." (KD08AM2, pp. 125–126) Associate Professor of Education at McGill University, Dr. Brian Alters, explained that students could interpret such instruction as a kind of *secret science* that—uniquely in the curriculum— prohibited them from even discussing the topic with their teachers. Alters described this as pedagogically "about as bad as I could possibly think of" (KD08AM2, p. 127).

Social discord—a summation. The testimonies of the plaintiffs, all were citizens of Dover, some of whom were teachers at the high school in question, clearly described a community which had been divided by the actions of the School Board. The community-wide newsletter of February 2005 demeaned parents of students attending the high school, simply for protecting their First Amendment rights (*Kitzmiller v. Dover*, 2005, p. 52). Hundreds of people within the Dover area responded in the local press and attended public meetings, illustrating the strength of feeling within the community. Pressure was applied to Board members, who were coerced into following the path set by the President (Alan Bonsell) and the Chair of the Curriculum Committee (William Buckingham), and abused if they did not follow their lead (KD04AM1, p. 95).

Parents complained that the education of their children was adversely affected by delays in purchasing textbooks, whilst the Board searched for suitably creationist material (KD02PM1,

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p14–15). A number of families felt that the Board had usurped the position of parents to instill faith, and their own standard of religious belief in their children (KD02PM1, pp. 14–15; KD03PM3, p. 106; KD02AM2, pp. 118-119), and were upset by the discord this had caused between family members (KD03PM1, pp. 38–39). Teachers complained of disrespect shown to themselves and their profession (KD02PM2, 93–94), of having to remove students from lessons to avoid the reading of the Board’s disclosure (KD09AM1, p. 30), and of bullying amongst students as a result of the controversy (KD02PM2, p. 96).

The actions of the School Board had clearly been the instigating factor of a deep and heated divide in the Dover community (KD02PM2, 93–94; KD09AM1, p. 31). Joel Leib, another high school parent and plaintiff, described the impact of the Board’s education agenda on the local community:

Well, it’s driven and a wedge where there hasn’t been a wedge before.

People are afraid to talk to people for fear, and that’s happened to me.

They’re afraid to talk to me because I’m on the wrong side of the fence.

(KD09PM2, pp. 146–147)

I would argue that whilst Judge Jones III spent 27 lines of his 139 page judicial opinion, specifically discussing the “effect of Board’s actions on plaintiffs” (pp. 128–130), the Court did not significantly address the harm caused by the School Board’s actions to the Dover area community. This aspect of the public controversy surrounding the evolution versus creationism debate represents an unequivocally deleterious effect on not just the curriculum of the school and students effected, but the social fabric of the community at large, and has not been sufficiently investigated.

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The Wedge Strategy. The Wedge Strategy referred to a plan produced by the Discovery Institute's Center for the Renewal of Science & Culture (CRSC, 1998), under the auspices of then Berkeley Professor of Law, Philip E. Johnson, with the following governing goals:

- [D]efeate scientific materialism and its destructive moral, cultural and political legacies.
- [R]eplace materialistic explanations with the theistic understanding that nature and human beings are created by God. (CRSC, 1998, p. 4)

Expert witness for the plaintiffs, Barbara Forrest, had researched this material extensively (Forrest & Gross, 2004). The authors describe the position of the strategy toward evolution, as defined in the guiding policies of the Wedge Document:

In the Wedge Document, all the world's evil is traced to "materialism"; and the most insidious of all the materialist forces, indeed the source of them all, is taken without hesitation to be "Darwinism," along with such other science as might support it or call into question the accepted truths of religious doctrine. (Forrest & Gross, 2004, p. 26)

Since it is possible to construe that all pro-creationist activities might fall within the remit of such a plan, this theme focuses on discussions of the existence and nature of the strategy. In *Kitzmiller v. Dover* (2005), plaintiff's expert witness, Dr. Barbara Forrest, was called upon to comment on the Wedge Strategy. She was deemed expert witness because of her (2004) book written with physiologist Dr. Paul R. Gross titled, *Creationism's Trojan Horse: The Wedge of Intelligent Design*, which focussed on the IDM and the Wedge Strategy in particular.

Forrest explained the mission of the Center for Science and Culture, a program run by the creationist Discovery Institute as follows:

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[Attorney] What is the mission of the Center for Science and Culture?

[Forrest] The mission of the Center for Science and Culture, as they state, is to replace materialistic science with science that is consonant with their Christian and theistic convictions.

[Attorney] Is there a document that states that?

[Forrest] There is.

[Attorney] And is that the Wedge document that you referred to earlier in your testimony?

[Forrest] It is. The formal title of that document is The Wedge Strategy.

(KD06PM1, p. 26)

Forrest went on to point out that the Discovery Institute had acknowledged the document in 2002, referring to it as “best most concise statement of what the [intelligent design] movement is about in its entirety... It lays out the strategy and goals for the next 20 years” (p. 27). The Wedge Document itself states, “[The] Discovery Institute’s Center for the Renewal of Science and Culture seeks nothing less than the overthrow of materialism and its cultural legacies” (CRSC, 1998, p. 2). The Wedge Strategy’s mission and stated goals provide a clear, self-acknowledged outline of the wide-reaching program embarked upon by the Discovery Institute and the IDM.

A three-phase implementation. Forrest went on to discuss how the Wedge Strategy was intended to be actioned in three chronological phases:

1. Scientific research, writing and publicity—Scientific research was one of the main five year objectives of the Wedge Strategy (CRSC, 1998, p. 4). As such, the IDM funded program of individual research fellowships, a paleontology and molecular biology research program (p. 5).

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2. Publicity and opinion making—made up of book publicity, opinion-maker conferences, apologetics seminars, teacher training, public broadcast service (PBS) or other television co-production, and publicity materials/publications (p. 5).
3. Cultural confrontation and renewal—academic and scientific challenge conferences, potential legal action for teacher training and curriculum change, and a research fellowship program, with a shift in emphasis to social sciences and humanities (p. 5).

Dr. Forrest stated her research had shown that the IDM had “executed virtually every aspect of these phases, except the first one” (KD06PM1, p. 32). To date, this statement remains supported by a number of other researchers in the field, all in agreement with the one exception—that no meaningful scientific research has as yet been produced by the IDM (Caudill, 2010; Forrest & Gross, 2004; Miller, 2004; NAS, 2008; Rosenau, 2014; Scott, 2009).

Rather than original, valid, scientific research, Dr. Forrest presented evidence at the trial that much of the IDM’s message has been in criticising and reinterpreting genuine scientific research for their own purposes. Quoting directly from the Wedge Document, Forrest stated:

Quote, The center explores how new developments in biology, physics, and cognitive science raise serious doubts about scientific materialism and have reopened the case for a broadly theistic understanding of nature, end quote. What this indicates is that the intelligent design creationists are using the developments of modern science and reinterpreting them in such a way as to support their view that the supernatural can be a scientific explanation. (KD06PM1, p. 30)

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Such an approach could also have the advantage of not having to identify suitable research projects, research personnel, or the funding of original research.

At the time of the formulation of the Wedge Strategy (1998), little account was taken of the internet as an interactive medium of information, publicity, marketing, and entertainment. However, recent events such as the Answers in Genesis live, online debate titled, *Uncensored science: Bill Nye debates Ken Ham—Is creation a viable model of origins in today’s modern, scientific era?* (AiG, 2014), have shown that the IDM has fully adapted its mission goals to take advantage of current communications media (Caudill, 2010).

