The Louisiana Sciences Education Act's impact on high school science

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THE LOUISIANA SCIENCE EDUCATION ACT’S IMPACT ON HIGH SCHOOL SCIENCE CLASSROOMS

A Thesis

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Louisiana State University and
Agricultural and Mechanical College
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ABSTRACT

Over the last two decades, extensive research has been conducted concerning the legality and effectiveness of teaching opposing viewpoints on controversial topics in science education. However, one of the most important aspects of this dilemma has been disregarded: the effect it has on individual teachers in their unique environments. The purpose of this research was to analyze teacher’s comprehension of recent state legislation as well as how it impacts their instruction. This quantitative approach took place through an online survey of secondary science teachers in biology, which focuses on their teaching experience, understanding of the Louisiana Science Education Act of 2008, and personal views on how evolution should be taught. The research found that about one-third (31%) of biology teachers in Louisiana thought creationism should be taught alongside evolution. About 3 in 4 biology teachers knew what the Louisiana Science Education Act was, and 1 in 10 said it had an influence on their instruction. These data support the hypothesis that recent state legislation has little impact on the daily instruction of science educators.
INTRODUCTION

The theory of evolution encompasses countless examples of testable hypotheses and specific, measurable predictions; the vast majority of these have held up to considerable testing and predictions or, when necessary, have been replaced by better hypotheses and related predictions. Obviously, the theory is not perfect, and we still have much to explain, but overall the theory is so successful that it is almost impossible to understand biology without it. Yes, evolution is a theory, but, no, it is not “just” a theory. To the contrary, it is one of the most successful and comprehensive theories in all of science.

–Matt Young and Paul K. Strode: Why Evolution Works (and Creationism Fails), 2009, p. 44

The Nature of Science

About half of United States citizens support the theory that humans developed from an earlier species of animal (J. D. Miller, Scott, & Okamoto, 2006). This figure has stayed relatively static over time even though court rulings and the scientific community have repeatedly sided with Darwin’s Theory of Evolution by Natural Selection (Baker, 2013). There are many topics in science that are currently misunderstood by large portions of the public due to a number of factors, perhaps none more important than a lack of emphasis on teaching the Nature of Science in K-12 schools (Ben-Ari, 2005). However, the origin of species is unique from theories in chemistry or physics because of the focus it receives from groups outside of science education. In science education, only the debate over global warming has received as much attention as evolution over the years (Skamp, Boyes, & Stanisstreet, 2013), and even the discussion over the former is starting to dissolve as fewer politicians and major companies continue the fight against the scientific community and public understanding of the phenomenon improves (Guber, 2013). The theory of evolution is complex, but the intricacies of the subject matter are not what maintains the divide between scientific community consensus and public misconceptions. This is
an important dilemma that should be analyzed so that future generations of students in the United States are not falling further behind their international peers.

Understanding what is and is not science is important but not easy. Karl Popper’s original idea of falsificationism is the most appropriate principle to demarcate science from nonscience, although as a methodology it has been criticized for being too simplistic (Pigliucci, 2010). Merely applying results to a theory leaves out the “complex process of mutual feedback within the community of scientists” (Ben-Ari, 2005, p. 68). Furthermore, scientists generally work towards supporting their own theories, not falsifying others. However, if a theory does not have the potential to be falsified, it is not considered science. Pseudoscience arises when a person claims to be doing science, but is focused on a theory which cannot be falsified (Ben-Ari, 2005). The example most often given is astrology, a practice which has been shown to be wrong through testing, yet continues to persist on a large scale (Pigliucci, 2010). Perhaps a more devastating pseudoscience example is the recent argument against vaccinations now prevalent in western countries due to faulty scientific discoveries (L. Miller & Reynolds, 2009), but also common in African countries focused on AIDS treatments (Pigliucci, 2010). In the former example, the scientific process was flawed, as published findings had to be retracted by the researchers, but the public opinion was unaware of how the scientific knowledge is generated, and became convinced that heightened rates of autism were caused by vaccines (Haertlein, 2012). In the latter example, politicians, prominent church officials, and hospital employees have proposed cures for the AIDS virus including drinking holy water or splashing potions on one’s body (Pigliucci, 2010). Pseudosciences become dangerous when they move from a belief system into the realm of science, arguing that they should be taught alongside scientific theories which actually explain and predict phenomena, thus wasting resources (Ben-Ari, 2005). One way of
ensuring the public understands the differences between science, non-science, and pseudoscience, is to construct both curriculum and standards around the nature of science as opposed to focusing coursework on solely science content knowledge.

The nature of science (NOS), teaching about the history, philosophy, and sociology of science instead of only science content knowledge, arose in the middle of the 20th century, when the National Science Foundation developed a high school curriculum which focused on teaching through inquiry and encouraging students to think like scientists (Duschl & Grandy, 2013). The NOS is a collection of values and processes which are needed to develop scientific knowledge (Lederman, 1992). Teaching the NOS is difficult for teachers at all levels, as it takes additional time and energy and often requires a transfer of power away from the traditional authority figure, the teacher. Often times, teachers and even students understand that science is a process that is constantly evolving but do not work inside this paradigm during instructional time, instead they focus on information which can be memorized and methods which are easily duplicated (Tobin & McRbbie, 1997). “For instance, science teachers may understand the atomic model, Boyle’s law, and evolutionary theory, but may not understand what law, theory and model mean” (McComas, Almazroa, & Clough, 1998, p. 518). The NOS is aimed at addressing these misconceptions and preparing science students to go into their respective fields ready to contribute, and all other students to think critically about all matters. Much of the research on the NOS has come in the form of quantitative testing, often through multiple choice exams, which seems problematic considering how much the NOS can change and how indefinable it can be (Nott & Wellington, 1998).

Why is understanding these differences and the NOS so important? “Everyone has a right to be irrational, but rampant irrationality in a society can be highly wasteful and destructive”
(Pigliucci, 2010, p. 57). First, understanding evolutionary biology can provide context for the erosion of genetic diversity and biodiversity currently taking place, as well as the repercussions (Young & Strode, 2009). Second, students can apply evolutionary theory to genetic diseases, helping to explain how a virus or bacterium travels and its effects, as well as how to combat both (Young & Strode, 2009). Finally, evolutionary biology “allows us to extend our genealogy much farther back” (Young & Strode, 2009, p. 8) through the study of DNA, helping to discover where human life originated. These are applications for merely evolutionary biology, countless others exist for the scientific fields of chemistry, or physics, or environmental science, further detailing why an understanding of what is and not science is vital for future generations of teachers and students. To be clear, public misconceptions do not alter what scientists are doing at their metaphorical lab table (Collins & Pinch, 1998), but that is very different from saying public misconception of science matters is unimportant. Unfortunately, it is extremely difficult to determine why each person holds on to such misconceptions, as “People believe in shamanism, UFOs, telepathy, astrology, and creationism for reasons that go well beyond their poor grasp of science and difficulty deploying the tools of critical thinking” (Pigliucci, 2010, p. 61).