The Wedge Strategy—a summation. The Wedge Strategy has been shown to be a very real and active challenge to modern science and even society (Berman, 2003; Forrest & Gross, 2004; Forrest, 2005; KD06PM1). As Judge Jones III stated, “ID aspires to change the ground rules of science to make room for religion, specifically, beliefs consonant with a particular version of Christianity” (Kitzmiller v. Dover, 2005, p. 29). When dealing with policymakers, the IDM can utilize seemingly scientific discourse—reinterpreted from legitimate research, and they can propose *balanced treatment*, and *critical thought* when *teaching the controversy*, thereby disguising a theistic and unconstitutional agenda. Barbara Forrest summarized the threat of the IDM and the Wedge Strategy to modern science education as follows:

The long-term results of ID proponents’ coordinated actions against teaching evolution, with the consequent diversion of time and money toward fending off its advances, will be the deterioration of science education, already threatened in many places by under-prepared and intimidated teachers. Fewer students who are properly educated about science will translate into fewer students who are qualified to become scientists. (Forrest, 2005, p. 162)

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Whilst I would contend that this section has successfully illustrated both the existence and the nature of the Wedge Strategy through evidence provided at the *Kitzmiller v. Dover* (2005) hearing and the triangulation of expert witness testimony with empirically-based research, it should also be remembered that no conclusive evidence was ever offered at trial to show that the Dover Area School Board had knowledge of such a strategy, much less were consciously active in its implementation:

[Attorney] You have no evidence that the board members of the Dover area school district had any knowledge of this Wedge Document, is that correct?

[Forrest] I have no evidence of that. (KD06AM1, p. 50)

Given that the Dover Area School Board's previously established lack of understanding and research into what ID actually was (KD16PM1, pp. 31–34; KD17AM3, p. 190), it might also be reasonable to assume that they were in ignorance of one of the major programs of an organization they had sought for advice (KD16AM1, p. 130).

However, whilst the School Board may have been ignorant of the IDM and the Wedge Strategy it supported, it might be considered less likely that the advisory organizations employed by the Board were similarly ignorant. Judge Jones III commented on this area in his final opinion:

[T]his case came to us as the result of the activism of an ill-informed faction on a school board, aided by a national public interest law firm eager to find a constitutional test case on ID, who in combination drove the Board to adopt an imprudent and ultimately unconstitutional policy. The breathtaking inanity of the Board's decision is evident when

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considered against the factual backdrop which has now been fully revealed through this trial. (*Kitzmiller v. Dover*, 2005, p. 137–138)

I would suggest that the *factual backdrop* revealed in the trial, and analyzed herein, is highly suggestive of a School Board that may not have been aware of a greater agenda at work (i.e., the Wedge Strategy), but which may well have been manipulated by the proponents of that agenda.

A Summation.

Chapter 4 has detailed the findings of this analysis and, discussed the main arguments of creationist proponents for the inclusion of religious doctrine in U.S. public science classes. Arguments for balanced treatment of creationism and evolutionary science, criticism and misrepresentation of current scientific theory, arguments for altering the very ground rules of scientific investigation have been shown to be utterly lacking in veracity. Whilst claims that creationism can be investigated in a scientific manner through the lens of ID, have shown no scientific merit. Legal tests applied during the hearing have been shown to be fitting to the circumstances of the case, and supported by well-established Supreme Court precedent. All such analysis has been fully supported by the testimony of plaintiffs, defendants, their expert witnesses and the summation of Judge John Jones III in the documentation comprising the case of *Kitzmiller v. Dover* (2005).

The impact that such arguments have had on American public education policy and the law has also been assessed, as have the two major themes of social discord and the Discovery Institutes' Wedge Strategy, which have emerged from the analysis of the *Kitzmiller* data. Chapter 5 will discuss how this analysis has addressed the research questions defined earlier in this study, and additional implications arising.

Chapter 5

Discussion and Implications

Chapter 5 first discusses the issue of whether this research has sufficiently addressed all parts of both research questions. In addition, two themes have emerged from the analysis of the *Kitzmiller v. Dover* (2005) trial data—social discord within the subject community and The Wedge Strategy, the self-acknowledged national agenda of the IDM. Lastly, the position of this study in existing literature and the implications of this study for further research are considered.

Research Question 1—Arguments for Creationism in U.S. Public Schools

This question was comprised of three parts and asked: (a) What arguments have been put forward by advocates of creationism, to make the case for creationist ideology in U.S. public school science classes? (b) Are these arguments scientifically plausible? And (c) do they withstand the assault of academic rigour and empirical reasoning?

The findings of this study have clearly answered each part of the first research question. Creationist arguments were presented throughout the *Kitzmiller v. Dover* (2005) trial. Each argument was laid out by the plaintiffs, expert witnesses in the field, and their associated work. Witnesses were examined and cross-examined under oath, and at length, by attorneys for both sides. This study represented each argument with a theme that emerged from my data analysis. Counter-arguments to each theme were drawn from defense witness testimony and associated literature throughout Chapter 4. I contend that these themes and the sub-categories of which they are comprised, represent a baseline of creationist argument—the best case for creationism, made up of historical and current argument, from the leading proponents of that side of the debate.

The argument for balanced treatment of creationism and evolution in public school science curricula had failed under the First Amendment in *Epperson v. Arkansas* (1968). Criticism of Darwinian theory and the scientific method invoked the contrived dualism

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argument, which had been dismissed in *McLean v. Arkansas* (1982). In addition, each argument levelled against evolutionary science was comprehensively refuted by plaintiff expert witnesses, Forrest, Miller, Padian, and Pennock.

The argument that creation science/ID is not religion, or even theistically-based, had been discounted in *McLean v. Arkansas* (1982). Barbara Forrest showed that ID textbook authors had systematically altered the content of their text in response to the ruling of *Edwards v. Aguillard* (1987). In addition, *Edwards v. Aguillard* (1987) later supported by *Selman v. Cobb County* (2005), ruled that a disclaimer, similar to that issued by the Dover Area District School Board, could be said to support creationist notions of the origins of life, by suggesting that evolution was a controversial theory, even in the scientific community.

Clearly, arguments put forward by creationist proponents were proven to be neither scientifically plausible, to not withstand even basic empirical reasoning or academic rigour. Indeed, most of the arguments seen in this study had been put forward and rejected in previous cases, including the U.S. Supreme Court, thereby providing a history of legal precedent upon which the Court in *Kitzmiller* could rely. The only exception to this being the argument that ID was not based upon supernatural supposition. The argument for creation science had been heard previously in *McLean v. Arkansas* (1982) but did not specifically address ID. As a result, the trial of *Kitzmiller v. Dover* (2005) ruled in one important area—that ID is fundamentally creation science, cannot be considered science and is based upon the supernatural supposition that a deistic creator designed life and the universe that we experience today.

Research Question 2—Impact on Policy and the Law

Research question 2 asked: (a) What impact have the arguments of proponents of creationism had on American public education policy and the law? (b) Have these arguments

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curtailed—or enabled—the overt, legalised teaching of ID in American public science classes? And (c) What rationale could justify the denial of these arguments in successive court hearings?

Between the cases of *Scopes v. Tennessee* (1927) and *Epperson v. Arkansas* (1968), the arguments of creationist proponents had stalled the teaching of evolution in U.S. public schools for more than forty years. With the ruling of *Epperson*, that the prohibition of teaching evolution in state schools violated the First and Fourteenth Amendments, the precedent was set to allow the teaching of evolution in U.S. science classes. Since *Epperson*, each legal challenge by creationist proponents has been dismissed, at least partially, on the basis of the First Amendment. In 1987, *Edwards v. Aguillard* took the law one stage further by ruling that teaching creationism was an endorsement of one religion over another, and, therefore, violated the First Amendment. From this point onward, policy, and the law—and thus teaching practice, through textbooks such as *Pandas* (Davis and Kenyon, 1993)—reflected the impact of the decision made in *Edwards*. In this respect, the case of *Kitzmiller v. Dover* (2005) is no different than any other creationist challenge to the U.S. Constitution since *Edwards*, with no real change in policy and the law having been made from 1987 to 2005.

However, in 2005 *Kitzmiller v. Dover* responded to creationist challenges by moving U.S. law and education policy one further step in curtailing the overt, legalised teaching of creationism in American public science classes. *Kitzmiller* showed that even relatively isolated school district attempts to include ID in U.S. public school curricula are clearly unconstitutional (Gey, 2005). ID is inherently religious and that its rationale could not uncouple itself from its supernatural roots (*Kitzmiller v. Dover*, 2005, p. 136). Whilst in these terms the impact of *Kitzmiller* may be considered positive from the perspective of modern science education, having further defined the limits of U.S. public education policy and teaching practice, the Court did not arrive at these limits without cost.

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Impact on policy and the law—operational cost. Aside from considering the strategic impact of a creationist challenge to U.S. education policy and the law, embodied by a trial such as *Kitzmiller*, the operational impact on aspects such as local area budget, school management, and public relations is difficult to assess. Judge John Jones III expressed the Courts' opinion in the following manner:

The citizens of the Dover area were poorly served by the members of the Board who voted for the ID Policy. It is ironic that several of these individuals, who so staunchly and proudly touted their religious convictions in public, would time and again lie to cover their tracks and disguise the real purpose behind the ID Policy. (*Kitzmiller v. Dover*, 2005, p. 137)

The students, parents, and teachers of the Dover Area School District deserved better than to be dragged into this legal maelstrom, with its resulting utter waste of monetary and personal resources. (*Kitzmiller v. Dover*, 2005, p. 138)

Third party legal commentators, such as Richard Katskee, assistant legal director for Americans United for Separation of Church and State, later observed, “Any board thinking of trying to do what the Dover board did is going to have to look for a bill in excess of \$2 million,” adding, “I think \$2 million is a lot to explain to taxpayers for a lawsuit that should never be fought” (NCSE, 2006, para. 4). Thus, the impact of such a challenge as that posed by the Dover Area School Board has far-reaching consequences. Yet attempts are still made to add creationism to U.S. public school science classes, as recorded by the National Centre for Science Education (NCSE, 2014a):

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- Louisiana, Senate Bill 70 and Senate Bill 175,
- Louisiana, Senate Bill 175,
- Missouri, House Bill 1472,
- Missouri, 1587,
- Oklahoma, House Bill 1674,
- Oklahoma, Senate Bill 1765, and
- South Carolina, House Bill 4482.

Each proposed change to statute was reported by the NCSE during the three month period from March to May, 2014, and whilst each has been defeated, they represent a challenge to U.S. law and education policy that must be reacted to, in order to prevent a retrograde slide for American public science education. To paraphrase Judge Jones, I would contend that such proposals for statutory change represent an on-going waste of monetary and political resources that is extremely difficult, if not impossible to quantify.

Impact on policy and the law—the times, they are not really a-changin’. Regardless of the political and legal backdrop, the constructivist worldview, as discussed by Patton (2002), goes some way to explaining the large number of implementers of education policy—and this, in the shape of teachers and their practice who continue to devote classroom time and resources to creationism (Berkman and Plutzer, 2011; Moore, 2007). This is epitomized by the worldviews described by the work of Long (2010a, 2010b, 2011, 2012), and summarized during the Answers in Genesis (AiG, 2014), the creationism versus evolution science debate, in answer to the question “[W]hat, if anything, would ever change your mind?” The creationist proponent responded that, in essence, nothing would make them change his mind about the word of God, whilst the evolutionary scientist responded “evidence”.

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This unchanging worldview is supported by the latest U.S. Gallup public opinion poll (Newport, 2014). Conducted in May 2014 and published in June of the same year, the poll has been repeated every year since 1982, and compares the responses of 1028 adults, aged 18 and older, living in all 50 U.S. states and the District of Columbia. One of the questions asked was, “[W]hich of the following statements comes closest to your views on the origin and development of human beings?” Since 1982, the most popular response to that question has been that God created humans in their present form, with 40–47% of the sample population choosing this answer. Gallup stated that the margin of sampling error is ± 4 percentage points at the 95% confidence level, so it is probably fair to say that—according to the data provided—the level of creationist belief in the U.S. has not varied greatly in more than 30 years, despite the level of scientific evidence and changes in policy and law.

Impact on the Community—Social Discord

Local journalist and author, Lauri Lebo, documented the period of the *Kitzmiller v. Dover* trial from the perspective of the local community, in her book titled, *The Devil in Dover* (Lebo, 2008). According to Lebo, the social discord surrounding the trial was expected before their policy to adopt ID as part of the school science curriculum; the Dover Area District School Board had been warned by Dover community leaders of what would most likely follow. Lebo wrote of two packed public meetings in June 2004:

Pastor Eshbach stood up and addressed the board. He begged them not to do what he feared they were about to do. He warned them they would only divide the town. He warned them they would turn neighbor against neighbor. (Lebo, 2008, p. 25)

[Dover Area District School Board member] Noel Wenrich, who believed in the literal truth of the Bible and spoke of creationism at the

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June meetings, also voted against the motion. He feared that the curriculum change would lead the district into a costly lawsuit... After the meeting, Buckingham and Wenrich shouted at each other in the parking lot. Buckingham called Wenrich an atheist for not supporting him. Wenrich threatened to punch Buckingham. (Lebo, 2008, p. 47)

This study has discussed the community unrest suffered as a result of the *Kitzmiller* trial, and documented by court transcripts. However, Court transcripts relied on brief questioning as to the harm that plaintiffs believed they had been caused by the actions of the Dover School Board, and documented an equally brief description of such harm in the Court's final opinion. Lebo's account suggests a far deeper sense of social upheaval than that shown by Court documentation.

Very little work has been done on this aspect of the creation versus evolution public controversy, but what little exists, confirms the polarised nature of the debate and the harm caused to local communities. In late 2003, the town of Darby, Montana, located in western Montana, with a population of approximately 1,000, very nearly became the host of a similar hearing to that of *Kitzmiller v. Dover*. A local minister, with the support of the Discovery Institute, sought to have the local school board add ID to the biological sciences curricula of the town's public schools, with an *objective origins* proposal. Evans and Branch (2004), described how the small town became a "flashpoint in the perennial creationism/evolution controversy... The ensuing acrimonious debate received national attention, including pieces in *The New York Times* and on National Public Radio" (Evans & Branch, 2004, p. 4).

In May 2004, unlike the Dover Area School Board, Darby voted to avoid the costly court proceedings and the continuing disruption of their community by rejecting the ID proposal. Clark (2004), a local author, writing in the peer-reviewed journal titled, *Reports of the National Centre for Science Education*, expressed the opinion that:

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Given such an outcome, many of us thought the tensions of the past six months would quickly and quietly dissipate into the background, with life in Darby returning to its usual pattern of petty ups and downs.

Unfortunately, this appears not to be the case. The “objective origins” supporters continue to submit agitating editorials to the local newspaper.

They attended the latest school board meeting in force. They seem undaunted and undeterred by the mandate of the voters. (Clark, 2004, p.

3)

Clark’s comments would seem to support both the established refusal of creationist proponents to accept evidence, policy, or the law, and the abiding extent to which such social discord can harm the local community. In her paper, Clark (2004) cited local citizens of Darby:

“I don’t grocery shop in Darby anymore.” “The florist didn’t deliver when she saw my name on the bill.” “My daughter stormed out of the classroom to avoid more trouble.” I even had a friend stop by the house and tell me that a fellow parishioner had asked her why I was leading up the religious education program at our church “if I didn’t believe in God.” (Clark, 2004, p. 2)

Given the extent of the feelings reported in the local community, it is unsurprising that—as previously discussed—Berkman & Plutzer (2011), found that almost a third of teachers advocating evolution had felt “nervous at an open house event or meeting with parents” (p. 404), in comparison to less than a fifth of their creationist counterparts, and that 60% of teachers chose to avoid advocating either position. This supports the assertion by Forrest (2005) that many teaching staff, even those that support the teaching of evolution, have felt intimidated at some stage in their career because they support legitimate science education for their students.