The Conflict Between Evolutionary Science and Creationism

Evolution is defined as descent with modification. This terminology can be applied to be small-scale and large-scale evolution (Caldwell, 2004). Evolution is both a fact and a theory. A theory is a term that is often misunderstood to mean a mere possibility or belief. In actuality, a theory is “not a guess or a hunch but a complete system of guesses and consequences that supports or explains experimental results or observations” (Young & Strode, 2009, p. 37). “Evolution is a fact in the sense that it is beyond reasonable doubt that living organisms have changed over time throughout the history of the earth” (Pigliucci, 2010, p. 163). Darwin’s theory
of evolution is supported by this modern definition of scientific theory. When broken down into smaller models, each is falsifiable and relies on “natural explanations for natural phenomena” (Lofaso, 2006, p. 227). Darwin relied on extensive observations over numerous years and after his death, his theories were further tested and revised based on newfound evidence (Lofaso, 2006).

Confusion between the terms evolution and Darwinism are often used to argue against evolutionary science by pointing out that current scientists disagree with some principles of Darwin’s evolutionary theory, thus proving uncertainty in the theory. On the contrary, scientists accept a common ancestor, and argue over driving mechanisms (Hofmann & Weber, 2003). This is an example of the absolutist position that Christianity takes towards truth: the foundation of the conflict between whether or not Intelligent Design (ID), the modern terminology applied to the general concept of creationism which was made popular by Phillip Johnson in his 1991 publication *Darwin on Trial*, should be taught in public schools (Young & Strode, 2009). This conflict extends outside of the natural sciences, influencing the development of social sciences in the twentieth century (Lienesch, 2012), as well as occurring in other nations and cultures, including Egypt (Mansour, 2011) and Turkey, where understanding of the origin of species has actually decreased as anti-evolutionary movements have increased in recent decades (Peker, Comert, & Kence, 2010).

Judeo-Christians believe that God created life on Earth. This is not a scientific theory, law, hypothesis, or fact, because it is not falsifiable; it is a supernatural explanation of a natural phenomenon (Lofaso, 2006). If this argument is proposed by using traditional terminology, such as ‘God,’ it is clear that it is religious doctrine and therefore should not be taught as part of the science curriculum in public school, as it violates the Establishment Clause of the First
Amendment, which states Congress shall make no law respecting an establishment of religion. Instead, when defining alternatives to evolution, opponents use scientific terminology, such as observation, evidence, and the addition of –ism at the end of creation, as well as the more deliberate use of the terms creation science and design science. This works to confuse the public, resulting in polling numbers that can be used to argue for the inclusion of ID in the classroom.

Furthermore, proponents of ID focus on the generally positive teaching practices of presenting multiple viewpoints on controversial topics and the need for students who can evaluate arguments to either accept or reject an idea. However, how and when these practices are applied to curriculum is critical. For example, it would be misleading to present global climate change in a manner that allows students to either accept or reject the theory, as the scientific community has accepted the earth’s climate is changing. If teachers wanted to emphasize a controversy, the students could debate how quickly they expect the earth’s climate to change over the next century, or the amount humans should reduce their carbon emissions by each year. There is a substantial and important difference between proposing an alternative to global climate change theory and teaching students to debate aspects of an accepted scientific theory. An example of the use of misleading terminology is when Luskin (2005) titles the second section of his paper “Teaching Creation Science” and states in his paper’s biography that he is the “co-president of the Intelligent Design and Evolution Awareness (IDEA) Center (ideacenter.org), a non-profit fostering student inquiry into intelligent design and evolutionary theory” (Luskin, 2005, p. 583). This elaborate and verbose language attempts to conceal the author’s purpose: to promote the inclusion of creationism in science curriculum. Ben-Ari (2005) writes:

Scientific creationism is the outgrowth of a particular political situation, but is an example of approaches that attempt to find room for a divine being within the scientific world. These approaches, often called natural theology, seize upon the obvious fact that since science doesn’t explain everything, some things can be explained by religion . . .
For one who believes in some form of natural theology, the holy scriptures and religious rituals can be interpreted as metaphors whose scientific truth is irrelevant (p. 135-36).

This is not to say that all religious people want ID taught in science class. For example, the Vatican “indicated that ID is unscientific and should not be taught as an alternative to evolution” (Lee, 2006, p. 587). However, the movement to include ID in classrooms does have the support of many religious politicians and organizations at the state and federal level.
TEACHING EVOLUTIONARY SCIENCE

The Challenges of Teaching Evolution

Evolution falls in the realm of science while creationism and ID do not, a point backed by the scientific community and explained comprehensively (Ben-Ari, 2005; Berkman, 2012; Pigliucci, 2010; Shapiro, 2013; Young & Strode, 2009). Most often creationism is considered a pseudoscience, a subject which pretends to be science by claiming to be based on evidence and hypotheses, or even the use of science-sounding terminology, but is ultimately ignored by the scientific community because its foundation is not falsifiable, perhaps the most fundamental aspect of what defines scientific study.

Understanding the cause for the disconnect between scientific consensus on evolution and the current public perception of the field is difficult. First, educators have deemphasized teaching the nature of science in K-12 schools as well as at the higher education level for a variety of reasons. Second, teaching evolution is difficult due to the aforementioned complexities in the subject matter (Smith, Siegel, & McInerney, 1995). Third, textbooks are poorly constructed, a problem which influences all subject areas in K-12 education (D. Ravitch, 2004). Finally, legislation has been fought for and passed that attempts to dissolve the clear boundary between what is and is not science. The first three challenges will be briefly discussed to serve as a comparison for the fourth and final challenge that is the focus of this research and the most under-researched of the four.