The Wedge Strategy—Seeing Creationists under the Bed

The IDM's Wedge Strategy, brainchild of Berkeley Professor of Law, Phillip Johnson, and an acknowledged program of the Discovery Institute's Center for the Renewal of Science & Culture (CRSC, 1998), has been shown to pose a very real and on-going threat to U.S. science education. With such a threat in mind, it would be very easy to imagine that every proposal for including creationism in U.S. public science classes, was part of an overarching conspiracy to replace modern science... and yet, that is exactly what the Wedge Strategy seems to be (Berman, 2003; Forrest & Gross, 2004; Forrest, 2005; KD06PM1). Professor of Philosophy at Southeastern Louisiana University, Dr. Barbara Forrest, has argued that the Wedge Strategy represents a fundamental threat to U.S. society at large:

[T]he results of ID's encroachment upon the public policy-making process include the further erosion of secular democracy, the bulwark of academic freedom that is the lifeblood of science. Separation of church and state may appear only distantly related to science education—until one remembers that we have only one Constitution to protect both. Science education is ID's chosen vehicle for its role in the Religious Right's broader attack on secular society. The undermining of church and state separation will mean the undermining of science education as well. (Forrest, 2005, p. 162)

Whether the Wedge Strategy was *deliberately* at work in the *Kitzmiller* trial is difficult to say, but undoubtedly a number of the programs' objectives were met by the trial, such as public debate, coverage in a variety of national media, popular writing, and documentaries (CRSC, 1998). In addition, it might be considered suggestive that defendants were represented by the Thomas Moore Law Centre (TMLC), described by Judge John Jones III as a "national public

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interest law firm eager to find a constitutional test case on ID” (*Kitzmiller v. Dover*, 2005, p. 137), and supported by the Discovery Institute throughout the Board’s decision-making process and the trial, as described by the Board’s Head of Curriculum Committee and creationist Bill Buckingham (KD16AM1, pp. 130, 132, 137, 141, 143). However, there would not have been many other organisations that would have been as well-equipped to support the Board as the TMLC and the Discovery Institute. Thus, whether or not a trial such as that of *Kitzmiller v. Dover* (2005), was a deliberately planned part of the Wedge Strategy becomes a moot point. It could be argued that the trial, its expense, publicity, and accompanying social discord, became a part of the broader attack on secular society discussed by Forrest (2005), regardless of original intent.

In June 2001, Phillip Johnson gave his keynote speech at the Intelligent Design Network’s (IDNet) titled, *Darwin, Design and Democracy II* symposium in Kansas, he stated:

[A] movement like this doesn’t really need to win all its battles. What you find is that after a temporary setback, they’re taking two steps forward. They come back strong and more determined to avoid whatever mistakes were made before... So, what is the state of the Wedge? The state of the Wedge is very good. Kansas made a great contribution to that state by raising the issue... It enabled us to organize a wonderful grassroots movement here in Kansas that is going to spread to many other places... The state of the Wedge is fine. (Johnson, 2001, pp. 1–2)

I would suggest that Phillip Johnson is quite correct in a number of respects, the strength—and true danger—of the Wedge Strategy lies not in its scientific, political, legal, or philosophical arguments, be they successes or failures, but in the power it achieves through publicity, its

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influence on policy-makers—ignorant of the real science, and its popularity with the 42% of Americans who believe that God created humans in their present form (Newport, 2014).

Implications

[N]o one is ever going to convince me that the word of God is not true... (AiG, 2014)

The arguments have been made and a baseline of logic and empirical evidence has been drawn by experts on both sides of the public debate, and have been exhaustively summarised in this research. The debate over whether notions of creationism can be included as valid scientific concepts, exists nowhere else but in the public arena. *Kitzmiller v. Dover* (2005) debated legal, philosophical, and scientific arguments, to find the case for the supernaturalists utterly wanting. The only controversy that can be found is in the public arena. Whilst scientists may debate the details of how evolution works, they have long since reached a consensus on the reality of its existence as a phenomenon (Coyne, 2009; Dawkins, 2009). In his *Evolution and Education* lecture in 2006, for the National Institutes of Health, Brian Alters—then founder and director of the Evolution Education Research Center at McGill University, Montreal, estimated the number of scientists who accepted evolution at 99.9 percent (Alters, 2006).

Regardless of more than 150 years of scientific evidence, counter-argument, and legal decisions, the findings of this study strongly imply that creationist proponents will continue to reject the evidence of empirically robust scientific study, logical counter-argument, or legally binding statute (AiG, 2014; Berkman & Plutzer, 2011; Moore, 2004). For example, on Saturday 7th June, 2014, delegates to the Republican Party of Texas (RPT) State convention approved a party platform containing the following anti-science resolutions:

Controversial Theories: We support objective teaching and equal treatment of all sides of scientific theories. We believe theories such as life origins and environmental change should be taught as challengeable

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scientific theories subject to change as new data is produced. Teachers and students should be able to discuss the strengths and weaknesses of these theories openly and without fear of retribution or discrimination of any kind (RPT, 2014, § 3-6)

With their acceptance of the RTP party platform, the Republican party—one of the two major political parties in the U.S.—outlines their commitment to supporting the failed creationist strategy of equal treatment, misrepresents the nature of a scientific theory, and repeats the fallacious argument of discussing the strengths and weaknesses of these theories—as presented in disclaimers used in cases such as *Selman v. Cobb County* (2005) and *Kitzmiller v. Dover* (2005). Not content with denying the one of the fundamental principles of biological science (Coyne, 2009; Dawkins, 1996; Futuyma, 2005), the Texas Republican Party go on to deny the processes of *anthropogenic* (human-caused) global warming; a theory accepted by 97% of the world’s scientists (Anderegg, Prall, Harold, & Schneider, 2010; Cook et al., 2013; Doran & Zimmerman, 2009):

Global Warming: We believe we are to be good stewards of our planet and thus manage the resources it provides. We believe that the changes in climate that we have observed are simply part of the ongoing natural planetary cycle; we reject the use of this natural process to promote more government regulation of the private economy. Furthermore we reject the idea of “climate justice” and the accompanying redistribution of wealth that comes with accepting it. (RPT, 2014, § 5-73)

As highlighted by Long (2012), any worldview that is based upon individual interpretations and deeply held religious convictions is highly unlikely to be changed by the same logical argument which has accompanied this debate since the Scopes Monkey Trial of

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1925. Therefore, it is my opinion that as educators, we have a duty to counter the arguments of the supernaturalists and science deniers by *teaching to the evidence*, with a patient, reasoned discourse, based on empirical, testable, falsifiable, replicable, and predictable *science*.

Above all, we cannot allow the untestable, unobservable hypotheses of *faith*, to be represented as a valid, knowledge-producing (Hilpinen, 1970; Costa, 2010) investigation of the natural world. Nor can we allow the denial of well-established scientific evidence on the basis of political and fiscal expediency. As Forrest (2005) discussed, if we allow the incursion of unsubstantiated supernaturalism and science denial to cause the deterioration of science education, the end result can only be fewer students qualified to become scientists in a global economy dependent upon science and technology, as described by Sagan (1997):

We've arranged a global civilization in which most crucial elements—transportation, communications, and all other industries; agriculture, medicine, education, entertainment, protecting the environment; and even the key democratic institution of voting —profoundly depend on science and technology. We have also arranged things so that almost no one understands science and technology. This is a prescription for disaster. We might get away with it for a while, but sooner or later this combustible mixture of ignorance and power is going to blow up in our faces. (p. 26)

Apple (2008), suggested that “[w]e may have to honestly face the fact that there will be no easy solutions here and that the struggle to establish ‘official knowledge’ is a never-ending process in which conflicts are to be expected” (p. 334). The findings of this study strongly support such an assertion, with no area of compromise or mutual agreement arising from the analysis.

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What can be done in the face of such intransigence? Alters (2006) stated that he believed one part of the solution must lie in effective teaching. To that end, if teachers are intimidated or their practice is otherwise restricted when teaching evolution, they could be further supported through increased awareness of the legal status surrounding the issue. Pre- and post-service training courses in evolutionary science and the law pertaining to its instruction should also be considered (Berkman & Plutzer, 2011; Cavagnetto, 2010; Dawkins, 2006; Donnelly & Boone, 2007; Linder, 2008; Long, 2011 and Moore, 2000). Alters (2006) also highlighted potential value in a *constructivist* approach to teaching evolution—posing questions that require students to act based on what they believe to be accurate, and presenting challenges designed to expose misconceptions, and explore scientific, evidence-based alternatives. Aikenhead (2006), has discussed the benefits of an evidence-based approach to science instruction, and has addressed the issue of contradictory worldviews (Aikenhead, 2011):

Discordant worldviews create an incompatibility between, on the one hand, students' self identities (e.g. who they are, where they have been, where they are going, and who they want to become) and, on the other hand:

- students' views of Western science, school science, or their science teacher, and
- students' views of the kind of person they think they must become in order to engage in science.

Students who do not feel comfortable taking on a school science identity (i.e., being able to talk, think, and believe like a scientist) represent the vast majority of any student population.

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It would follow a logical progression to imagine that the discordant worldviews described by Aikenhead (2011), underpin those already discussed in the work of Long (2011), and the existential anxiety which Long ascribes to undergraduate students. However, I would urge science educators to be cautious in their sensitivity to cultural variables within a student body, lest an unwillingness to contradict certain beliefs, becomes an unwillingness to teach certain theories. I would urge further development of strategies which could be used to better prepare novice teachers to address *publicly controversial* scientific subjects, i.e., those subjects where the science is well-established, but may still incur public or political debate (e.g., anthropogenic global warming, genetically modified food products, or vaccination against common childhood diseases).

Lastly, science denial in the classroom should alarm us all—members of the public, in every community—not just policy makers, legislators, politicians, and professional educators. I would contend that it is imperative for everyone concerned with education—particularly science education, at any level—to be aware of the strategies used in denying legitimate science and the consequential damage to education and society. As Clark (2004) concluded when discussing the ID policy proposed for schools in her local community:

For the foreseeable future, those of us against the policy will have to remain vigilant. One victory at the polls does not translate into an end to the hostilities. Advice to others: pay attention to local trustee elections, follow school board proceedings carefully, be aware of underlying agendas. Save your community from this malignancy. (p. 4)

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Appendix A

List of Plaintiffs, Defendants and Expert Witnesses

Plaintiffs

The plaintiffs were all parents of students enrolled in the Dover Area School district in October 2004, when the Dover Area School District (Pennsylvania, defendants) made changes to the biological sciences curriculum, which instigated the *Kitzmiller v. Dover* (2005) case.

- Tammy Kitzmiller
- Bryan Rehm
- Christy Rehm
- Deborah Fenimore
- Joel Lieb
- Steven Stough
- Beth Eveland
- Cynthia Sneath
- Julie Smith
- Aralene “Barrie” D. Callahan
- Frederick B. Callahan

Defendants

- Dover Area School District
- Dover Area School District Board of Directors

Members who voted for the curriculum changes:

- Bill Buckingham (resigned August 2005 due to health concerns)
- Alan Bonsell (President, Dover Area School District Board of Directors)

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- Sheila Harkins
- Heather Geesey
- Jane Cleaver (resigned October 4, 2004)
- Angie Ziegler-Yingling (resigned December 6, 2004)

Members who voted against:

- Noel Wenrich (announced his resignation October 4, 2004; last day of service was October 31, 2004; moved out of the district)
- Carol Brown (resigned October 18, 2004 in protest)
- Jeff Brown (resigned October 18, 2004 in protest)

Witnesses for Defense

- Heidi Bernhard-Bubb—freelance writer with The York Dispatch
- Joseph Maldonado—freelance writer with the York Daily Record/Sunday News

Expert witnesses for Plaintiffs

- Barbara Forrest, PhD—Professor of Philosophy, Southeastern Louisiana University. Expert on the IDM's goals and history
- John F. Haught, PhD—Theology Professor, Georgetown University.
Theology/religion expert
- Kenneth R. Miller, PhD—Professor of Biology, Brown University. Biology expert
- Brian Alters, PhD—Associate Professor of Education, McGill University,
Education/pedagogy expert

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- Kevin Padian, PhD—Professor of Integrative Biology, University of California, Berkeley, Curator, Museum of Paleontology, University of California, Berkeley. Paleontology/evolution expert
- Robert Pennock, PhD—Associate Professor of Science and Technology Studies and Associate Professor of Philosophy, Michigan State University. Philosophy of science expert

Rebuttal expert for Plaintiffs

(Rebuttal experts are named after the initial set of expert reports are filed)

- Jeffrey Shallit, PhD—(deposed, but did not testify at trial due to Dembski's withdrawal). Professor of Computer Science, University of Waterloo, Ontario

Expert witnesses for Defendants

- Michael Behe, PhD—Professor of Biochemistry, Lehigh University. DI fellow, biochemistry/intelligent design expert
- John Angus Campbell—(withdrew before deposition) Professor, Department of Communication, University of Memphis. DI fellow, education/rhetoric of science
- Dick M. Carpenter II, PhD—(deposed, but did not testify at trial) Assistant Professor of Educational Leadership, University of Colorado. Defense education expert, Focus on the Family guest
- William Dembski—(withdrew before deposition) Associate Research Professor, Baylor University (at time of deposition). DI fellow, biochemistry/intelligent design expert

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- Scott Minnich, PhD—Associate Professor of Microbiology, University of Idaho.
DI fellow, microbiology/intelligent design expert
- Warren A. Nord, PhD—(deposed, but did not testify at trial) Director, Program
in the Humanities and Human Values, University of North Carolina, Chapel Hill.
Lecturer in Philosophy, University of North Carolina, Chapel Hill
religion/education expert

Rebuttal experts for Defendants

(Rebuttal experts are named after the initial set of expert reports are filed)

- Steve Fuller, PhD—Professor of Sociology, University of Warwick
- Stephen Meyer—(withdrew before deposition) Director, Discovery Institute
Center for Science and Culture (the “intelligent design” program at Discovery
Institute)

Appendix B

List of Documents Analyzed

Code:	<i>Kitzmiller v. Dover</i> , 2005 (Date/Session):	Citation Reference:
KD01AM1	Transcript Day 1, 09/26/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 31–143 (morning session, September 26, 2005) (testimony of Kenneth R. Miller). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_0926_day1_am.pdf
KD01PM1	Transcript Day 1, 09/26/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 2–113 (afternoon session, September 26, 2005) (testimony of Kenneth R. Miller). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_0926_day1_pm.pdf
KD02AM1	Transcript Day 2, 09/27/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 1–111 (morning session, September 27, 2005) (testimony of Kenneth R. Miller). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_0927_day2_am.pdf
KD02AM2	Transcript Day 2, 09/27/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 112–122 (morning session, September 27, 2005) (testimony of Tammy Kitzmiller). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_0927_day2_am.pdf
KD02AM3	Transcript Day 2, 09/27/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 122–155 (morning session, September 27, 2005) (testimony of Aralene Joan Callahan). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_0927_day2_am.pdf

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Code:	<i>Kitzmiller v. Dover</i> , 2005 (Date/Session):	Citation Reference:
KD02PM1	Transcript Day 2, 09/27/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 1–34 (afternoon session, September 27, 2005) (testimony of Aralene Joan Callahan). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_0927_day2_pm.pdf
KD02PM2	Transcript Day 2, 09/27/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 35–118 (afternoon session, September 27, 2005) (testimony of Bryan Rehm). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_0927_day2_pm.pdf
KD03AM1	Transcript Day 3, 09/28/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 4–109 (morning session, September 28, 2005) (testimony of Robert T. Pennock). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_0928_day3_am.pdf
KD03PM1	Transcript Day 3, 09/28/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 34–58 (afternoon session, September 28, 2005) (testimony of Julie Smith). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_0928_day3_pm.pdf
KD03PM2	Transcript Day 3, 09/28/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 58–92 (afternoon session, September 28, 2005) (testimony of Christy Rehm). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_0928_day3_pm.pdf
KD03PM3	Transcript Day 3, 09/28/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 92–118 (afternoon session, September 28, 2005) (testimony of Beth Eveland). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_0928_day3_pm.pdf