Schools today face a variety of both new and old challenges. Standardized tests are not a new phenomenon, although recent evaluations of districts, schools, and teachers have increased their importance and subsequently created a culture where teachers feel pressure to focus more on achieving high scores than anything else. President George W. Bush’s No Child Left Behind
(NCLB) program focused on accountability and choice, leaving what was actually taught to individual states (D. Ravitch, 2011), although state curriculums are now being addressed with the implementation of the Common Core Curriculum. Since NCLB was passed, math and English are the two subjects most focused on for accountability purposes, which has led to a decrease in science instructional time in elementary grades (Blank, 2013). Traditional science instruction, which focuses on the knowledge of scientific facts, laws, theories, and applications and relies on laboratory activities as verification exercises, is not as effective as new science curriculum, which emphasizes the nature, structure, and processes of science and relies on laboratory exercises as an integral part of the class routine (Shymansky, Kyle, & Alport, 1983). The former is easier to assess on statewide exams and therefore is more common, although the Next Generation Science Standards vow to emphasize the latter (Rodger W. Bybee, 2012).

Furthermore, today’s K-12 science curricula covers far too many topics without focusing time and energy on the most fundamental concepts (Donnelly & Sadler, 2009), which the new national standards also claim to do (R.W. Bybee, 2006). Science teachers are more likely to support the use of provided standards as a guide to how they teach rather than provided assessments which require student mastery (Donnelly & Sadler, 2009). However, new standards can take time to adapt to, as teachers must familiarize themselves with the material and try out different instructional strategies before finding the best method (King, 2001). Collectively, these issues decrease the likelihood that K-12 students are receiving the inquiry-driven instruction focusing on the NOS on any topic, such as the origin of species.

The challenges biology teachers face are similar to other subjects. Teachers must focus on state exam criteria, laboratory equipment is difficult to acquire and must be shared by entire departments while students arrive with little knowledge or training on how to use laboratory
materials and equipment, class size is prohibitive, measurable objectives must be mastered each class period, and so on. ‘Good’ instruction on the topic of evolution therefore mimics ‘good’ instruction in many science areas, focusing on an inquiry-based approach that takes into account common student misconceptions and relates the material to real-world applications. For example, students taught with the Teaching for Transformative Experiences in Science model, a set of instructional methods which focus on the utility and value of understanding a concept, experience greater conceptual change (Heddy & Sinatra, 2013). Assessment formats can also be altered from purely multiple choice to a variety of question styles in order to bridge the gap between students with conflicting religious ideas entering the unit on evolution (Stanger-Hall & Wenner, 2014). Ideally, these types of examples would not be uncommon: Instruction would take place through lab inquiry which “provides students with the opportunity to personally experience the NOS aspects that are manifested in their inquiry process” (Lau & Chan, 2013, p. 2654). Teachers can work toward strong student investment by highlighting the importance of understanding evolution. “For example, understanding evolution could help a patient understand how continuing to take the full course of an antibiotic even though the symptoms have disappeared prevents relapse.” (Smith et al., 1995, p. 23). Apart from the application of general ‘good instructional’ practices, evolution lacks research-based teaching methods, especially regarding the controversial nature of the topic. Evolution seems to be the perfect example to highlight the difference between a belief (little weighing of evidence and used with theological dogma) and acceptance (weighing all evidence and used with scientific evidence) of a concept (Hermann, 2008).

In 2009, Nehm et al. found that approximately half of science teachers advocate for teaching some creationism, making it difficult to implement research-based instructional
practices. In fact, this number does not change significantly when comparing biology science teachers and non-biology science teachers, a surprising fact considering the former have a stronger understanding of the course material (Nehm, Kim, & Sheppard, 2009). Nehm also showed that college biology majors are more likely to support evolution, which seems to disconnect from those who are ending up in the classroom as teachers (2009). Therefore, it is not merely that the biology teachers do not have the tools to successfully teach the material, as is the case in other science courses, they also struggle with what material ought to be taught. Curriculum development is perhaps even more important in a field consisting of so many different views. Bybee’s (2006) proposal of spiraling course material throughout every grade to ensure students are constantly learning about the most fundamental structures of science may help in this regard. However, the first step in this process is “gaining widespread acceptance and agreement on what science teachers should teach and what students should learn” (R.W. Bybee, 2006, p. 34) which is clearly not aligning with scientists who “are at a loss to understand how so many educated Americans believe that creationism should be accorded ‘equal time’ in science education” (Berkman, 2012, p. 1).

The first two challenges facing evolution science in the classroom may be considered inside influences; they originate from those inside the classroom or school or inside the education community. The second two challenges involve those outside of the education realm attempting to change what take place inside the education realm. The first strategy is through the focus on textbooks, which have long been one of the most integral parts of a course’s construction. “Students, teachers, and state officials all regarded textbooks as valuable teaching tools precisely because they were taken to be authoritative.” (Shapiro, 2013, p. 41) Following the Scopes Trial of 1925, the Tennessee case which brought national attention to the origin of
species in public schools, evolution was purged from biology textbooks, decreasing the time spent teaching evolution in the classroom. This was primarily through the influence of prominent politicians and organizations (Moore, 2001). Textbook manufacturers used the perception that the volumes did not have an agenda to appeal to as many people as possible, thereby increasing sales. This was accomplished by omitting controversial issues, a practice that continues today (D. Ravitch, 2004). Furthermore, a serious disconnect existed between the authors of the science pedagogy, who were mostly faculty members, and the textbook publishers, who were salesmen (Shapiro, 2013). Evolution did not start reappearing in textbooks until after World War II. In the 1960s, textbooks started to give evolution comprehensive coverage and in the 1980s, most textbooks increased their emphasis on evolution and the directness of language, which has continued to today (Skoog, 2005). However, individuals and organizations continue to argue for coverage of creationism and ID in major textbooks. Evolution is not the only scientific subject which is involved in this debate, as geological time is crucial to understanding the origin of species, a topic which is difficult to teach merely out of a textbook as students “can recall dates of historical events, but they often have difficulty in placing them in appropriate relationship to each other” (Decker, Summers, & Barrow, 2007, p. 404).

Groups that advocate for the teaching of creationism have traditionally been politically conservative. Alabama passed a textbook disclaimer policy in 1996 (revised in 2001) which had two goals: It raised doubts about the validity of the theory of evolution and it allowed for alternative teachings concerning the origin of species, such as intelligent design (Rich, 2012). Louisiana, Oklahoma, Arkansas, and Georgia have also passed textbook disclaimers, some of which explicitly say evolution is not a fact and should be critically considered. The disclaimers
use scientific language and leave out religious terminology such as creationism to avoid legal action and to appear more legitimate (Borenstein, 2008).