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Code:	<i>Kitzmiller v. Dover</i> , 2005 (Date/Session):	Citation Reference:
KD04AM1	Transcript Day 4, 09/29/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 4–95 (morning session, September 29, 2005) (testimony of Carol Brown). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_0929_day4_am.pdf
KD04PM1	Transcript Day 4, 09/29/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 3–42 (afternoon session, September 29, 2005) (testimony of Carol Brown). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_0929_day4_pm.pdf
KD04PM2	Transcript Day 4, 09/29/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 47–102 (afternoon session, September 29, 2005) (testimony of Jeffrey Brown). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_0929_day4_pm.pdf
KD04PM3	Transcript Day 4, 09/29/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 103–134 (afternoon session, September 29, 2005) (testimony of Frederick Callahan). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_0929_day4_pm.pdf
KD05PM1	Transcript Day 5, 09/30/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 3–101 (afternoon session, September 30, 2005) (testimony of John F. Haught). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_0926_day5_pm.pdf
KD06AM1	Transcript Day 6, 10/05/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 4–149 (morning session, October 5, 2005) (testimony of Barbara Forrest). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1005_day6_am.pdf

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Code:	<i>Kitzmiller v. Dover</i> , 2005 (Date/Session):	Citation Reference:
KD06PM1	Transcript Day 6, 10/05/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 3–119 (afternoon session, October 5, 2005) (testimony of Barbara Forrest). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1005_day6_pm.pdf
KD07AM1	Transcript Day 7, 10/06/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 3–93 (morning session, October 6, 2005) (testimony of Barbara Forrest). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1006_day7_am.pdf
KD07AM2	Transcript Day 7, 10/06/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 93–150 (morning session, October 6, 2005) (testimony of Jennifer Miller). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1006_day7_am.pdf
KD07PM1	Transcript Day 7, 10/06/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 12–65 (afternoon session, October 6, 2005) (testimony of Jennifer Miller). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1006_day7_pm.pdf
KD07PM2	Transcript Day 7, 10/06/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 67–103 (afternoon session, October 6, 2005) (testimony of Bertha Spahr). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1006_day7_pm.pdf
KD08AM1	Transcript Day 8, 10/12/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 4–46 (morning session, October 12, 2005) (testimony of Bertha Spahr). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1012_day8_am.pdf

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Code:	<i>Kitzmiller v. Dover, 2005</i> (Date/Session):	Citation Reference:
KD08AM2	Transcript Day 8, 10/12/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 50–145 (morning session, October 12, 2005) (testimony of Brian Alters). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1012_day8_am.pdf
KD08PM1	Transcript Day 8, 10/12/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 3–67 (afternoon session, October 12, 2005) (testimony of Brian Alters). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1012_day8_pm.pdf
KD08PM2	Transcript Day 8, 10/12/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 75–108 (afternoon session, October 12, 2005) (testimony of Cynthia Sneath). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1012_day8_pm.pdf
KD08PM3	Transcript Day 8, 10/12/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 109–141 (afternoon session, October 12, 2005) (testimony of Steve Stough). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1012_day8_pm.pdf
KD09AM1	Transcript Day 9, 10/14/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 3–42 (morning session, October 14, 2005) (testimony of Steve Stough). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1014_day9_am.pdf
KD09AM2	Transcript Day 9, 10/14/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 42–148 (morning session, October 14, 2005) (testimony of Kevin Padian). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1014_day9_am.pdf

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Code:	<i>Kitzmiller v. Dover</i> , 2005 (Date/Session):	Citation Reference:
KD09PM1	Transcript Day 9, 10/14/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 6–139 (afternoon session, October 14, 2005) (testimony of Kevin Padian). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1014_day9_pm.pdf
KD09PM2	Transcript Day 9, 10/14/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 141–156 (afternoon session, October 14, 2005) (testimony of Joel Leib). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1014_day9_pm.pdf
KD10AM1	Transcript Day 10, 10/17/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 20–129 (morning session, October 17, 2005) (testimony of Michael Behe). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1017_day10_am.pdf
KD10PM1	Transcript Day 10, 10/17/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 4–121 (afternoon session, October 17, 2005) (testimony of Michael Behe). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1017_day10_pm.pdf
KD11AM1	Transcript Day 11, 10/18/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 3–105 (morning session, October 18, 2005) (testimony of Michael Behe). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1018_day11_am.pdf
KD11PM1	Transcript Day 11, 10/18/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 4–115 (afternoon session, October 18, 2005) (testimony of Michael Behe). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1018_day11_pm.pdf

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Code:	<i>Kitzmiller v. Dover</i> , 2005 (Date/Session):	Citation Reference:
KD12AM1	Transcript Day 12, 10/19/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 12–125 (morning session, October 19, 2005) (testimony of Michael Behe). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1019_day12_am.pdf
KD12PM1	Transcript Day 12, 10/19/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 4–101 (afternoon session, October 19, 2005) (testimony of Michael Behe). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1019_day12_pm.pdf
KD13PM1	Transcript Day 13, 10/20/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 3–118 (afternoon session, October 20, 2005) (testimony of Richard Nilsen). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1020_day13_pm.pdf
KD14AM1	Transcript Day 14, 10/21/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 13–139 (morning session, October 21, 2005) (testimony of Richard Nilsen). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1021_day14_am.pdf
KD14PM1	Transcript Day 14, 10/21/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 4–56 (afternoon session, October 21, 2005) (testimony of Richard Nilsen). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1021_day14_pm.pdf
KD14PM2	Transcript Day 14, 10/21/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 59–128 (afternoon session, October 21, 2005) (testimony of Michael Baksa). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1021_day14_pm.pdf

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Code:	<i>Kitzmiller v. Dover</i> , 2005 (Date/Session):	Citation Reference:
KD15AM1	Transcript Day 15, 10/24/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 3–137 (morning session, October 24, 2005) (testimony of Steven William Fuller). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1024_day15_am.pdf
KD15PM1	Transcript Day 15, 10/24/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 3–115 (afternoon session, October 24, 2005) (testimony of Steven William Fuller). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1024_day15_pm.pdf
KD16AM1	Transcript Day 16, 10/27/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 4–143 (morning session, October 27, 2005) (testimony of William Buckingham). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1027_day16_am.pdf
KD16PM1	Transcript Day 16, 10/27/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 3–65 (afternoon session, October 27, 2005) (testimony of William Buckingham). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1027_day16_pm.pdf
KD16PM2	Transcript Day 16, 10/27/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 67–132 (afternoon session, October 27, 2005) (testimony of Heidi Bernhard-Bubb). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1027_day16_pm.pdf
KD17AM1	Transcript Day 17, 10/28/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 7–51 (morning session, October 28, 2005) (testimony of Heidi Bernhard-Bubb). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1028_day17_am.pdf

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Code:	<i>Kitzmiller v. Dover</i> , 2005 (Date/Session):	Citation Reference:
KD17AM2	Transcript Day 17, 10/28/2005 Morning & afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 52–123 (morning & afternoon session, October 28, 2005) (testimony of Joseph Maldonado). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1028_day17_am.pdf
KD17AM3	Transcript Day 17, 10/28/2005 Morning & afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 145–205 (morning & afternoon session, October 28, 2005) (testimony of Heather Geesey). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1028_day17_am.pdf
KD17AM4	Transcript Day 17, 10/28/2005 Morning & afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 208–244 (morning & afternoon session, October 28, 2005) (testimony of Michael Baksa). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1028_day17_am.pdf
KD18AM1	Transcript Day 18, 10/31/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 4–51 (morning session, October 31, 2005) (testimony of Jane Cleaver). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1031_day18_am.pdf
KD18AM2	Transcript Day 18, 10/31/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 52–145 (morning session, October 31, 2005) (testimony of Alan Bonsell). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1031_day18_am.pdf
KD18PM1	Transcript Day 18, 10/31/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 3–133 (afternoon session, October 31, 2005) (testimony of Alan Bonsell). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1031_day18_pm.pdf