Large organizations, such as the Discovery Institute or Louisiana Family Forum are not the only concern for science educators. Because there is such strong public support for creationism, science educators, particularly ones with little experience, can find themselves having difficult conversations with the parents of their students over what is or is not in a textbook or other course material. This can be frustrating for educators who feel the pressure of local culture conflict with their instructional goals (Dotger, Dotger, & Tillotson, 2010).

**Legislation**

The fourth and final challenge, legislation on evolution and creationism, which is the focus of this research, has been researched extensively from both a science and law perspective, although not on how it directly impacts instruction. There have been few federal cases concerning whether ID should be taught in public schools. In 2005, a school board in Dover, Pennsylvania voted to require Biology teachers to read a specific disclaimer that explained that Darwinian evolution was a theory and not a fact, as well as emphasized the gaps in evidence for the theory. *Kitzmiller v. Dover Area Sch. Dist., 400 F. Supp. 2d 707 (M.D. Pa. 2005).* Furthermore, the excerpt explained that ID was an alternative to evolutionary theory and, if students requested, they could read more about it in the library. Eleven parents sued the school on the grounds that ID is religion and therefore teaching it violates the Constitution. The court held that the school district’s policy of teaching ID in public schools violated the Establishment Clause because ID is religion. However, the court’s decision disregarded the scientific evidence in support of Darwinian evolutionary theory, a point which can also be used to entail why ID is not taught by science educators (Thomasson, 2011). This was not due to a lack of expert
testimony on numerous scientific subjects. The Dover case was unique from other cases on creationism in that it presented extensive witness testimony on the debate of what is and is not considered science, Darwinian evolutionary theory, and the scientific flaws in ID, namely that a working definition of science which includes ID must also include astrology, and that no peer-reviewed paper has been published on ID. Most other cases concerned with this topic have left out detailed scientific theories or terminology, such as the 1925 Scopes “Monkey Trial”, *Epperson v. Arkansas* in 1968, and *Edwards v. Aguillard* in 1987 (Talbot, 2005). Educational theory seems to be easily lost in these cases, as activists either disregarded how students learned to focus on their own agenda, or they did not fully understand the field because they were not specialists trained to critique what and how material ought to be have been taught (Shapiro, 2008). Finally, it is important to note the background of the activists who presently argue in support of ID through legislation. Very few ID proponents have a scientific background (graduate degree or higher) and the literature is almost exclusively published in law journals. For example, Hofman’s (2013) work was published in the Regent University Law Review, writing:

A more recent alternative to Darwinism is I.D. While creation-science has its foundation a religious text, I.D. has its foundation traditional scientific observation [*sic*]. I.D. posits that life developed as a result of an intentional selection process, requiring a selective guidance for which traditional Darwinism cannot account (p. 472).

Hofman goes on to say that a general definition of ID describes it as a scientific theory (Hofman, 2013). However, this definition is actually from Casey Luskin, also a lawyer (who does have a B.S. and M.S. from UC San Diego in Earth Science), who is part of the Discovery Institute that works to incorporate ID in science education.

State laws concerning the teaching of evolution and alternatives have been far more common than federal law, most recently in the form of the Academic Freedom Acts (Rich, 2012). Louisiana passed the Louisiana Science Education Act (LSEA) in 2008 that allows
teachers the freedom to instruct multiple viewpoints on controversial issues, such as the origin of species. The law specifically mentions evolution, the origin of species, global warming, and human cloning, none of which are currently discussed extensively in science literature as being controversial. “The law explicitly targets evolution, which is unsurprising — for lurking in the background of the law is creationism, the rejection of a scientific explanation of the history of life in favor of a supernatural account involving a personal creator.” (Branch & Scott, 2009, p. 94). Politicians, including Governor Bobby Jindal have openly stated that the act allows for the teaching of ID ("Baton Rouge Advocate endorses repeal effort again," 2014). Louisiana has a long history with legal battles focused on the teachings of evolutionary theory. In 1987, the United States Supreme Court ruled that the Louisiana Balanced Treatment Act, a law passed in 1981 to allow for equal instructional time for evolution and creationism, was unconstitutional, as it violated the Establishment Clause of the First Amendment. However, as of March 2014, the Balanced Treatment Act has not been repealed even though it was deemed unconstitutional by the federal Supreme Court, a point which shows the possible disconnect states may have with the rest of the nation and how slowly some issues progress ("Louisiana edges toward repealing 1981 creationist law," 2014).

The majority of these types of decisions have been founded on the Lemon Test, a set of requirements for legislation on religion made popular in the case Lemon v. Kurtzman in 1971. The Lemon Test has three prongs: The government must have a secular purpose for the proposed law/action, the primary effect of the law cannot advance nor inhibit religion, and there cannot be excessive entanglement between government and religion (Bauer, 2006). Historically, creationism laws have failed the first prong as the legislation is not secular due to the theory (creationism, creation science, intelligent design, etc.), not falling in the scope of the definition
of science (F. S. Ravitch, 2012). Thus far, the LSEA has avoided these objections because it does not mention any religious theories and specifically states that it is not promoting religious doctrine. Instead, it focuses on the critical examination of the theory of evolution and other controversial science topics. However, it is possible and perhaps likely that at some point the law will be overturned as the terminology used in place of traditional ID language may still violate the Establishment Clause. Furthermore, the law originates from a combination of individual supporters of ID, including city court judges, and institutions which promote the teaching of ID, such as the Discovery Institute (Morelli, 2010). The LSEA and other Academic Freedom Laws are merely changing the language to remove religious terminology and adding in an excerpt explaining the legislation is not meant to promote theology, even though that is the laws’ primary objective, one which was identical to the creationism laws passed three decades ago and found unconstitutional by the Supreme Court.

**Louisiana Legislation**

Louisiana is at the forefront of the charter school movement. For legal purposes of the Establishment Clause, charter schools are considered private schools (Saiger, 2013). This “invites religiously oriented educational entrepreneurs and parents to exploit the fuzziness of the categories ‘religion’ and ‘school’ in order to undermine such a ban” on teaching ID (Saiger, 2013, p. 1163). It is worth noting that the LSEA was passed under Governor Bobby Jindal despite strong protest from his former professor Arthur Landry, a distinguished Brown University biochemist, and other prominent scientists and science organizations (Branch & Scott, 2009).

The legal argument for teaching creationism or ID has so far failed at the federal level, while it does live on at the local and state levels. However, there are alternative ways to ensure
religious teachings do not enter scientific classrooms. One such way is to remove the public’s confusion of what is and is not considered science (F. S. Ravitch, 2009). K-12 science education should emphasize the NOS, focusing on the fundamental aspects of what makes science unique, how to conduct proper science, and how to think critically. Unfortunately, declarative knowledge that is easily assessed on end-of-year state exams has become the emphasis in many schools due to the recent shift towards accountability since the passing of the No Child Left Behind Act of 2001. The NOS has often been disregarded because it is more difficult to test on a standardized exam and is more difficult to teach, requiring consistent and thorough coaching and feedback for science educators. However, if students do not comprehend the differences between law and theory, or science and pseudoscience, these debates over what students should be learning in science will continue, as the public remains confused on what is considered science. If courts recognized the characteristics necessary for analyzing if a theory was scientific, namely by analyzing the theories “testability, peer review, rate of error, and general acceptance” (Kitcher, 2006, p. 481), a simplified criteria could be used throughout all courtrooms, regardless of the changing terminology. Furthermore, religious parents who refuse to accept evolutionary theory will continue to educate their children on why they should adopt ID, but it is up to science educators and policy makers to ensure those views are kept at home and outside of public school science classrooms (Lentini, 2007). This is best summarized by Branch and Scott (2009):

The enactment of the Louisiana Science Education Act, and the prospect of similar legislation in the future, confirms Darwin’s assessment of the power of steady misrepresentation. But because the passage of such antievolution bills ultimately results from politics rather than science, it will not be the progress of science that ensures their failure to endure. Rather it will take the efforts of citizens who are willing to take a stand and defend the uncompromised teaching of evolution (p. 99).

To many, the Academic Freedom Laws sound pragmatic, as they require teachers to emphasize critical thinking and analysis of theories, which are after all, not fact. However, to
those who fully understand the NOS, it is clear that anti-evolutionists are attempting to instill religious doctrine in the science classroom. Whether this is done knowingly is irrelevant, as the outcome is what is most important. Through further legal dispute focused on the Establishment Clause of the First Amendment of the Constitution and the consistent emphasis on the NOS throughout courses and grades in public schools, this debate should ultimately end so that more important discourse on how science ought to be taught may occur.
RESEARCH

Purpose

Policy research in general has been disregarded over the last half-century in science education. This is problematic, as “[e]ducational policies, and more specific ones for science education, very often influence the practice of science education by authorizing some conditions of practice over others and emphasizing particular aspects of the what and how of science teaching and learning” (Fensham, 2009, p. 1077). Teachers are very aware of the topic of evolution, understanding its implications and importance. In fact, during a unit on evolution, the culture and instruction of a classroom can be completely unique from all other science topics (Goldston & Kyzer, 2009). However, this does not mean biology teachers are fully aware of legislation on evolution. While extensive research has been conducted on the legislation passed mostly at the state level on evolution, there has been a void on teacher comprehension of such laws as well as their influence on instruction. This may be possible as laws are frequently passed and overturned, although it is also possible educators keep up to date with laws that are based on their profession. Private and public school teachers place similar emphasis on evolution, although the reasoning behind their instruction may differ (Schulteis, 2010). If teachers are either unaware of current state legislation or they disregard it when making instructional choices, legislation would be said to have little to no influence on biology teachers in Louisiana. Given this, the purpose of this research was to analyze the influence of current legislation on classroom teachers. The research question was: How does state legislation impact classroom instruction? As a former science educator who was unaware of the LSEA during his teaching tenure, the researcher hypothesized recent science education legislation has little impact on the daily instruction of secondary science educators.
Methods

To analyze the number of science educators who are influenced by state legislation, specifically the Louisiana Science Education Act of 2008, an online survey was created and emailed to 350 science teachers across the state of Louisiana. Potential participants and their email addresses were identified on school websites. This was a difficult task, as many schools’ websites were not functioning or up-to-date, lacked email addresses, or did not list the subject teachers taught; therefore, convenience sampling was used based on information gleaned from school websites. Ideally, a database that listed current biology teachers in the state would have saved time and increased the scope of the research, but unfortunately no such resource exists. An incentive was offered: The email notified respondents that participation would enter them in a drawing for a $25 gift card to Amazon.com (Appendix 1). The first page of the survey was an informed consent script (Appendix 2) that would automatically close the survey if answered ‘disagree.’ Following the participants’ agreement to consent, the survey consisted of thirteen multiple-choice questions and one short-answer question (Appendix 3). The purpose of the questions was to sort teachers into categories based on experience (years and subject) and type of school at which they taught (public, private, and public charter), to determine their understanding of legislation (federal and state), and to analyze how the legislation effects their views on evolution versus creationism, as well as how the Louisiana Science Education Act particularly has influenced their teaching. The survey asked teachers if they had taught biology over the last two years to separate individuals who did not have recent teaching experience on evolution as the Louisiana Science Education act specifically focuses on evolution, a topic covered in biology. These differences will be termed BT for biology teachers and NBT for non-biology teachers.
The online survey website used was surveymonkey.com, select edition. This service included unlimited questions, up to 1000 respondents, and enhanced security. To keep the respondents’ names both confidential and anonymous (Sieber & Tolich, 2013), school names and educator names have been left out of this research paper. While respondents’ answers most likely would cause little to no harm if made public, there was no need to make them known. Questions were constructed to collect as wide a range of data as possible, including experience, type of school, understanding of legislation, views on evolution and creationism, and understand and use of the LSEA. Questions were written to ensure clarity and precision (Fowler, 1995).

To analyze free response data, a coding technique was used to categorize responses (Holt, 2003). This allowed the researcher to make general observations from the data while allowing the subjects the freedom to include a variety of ideas on the subject.

Results

Of the 350 science teachers who received emails for the online survey, 95 responded for a response rate of 27.1%. Of the respondents, 70 (73.7%) taught biology. Of the respondents, 88 (92.6%) answered all 14 multiple choice questions; 49 (51.2%) answered all multiple choice questions and the short answer question. A majority of the respondents were experienced (≥6 years of teaching) biology teachers from traditional public schools (52.69%). About 80% of the respondents worked at public schools, which mimicked the 20% private school rate across Louisiana in 2013 (Dreilinger, 2014). Ultimately, insufficient data was collected to compare two variables. First, only one respondent taught at a public charter school, therefore public charters could not be compared with private and traditional public schools. Second, only two of the private schools did not have a religious affiliation. Therefore, for the purpose of this paper,
private schools will be considered religious private schools, and non-secular private schools will not be considered.