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Code:	<i>Kitzmiller v. Dover</i> , 2005 (Date/Session):	Citation Reference:
KD19AM1	Transcript Day 19, 11/02/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 3–19 (morning session, November 02, 2005) (testimony of Alan Bonsell). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1102_day19_am.pdf
KD19AM2	Transcript Day 19, 11/02/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 24–136 (morning session, November 02, 2005) (testimony of Sheila Harkins). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1102_day19_am.pdf
KD19PM1	Transcript Day 19, 11/02/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 7–129 (afternoon session, November 02, 2005) (testimony of Michael Baksa). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1102_day19_pm.pdf
KD20AM1	Transcript Day 20, 11/03/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 4–60 (morning session, November 03, 2005) (testimony of Michael Baksa). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1103_day20_am.pdf
KD20AM2	Transcript Day 20, 11/03/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 61–103 (morning session, November 03, 2005) (testimony of Robert S. Linker). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1103_day20_am.pdf
KD20PM1	Transcript Day 20, 11/03/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 5–157 (afternoon session, November 03, 2005) (testimony of Scott Minnich). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1103_day20_pm.pdf

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Code:	<i>Kitzmiller v. Dover</i> , 2005 (Date/Session):	Citation Reference:
KD21AM1	Transcript Day 21, 11/04/2005 Morning session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 3–112 (morning session, November 04, 2005) (testimony of Scott Minnich). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1104_day21_am.pdf
KD21PM1	Transcript Day 21, 11/04/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 28–60 (afternoon session, November 4, 2005) (plaintiffs closing arguments, Eric J. Rothschild). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1104_day21_pm.pdf
KD21PM2	Transcript Day 21, 11/04/2005 Afternoon session	04cv2688: Kitzmiller, T. et al. v. Dover Area School District, transcript of proceedings bench trial, pp. 60–90 (afternoon session, November 4, 2005) (defendants closing arguments, Patrick T. Gillen). Retrieved from http://ncse.com/files/pub/legal/kitzmiller/trial_transcripts/2005_1104_day21_pm.pdf
<i>Kitzmiller v. Dover</i> , 2005	Opinion Day 22, 12/20/2005	<i>Kitzmiller v. Dover Area School District</i> , No. 04cv2688, 2005 U.S. Dist. (M.D. Pa. 2005). Retrieved from http://www.pamd.uscourts.gov/opinions/jones/04v2688d.pdf .

Appendix C

Examples of Document Coding

Taken from pages 134–138 of the final opinion of the court, in *Kitzmiller v. Dover Area School District*, No. 04cv2688, 2005 U.S. Dist. (M.D. Pa. 2005). Retrieved from <http://www.pamd.uscourts.gov/opinions/jones/04v2688d.pdf>.

NB.: Excerpts taken from the *personal reflex journal* used to explain the rationale of assigning quotations to sub-category codes, have been directly copied from the electronic journal, and as such are not phrased in a formal manner and may contain abbreviations. A key to abbreviations used is therefore included at the end of the table.

Quotation from Text	Coding—Sub-Categories and Explanatory Excerpts from Personal Reflexive Journal
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<p>Second, the disclaimer read to students “has the effect of implicitly bolstering alternative religious theories of origin by suggesting that evolution is a problematic theory even in the field of science.” Selman, 390 F. Supp. 2d at 1308-09. Third, reading the disclaimer not only disavows endorsement of educational materials but also “juxtaposes that disavowal with an urging to contemplate alternative religious concepts implies School Board approval of religious principles.” Freiler, 185 F.3d at 348.</p> <p>The effect of Defendants’ actions in adopting the curriculum change was to impose a religious view of biological origins into the biology course, in violation of the Establishment Clause.</p>	<p>Criticisms of Darwinian theory ID - As science and an equivalent of Darwinian evolution Legal—Creationism as science fails the Establishment Clause/First Amendment Legal—ID policy violates rights under the U.S. Constitution Nature of Science - Incorrect definition or misrepresentation of a scientific theory School Board—Behavior fails constitutional Tests</p> <p>Excerpt from personal reflex journal: <i>Suggesting evolution is a problematic theory = misleading. Can be interpreted as criticism of Darwin theory. Judge = disclaimer implies SB approval of religion. Clear violation of Est. Cl.</i></p>

G. Challenge under Pennsylvania Constitution

In addition to the Establishment Clause challenge, Plaintiffs assert that Defendants' actions in enacting the ID Policy violate their rights under the Pennsylvania Constitution, specifically Art. I, § 3.23 Article I, § 3 of the Pennsylvania Constitution states the following:

All men have a natural and indefeasible right to worship Almighty God according to the dictates of their own consciences; no man can of right be compelled to attend

Legal—Enacting ID policy violates rights under the Pennsylvania State Constitution

p. 135

erect or support any place of worship, or to maintain any ministry against his consent; no human authority can, in any case whatever, control or interfere with the rights of conscience, and no preference shall ever be given by law to any religious establishments or modes of worship. Pa. Const. Art. I, § 3 (2005)

Legal—Enacting ID policy violates rights under the Pennsylvania State Constitution

Excerpt from personal reflex journal:
Clearly fits sub-category

As we explained in our March 10, 2005 Order, the Pennsylvania Supreme Court has opined in *Springfield Sch. Dist. v. Commonwealth of Pa.*, 397 A.2d 1154, 1170 (Pa. 1979), that the provisions of Art. I, § 3 do not exceed the limitations in the First Amendment's Establishment Clause. See also *Wiest v. Mt. Lebanon Sch. Dist.*, 320 A.2d 362, 366 (Pa. 1974), cert. denied, 419 U.S. 967 (1974).

Legal Tests—Appropriate Selection of Legal Tests

In discussing the provisions of Art. I, § 3, the Pennsylvania Supreme Court explained:
The principles enunciated in this part of our Constitution reflected a concern for the protection of the religious freedoms of Pennsylvanians long before the first amendment to the United States Constitution was made applicable to the states through the fourteenth amendment . . . The protection of rights and freedoms

Legal Tests—Appropriate Selection of Legal Tests

Excerpt from personal reflex journal:
Section does not argue for/against creationism. Explains selection of const. tests.

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secured by this section of our Constitution, however, does not transcend the protection of the first amendment of the United States Constitution.

Wiest, 320 A.2d at 366. Consequently, our discussion of the issues raised under the federal constitution applies with equal vigor to the issues raised by Plaintiffs that are

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grounded in our state constitution. In light of this Court’s prior ruling that the ID Policy violates the Establishment Clause of the First Amendment, the Court likewise concludes that the ID Policy is violative of Plaintiffs’ rights under the Pennsylvania Constitution.

Legal Tests—Appropriate Selection of Legal Tests
Legal—Enacting ID policy violates rights under the Pennsylvania State Constitution
ID - Contravenes the First Amendment
ID - Creation Science/ID is NOT science (and therefore fails constitutional tests)
Legal—Creationism as science fails the Establishment Clause/First Amendment
Legal—ID policy violates rights under the U.S. Constitution
Legal - Enacting ID policy violates rights under State Constitution
Schoolboard - Agenda to promote creationism
Schoolboard - Behaviour fails Lemon Test and/or Endorsement Test

Excerpt from personal reflex journal:

SB behavior—not mentioned in quote, but implied by text. If ID policy violates const. then imposing it fails legal tests & implies agenda to promote creationism. All other text fits sub-categories.

H. Conclusion

The proper application of both the endorsement and Lemon tests to the facts of this case makes it abundantly clear that the Board’s ID Policy violates the Establishment Clause. In making this determination, we have addressed the seminal question of whether ID is science. We have concluded that it is not, and moreover that ID cannot uncouple itself from its creationist, and thus religious, antecedents.