The number of years of experience teaching had no correlation with the teachers’ understanding of either federal or state legislation. About two-thirds of the respondents considered themselves some-what familiar with state and federal legislation on education, and one-third considered themselves ‘very familiar’, with less than 5% of teachers saying they were ‘not familiar’ or they were ‘an expert on the subject’ (Table 1). This was also the case when asking teachers about their understanding of the Louisiana Science Education Act, with 75% of respondents answering they were somewhat familiar or very familiar on the subject.

Table 1. Teacher comprehension of state and federal education legislation

<table>
<thead>
<tr>
<th>State Legislation</th>
<th>1- Not familiar</th>
<th>2- Somewhat familiar</th>
<th>3- Very familiar</th>
<th>4- Expert on the subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology teachers</td>
<td>1.4% (1/69)</td>
<td>68.1% (47/69)</td>
<td>30.4% (21/69)</td>
<td>0% (0/69)</td>
</tr>
<tr>
<td>Non-biology teachers</td>
<td>0% (0/24)</td>
<td>54.2% (13/24)</td>
<td>45.8% (11/24)</td>
<td>0% (0/93)</td>
</tr>
<tr>
<td>Total</td>
<td>1.1% (1/93)</td>
<td>64.5% (60/93)</td>
<td>34.4% (32/93)</td>
<td>0% (0/93)</td>
</tr>
<tr>
<td>Federal Legislation</td>
<td>1- Not familiar</td>
<td>2- Somewhat familiar</td>
<td>3- Very familiar</td>
<td>4- Expert on the subject</td>
</tr>
<tr>
<td>Biology teachers</td>
<td>4.3% (3/69)</td>
<td>76.8% (53/69)</td>
<td>18.8% (13/69)</td>
<td>0% (0/69)</td>
</tr>
<tr>
<td>Non-biology teachers</td>
<td>12.5% (3/24)</td>
<td>41.7% (10/24)</td>
<td>45.8% (11/24)</td>
<td>0% (0/93)</td>
</tr>
<tr>
<td>Total</td>
<td>6.5% (6/93)</td>
<td>67.7% (63/93)</td>
<td>25.8% (24/93)</td>
<td>0% (0/93)</td>
</tr>
<tr>
<td>LSEA</td>
<td>1- Not familiar</td>
<td>2- Somewhat familiar</td>
<td>3- Very familiar</td>
<td>4- Expert on the subject</td>
</tr>
<tr>
<td>Biology teachers</td>
<td>26.0% (18/69)</td>
<td>50.7% (35/69)</td>
<td>20.3% (14/69)</td>
<td>2.9% (2/69)</td>
</tr>
<tr>
<td>Non-biology teachers</td>
<td>16.7% (4/24)</td>
<td>62.5% (15/24)</td>
<td>20.8% (5/24)</td>
<td>0% (0/93)</td>
</tr>
<tr>
<td>Total</td>
<td>23.7% (22/93)</td>
<td>53.8% (50/93)</td>
<td>20.4% (19/93)</td>
<td>2.2% (2/93)</td>
</tr>
</tbody>
</table>
When comparing private and public schools, teachers had very similar views on whether evolution and creationism should be taught. Over 95% of respondents for public and private schools stated evolution should be taught in schools, and about one-third of public schools (32.9%) and private schools (33.3%) said creationism should be taught in science class (Table 2).

Table 2. Percent of teachers who replied “Yes, it should be taught in secondary science classrooms” to the following questions:

<table>
<thead>
<tr>
<th></th>
<th>Should Darwinian Evolution be taught in secondary science courses in public schools?</th>
<th>Should Creationism and/or Intelligent Design be taught in secondary science courses?</th>
</tr>
</thead>
<tbody>
<tr>
<td>BT</td>
<td>100% (68/68)</td>
<td>31.8% (21/66)</td>
</tr>
<tr>
<td>NBT</td>
<td>83.3% (20/24)</td>
<td>34.8% (8/23)</td>
</tr>
<tr>
<td>Total</td>
<td>95.7% (88/92)</td>
<td>32.6% (29/89)</td>
</tr>
<tr>
<td>Traditional public school</td>
<td>96.0% (71/74)</td>
<td>32.9% (24/73)</td>
</tr>
<tr>
<td>Private school</td>
<td>93.8% (15/16)</td>
<td>(5/15) 33.3%</td>
</tr>
</tbody>
</table>

The way in which creationism is approached in high schools is an important factor when considering respondent data. For example, educators may support the teaching of creationism in a history course but not in a science course. Table 3 summarizes respondent data by course (biology teachers vs. non-biology teachers) and by institution (public vs. private schools). The majority of respondents stated creationism should be taught in a history course or not at all, with about one-third (31.1%) stating it should be taught alongside evolution as an alternative theory, similar to how the Louisiana Balanced Treatment Act (deemed unconstitutional in 1987) intended.
Table 3. How should creationism be approached by educators in secondary schools?

<table>
<thead>
<tr>
<th></th>
<th>It should be taught alongside evolution as an alternative theory.</th>
<th>It should not be taught in science courses but can be taught in a history or social studies class alongside theology.</th>
<th>It should not be taught in secondary schools because it is religious doctrine.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BT</td>
<td>31.3% (21/67)</td>
<td>34.3% (23/67)</td>
<td>34.3% (23/67)</td>
</tr>
<tr>
<td>NBT</td>
<td>30.4% (7/23)</td>
<td>34.8% (8/23)</td>
<td>34.8% (8/23)</td>
</tr>
<tr>
<td>Total</td>
<td>31.1% (28/90)</td>
<td>34.4% (31/90)</td>
<td>34.4% (31/90)</td>
</tr>
<tr>
<td>TPS</td>
<td>32.9% (24/73)</td>
<td>33.3% (25/75)</td>
<td>32.9% (24/75)</td>
</tr>
<tr>
<td>PS</td>
<td>26.7% (4/15)</td>
<td>33.3% (5/15)</td>
<td>40.0% (6/15)</td>
</tr>
</tbody>
</table>

7 out of the 87 respondents (8%) stated they have changed their instructional practices because of the Louisiana Science Education Act (Table 4- See Appendix 3 for whole answer choices). 23% stated they did not know what the act was, 61% stated they did not change their instruction practices because of the act, and 8% stated they do not teach the subject. These numbers changed slightly when only considering biology teachers. For BT, 9% stated they had changed their methods because of the LSEA, 1% stated it did not affect them because of their content matter, 64% stated they have not changed because of the act, and 26% stated they did not know what the act was.

Table 4. How has the Louisiana Science Education Act influenced how you teach the origin of species or evolution in your classroom?

<table>
<thead>
<tr>
<th></th>
<th>I do not teach this topic because it is not in the state standards.</th>
<th>LSEA has not changed how I teach the origin of species…</th>
<th>Because of LSEA, I now incorporate alternative theories…</th>
<th>I do not know what LSEA is.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BT</td>
<td>1.5% (1/66)</td>
<td>63.6% (42/66)</td>
<td>9.1% (6/66)</td>
<td>25.8% (17/66)</td>
</tr>
<tr>
<td>NBT</td>
<td>28.6% (6/21)</td>
<td>52.4% (11/21)</td>
<td>4.8% (1/21)</td>
<td>14.3% (3/21)</td>
</tr>
<tr>
<td>Total</td>
<td>8.0% (7/87)</td>
<td>60.9% (53/87)</td>
<td>8.0% (7/87)</td>
<td>23.0% (20/87)</td>
</tr>
<tr>
<td>TPS</td>
<td>8/5% (6/71)</td>
<td>62.0% (44/71)</td>
<td>9.9% (7/71)</td>
<td>19.7% (14/71)</td>
</tr>
<tr>
<td>PS</td>
<td>0% (0/14)</td>
<td>71.4% (10/14)</td>
<td>0% (0/14)</td>
<td>28.6% (4/14)</td>
</tr>
</tbody>
</table>

24
The short answers for question 15 were categorized into 1 of 5 themes (Table 5). Only biology teachers were analyzed with the subject matter. 49 teachers responded to the question (out of 71 possible biology teachers). Many of those who did not respond may not have understood what the Louisiana Science Education Act was.

Table 5. Free response data on how the LSEA has impacted instruction from BT

<table>
<thead>
<tr>
<th>Generalized theme summarizing free response</th>
<th>Number of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>“I use creationism to show students the difference between non-science and science.”</td>
<td>14.3% (7/49)</td>
</tr>
<tr>
<td>“I purposefully leave out creationism when teaching the origin of species.”</td>
<td>55.1% (27/49)</td>
</tr>
<tr>
<td>“I teach creationism is some capacity in my classroom as an alternative theory to evolution.”</td>
<td>18.4% (9/49)</td>
</tr>
<tr>
<td>“I do not know what the Louisiana Science Education Act is.”</td>
<td>12.2% (6/49)</td>
</tr>
</tbody>
</table>
CONCLUSION

Significance and Implications

The debate over whether ID is a science and thus should be taught in schools hinges on the definitions of science and scientific theory. Science is the study of the material world and how it works. A scientific theory is “a concise and coherent set of concepts, claims, and laws (frequently expressed mathematically) that can be used to precisely and accurately explain and predict natural phenomena” (Ben-Ari, 2005). Furthermore, it is important that a theory “include a mechanism that explains how its concepts, claims, and laws arise from lower-level theories” (Ben-Ari, 2005). Science focuses on causes which explain the functions of the universe which are not supernatural; however, science does not necessarily reject the existence of all supernatural influence (Lofaso, 2006). Most importantly, a scientific theory must be falsifiable and is always tentative, open to revision in light of new, substantial evidence (Pigliucci, 2010). Darwin’s theory of evolution is supported by this modern definition of scientific theory. However, public perception on the origin of species does not coincide with the scientific community, leading to strong opponents of teaching only evolution in K-12 schools. Over the last century, many laws have been passed because of this divide, although the laws’ influences on science educators have not been thoroughly investigated.

This study found that the Louisiana Science Education Act, one of the Academic Freedom Acts that aims to introduce doubt in students concerning evolution and to propose religious alternatives, does not have a strong influence on biology teachers in K-12 schools. Less than 10% of science teachers said they had changed their instruction because of the law, and about a quarter did not know what the law was. While many science organizations strongly
criticized the law, it appears it has little influence on actual classroom instruction, perhaps a
silver lining in the clearly anti-science legislation.

One interesting difference was that more private school teachers thought creationism
should not be taught in science class (either at all or it should be taught in a history or theology
class). This was surprising considering almost all private school teachers were working at
schools with a religious affiliation. One possible explanation could be that, because the educators
are working in such close proximity to religious doctrine, they are more aware of the differences
between theology and science, whereas public school teachers do not often consider the possible
collision.

One surprising finding, which will be viewed negatively in the scientific community, was
that less than 100% of respondents thought evolution should be taught in secondary science
classes (Table 1). While all biology teacher respondents agreed it should be taught, out of the
non-biology teachers 4 out of 24 (16.7%) thought it should not be taught in school. This is
troubling since every respondent was listed as a science faculty member at their school and are
against the idea that an established scientific topic, especially one so fundamental to science,
should be disregarded in school science. Out of those 4 respondents, one stated that creationism
should be taught in secondary science classes; 2 stated creationism should not be taught in
science courses, and one refrained from answering. Because biology teachers were the focus of
the paper, the NBT portion is a small sample size.

The short answer responses were slightly different from the multiple-choice questions. A
smaller percentage of the biology teacher respondents stated they taught evolution (18% vs.
31%). Those who stated they did not teach creationism (55%) did so for a variety of reasons,
including the possible conflicts it can cause between students, it is not on the end of course
assessment (EOC), it is not explicitly stated in the state standards, it is religious doctrine, or it is not science. One respondent stated the LSEA has caused conflicts with parents who argue for the inclusion of creationism in the classroom, while others at private schools stated the support of administration in omitting creationism. Those who stated creationism should be included consistently used similar terminology such as “alternative view” and “different perspective”. Those respondents also stated that including other ideas was not harmful and students should have the right to choose what they believe.

Limitations and Recommendations for Future Research

Question number 13 focused on how creationism should or should not be taught in science class should have included a fourth answer choice: “Creationism should be taught instead of evolutionary science”. The open-ended questions should also have been more direct, as answers seemed to be sporadic. However, this was not necessarily negative, as respondents were able to share a variety of beliefs on education legislation.