Legal Tests—Appropriate Selection of Legal Tests
ID - Contravenes the First Amendment
ID - Creation Science/ID is NOT science (and therefore fails constitutional tests)
Legal—Creationism as science fails the Establishment Clause/First Amendment
Legal—ID policy violates rights under the U.S. Constitution
Legal - Enacting ID policy violates rights under State Constitution
Schoolboard - Agenda to promote creationism

Schoolboard - Behaviour fails Lemon Test and/or Endorsement Test

Excerpt from personal reflex journal:

SB behavior—implied by mention of SB ID policy violating EC. All other text fits sub-categories.

Both Defendants and many of the leading proponents of ID make a bedrock assumption which is utterly false. Their presupposition is that evolutionary theory is antithetical to a belief in the existence of a supreme being and to religion in general. Repeatedly in this trial, Plaintiffs’ scientific experts testified that the theory of evolution represents good science, is overwhelmingly accepted by the scientific community, and that it in no way conflicts with, nor does it deny, the existence of a divine creator. To be sure, Darwin’s theory of evolution is imperfect. However, the fact

Nature of Science—Incorrect definition or misrepresentation of a scientific theory
Evolutionary science does not speak to the existence of a divine creator
Criticisms of Darwinian theory
Logical Fallacy—Evolutionary science denies a divine creator

Excerpt from personal reflex journal:

ID supporters, error in reasoning = incorrect/misrep’ of theory. Science doesn’t confirm/deny religion—but may speak to probability? Expand. Logical fallacy. Implies criticism of D’s theory.

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that a scientific theory cannot yet render an explanation on every point should not be used as a pretext to thrust an untestable alternative hypothesis grounded in religion into the science classroom or to misrepresent well-established scientific propositions.

Logical Fallacy—Criticism of evolution therefore supports creationism
Nature of Science—Incorrect definition or misrepresentation of a scientific theory
Logical Fallacy—Personal incredulity

Excerpt from personal reflex journal:

I can’t think of how this could be, so God did it. Misrep’s “well-established scientific propositions” False dichotomy.

The citizens of the Dover area were poorly served by the members of the Board who voted for the ID Policy. It is ironic that several of these individuals, who so staunchly and proudly touted their religious convictions in public, would time and again lie to cover their tracks and disguise the real purpose behind the ID Policy.

School Board—Behavior fails constitutional Tests
School Board—Credibility/honesty of testimony

Excerpt from personal reflex journal:

SB behavior shows agenda? Adversely affects teaching/curriculum.

Judge outright calls defendants on lying under oath.

With that said, we do not question that many of the leading advocates of ID have bona fide and deeply held beliefs which drive their scholarly endeavors. Nor do we controvert that ID should continue to be studied, debated, and discussed. As stated, our conclusion today is that it is unconstitutional to teach ID as an alternative to evolution in a public school science classroom.

Legal—Creationism as science fails the Establishment Clause/First Amendment
Legal—ID policy violates rights under the U.S. Constitution
ID - Contravenes the First Amendment
ID - Creation Science/ID is NOT science (and therefore fails constitutional tests)
Legal—Creationism as science fails the Establishment Clause/First Amendment

Excerpt from personal reflex journal:

ID as philosophical discussion might be acceptable for critical thinking? But it's NOT science & violates const.

This implies that ID needs a change of “what is science” to be accepted. Does this mean that every quote of ID is NOT science, is therefore also “requires a change of what is science”?

To avoid large-scale “cross-coding” only specific discussions of changing the nature of science to be coded as “ID—Requires a change in the nature of science to be accepted”

Those who disagree with our holding will likely mark it as the product of an activist judge. If so, they will have erred as this is manifestly not an activist Court. Rather, this case came to us as the result of the activism of an ill-informed faction on a school board, aided by a national public interest law firm eager to find a constitutional test case on ID, who in combination drove the Board to adopt an

Legal—National public interest law firm seeking constitutional test case on ID
School board—Coercion/intimidation of non-adherents to board creationist agenda
Social Pressure—On non-adherents to religious endorsement

Excerpt from personal reflex journal:

Implies agenda by SB and others: Wedge Strategy?

SB = ill-informed.

“Drove the board” implies coercion of anyone who disagreed.

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imprudent and ultimately unconstitutional policy. The breathtaking inanity of the Board's decision is evident when considered against the factual backdrop which has now been fully revealed through this trial. The students, parents, and teachers of the Dover Area School District deserved better than to be dragged into this legal maelstrom, with its resulting utter waste of monetary and personal resources.

Legal—Creationism as science fails the Establishment Clause/First Amendment
School Board—Credibility/honesty of testimony
ID—Contravenes the First Amendment
Legal—Waste of resources
Social Discord

Excerpt from personal reflex journal:

ID policy = breaks 1st Am. ∴ unconstitutional

SB = breathtaking inanity (beautiful) ∴ lack credibility

Wasteful

“Dragged students, parents, and teachers Dover” plaintiffs into “legal maelstrom” plus plaintiffs are citizens of Dover implies discord in community.

We will also issue a declaratory judgment that Plaintiffs' rights under the Constitutions of the United States and the Commonwealth of Pennsylvania have been violated by Defendants' actions. Defendants' actions in violation of Plaintiffs' civil rights as guaranteed to them by the Constitution of the United States and 42 U.S.C. § 1983 subject Defendants to liability with respect to injunctive and declaratory relief, but also for nominal damages and the reasonable value of Plaintiffs' attorneys' services and costs incurred in vindicating Plaintiffs' constitutional rights.

Legal - Final adjudication
Legal - History of opposition to teaching evolution
Legal - ID policy violates rights under the U.S. Constitution
Legal - Rationale for court vigilance in compliance with Establishment Clause

Excerpt from personal reflex journal:

ID policy = breaks 1st Amendment ∴ unconstitutional

SB = breathtaking inanity (beautiful) ∴ lack credibility

Wasteful

“Dragged students, parents, and teachers Dover” plaintiffs into “legal maelstrom” plus plaintiffs are citizens of Dover implies discord in community.

Key to Abbreviations Used in Table for Appendix C:

1st Am.	First Amendment
C/const.	Constitutional or Constitution depending upon context
EC/Est. Cl.	Establishment Clause
ID	Intelligent Design
misrep'	misrepresent
SB	School Board

Appendix D

Alphabetical List of Themes Arising from Documentation

Theme	Description
Balanced treatment	Arguments that teaching of ID and evolution should be equal in time and resources.
Creation Science/ID IS NOT religion	Arguments that creation science and/or ID <i>are not</i> religion or religious in nature.
Creation Science/ID IS religion	Arguments that creation science and/or ID <i>are</i> religion or religious in nature.
Criticism of Darwinian theory	Critique of the Darwinian theory of evolution science, including modern advances such as phylogenetics.
Criticism of scientific method	Critique of the scientific method, including testability, replicability, falsifiability, predictability and methodological naturalism.
Legal - Appropriate use of test/s	Arguments on the appropriate application of legal tests such as the Lemon Test or Endorsement Test.
Legal - Fails one or more legal tests	ID is reckoned to have failed one or more legal tests.
Legal - History of argument/s	Discussion of the legal history of arguments, such as forbidding the teaching of creationism violates a right to free speech.
Legal - Impact on American public education policy and the law	Reference to changes made to American public education policy and the law, as a result of creationist challenges.
Nature of Science - Testability, falsifiability and methodological naturalism	General discussion of the nature of science including testability, replicability, falsifiability, predictability and methodological naturalism, which does not constitute a critique of the subject.
Public misrepresentation of fact	Misrepresentation of fact in a public forum.
School board - Credibility/honesty of testimony	Statements by the court, pointing out occasions of dishonesty and/or a lack of credibility in testimony provided by members of the school board.
School board - Influencing curriculum/teaching practice to endorse creationism	Occasions where the school board has clearly influenced curriculum and/or teaching practice to endorse religion.

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Social Discord -
Pressure/anxiety caused by
board's actions

Occasions where the behavior of the school board may be
said to have caused stress or anxiety in the surrounding
community.

Wedge strategy - To replace
science as currently practiced
with "theistic & Christian
science"

Existence and nature of the Wedge Strategy, as detailed in
the Wedge document (CRSC, 1998).