As previously stated, contacting biology teachers was difficult, as email addresses were difficult to find. A larger scale investigation could further analyze differences between charter schools and traditional public schools, as well as differences between secular and non-secular private schools. Perhaps the greatest limitation of the research was the reliance on self-report data. Teachers were asked about their understanding of state and federal education legislation but this analysis is subjective. Almost half (47.8%) of biology teachers responded with the exact same answer, either ‘somewhat familiar’ or ‘very familiar’ to all three questions on education legislation. Future research could test their understanding instead of just asking what they believe their understanding level is. Monitoring classrooms to identify how legislation influences instruction would be difficult, although it may be beneficial, especially if done before and after
an instructional session on the legislation for teachers who are not familiar with laws such as the Louisiana Science Education Act. More short answer questions may have been useful, as many of the answers provided to the final question were informative but many were ultimately too brief.
REFERENCES


APPENDIX

Email

Science Educators,

My name is Gareth Mitchell and I am a graduate student at Louisiana State University (LSU). For my master’s thesis I am conducting research on science instruction which focuses on topics in biology. Below, a very brief survey (all multiple choice and one short answer) will ask about your experience teaching. Your answers will be completely anonymous and kept confidential. It will take a maximum of 15 minutes. As a former middle school science teacher, I fully understand how valuable your time is and appreciate your involvement in my research. Your participation will enter you in a drawing to win a $25.00 Amazon gift card which will be emailed to the winner. Please feel free to respond with any questions you have. Thank you.

https://www.surveymonkey.com/s/VV5NZKN

Gareth Mitchell
LSU M.Ed. Student 2014

Consent

The purpose of this research project is to analyze secondary science teachers' comprehension of current state legislation on science education and how it influences their instruction. This is a research project being conducted by Gareth Mitchell at Louisiana State University. You are invited to participate in this research project because you are a secondary science educator in Louisiana. Your participation in this research study is voluntary. You may choose not to participate. If you decide to participate in this research survey, you may withdraw at any time. If you decide not to participate in this study or if you withdraw from participating at any time, you will not be penalized. The procedure involves filling an online survey that will take approximately 15 minutes. Your responses will be confidential and we do not collect identifying information such as your name, email address or IP address. The survey questions will be about your science teaching practices and your experience as a teacher. We will do our best to keep your information confidential. All data is stored in a password protected electronic format. To help protect your confidentiality, the surveys will not contain information that will personally identify you. The results of this study will be used for scholarly purposes only and may be shared with Louisiana State University representatives. If you have any questions about the research study, please contact Gareth Mitchell at gmitch5@lsu.edu. This research has been reviewed according to Louisiana State University IRB procedures for research involving human subjects.

ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that:
• you have ready the above information
• you voluntarily agree to participate
• you are at least 18 years of age

Agree  Disagree
Survey

Q: Have you taught biology at the secondary level during this school year or last school year?
A: Yes   B: No

Q: Including this current school year, how many years have you been teaching?
A: 0-2   B: 3-5   C: 6-8   D: 9+

Q: Do you currently teach at a private school, traditional public school, or public charter school?
A: Private school   B: Traditional public school   C: Public charter school

Q: Have the majority of your years teaching been at a private school, traditional public school, or public charter school?
A: Private school   B: Traditional public school   C: Public charter school

Q: If teaching at a private school, does the school have a religious affiliation?
A: I do not teach at a private school   B: Yes   C: No

Q: Is evolution or the origin of life part of grade-level standards for the course(s) you currently teach?
A: Yes, it is in the standards put forth for by the Louisiana Department of Education
B: No, it is not in the standards put forth by the Louisiana Department of Education
C: The course I teach does not rely on state standards
D: I do not know

For the next three questions, please use the following scale:
1-Not familiar/ never heard of it  2-somewhat familiar  3-very familiar  4-expert on the subject

Q: How familiar are you with current education legislation at the state level?
1  2  3  4

Q: How familiar are you with current education legislation at the federal level?
1  2  3  4

Q: How familiar are you with the Louisiana Science Education Act?
1  2  3  4

Q: Should Darwinian Evolution be taught in science courses in public schools?
A: Yes, it should be taught in science courses in public schools.
B: No, it should not be taught in science courses in public schools.

Q: Should Creationism and/or Intelligent Design be taught in secondary science courses?
A: Yes, it should be taught in science courses in public schools.
B: No, it should not be taught in science courses in public schools.

Q: How should creationism/intelligent design be approached by educators in secondary schools?
A: It should be taught alongside evolution as an alternative theory.
B: It should not be taught in science courses but can be taught in a history or social studies class alongside theology.
C: It should not be taught in secondary schools because it is religious doctrine.

Q: How has the Louisiana Science Education Act influenced how you teach the origin of species or evolution in your classroom?
A: I do not teach this topic because it is not in the state standards.
B: The Louisiana Science Education Act has not changed how I teach the origin of species or evolution.
C: Because of the Louisiana Science Education Act, I now incorporate alternative theories to the origin of species, such as creationism.

Q: Short Answer: In what ways, if any, has the Louisiana Science Education Act influenced how you teach the origin of species or evolution? You may also include views on how creationism/intelligent design should or should not be taught in secondary schools.

**Frequently Used Terms and Acronyms**

BT- biology teacher

creationism- the belief that the universe as well as living organisms were created by the divine

evolution- change in inherited characteristics of populations in nature over time; descent with modification from a common ancestor

falsifiable- able to be proved wrong; it is possible to conceive an observation which refutes the statement in question

ID- intelligent design- changes in species are a result of intervention by the divine; a modern term for creationism

LSEA- Louisiana Science Education Act

NBT- non-biology teacher

NOS- nature of science

PS- private school

TPS- traditional public school
Application for Exemption from Institutional Oversight

Unless qualified as meeting the specific criteria for exemption from Institutional Review Board (IRB) oversight, ALL LSU research projects using living humans as subjects, or samples, or data obtained from humans, directly or indirectly, with or without their consent, must be approved or exempted in advance by the LSU IRB. This form helps the PI determine if a project may be exempted, and is used to request an exemption.

- Applicant, please fill out the application in its entirety and include the completed application as well as parts A-F, listed below, when submitting to the IRB. Once the application is completed, please the completed application to the IRB Office or to a member of the Human Subjects Screening Committee. Members of this committee can be found at:

https://www.ls.edu/irb/human-subjects-screening-committee-member/

- A Complete Application Includes All of the Following:
  (A) A copy of this completed form and a copy of parts #1 thru #4,
  (B) A brief project description (adequate to evaluate risks to subjects and to explain your responses to Parts 1 & 2),
  (C) Copies of all instruments to be used.
  (D) If this proposal is part of a grant proposal, include a copy of the proposal and all recruitment material.
  (E) The consent form that you will use in the study (see Part 3 for more information).
  (F) Certificate of Completion of Human Subjects Protection Training for all personnel involved in the project, including students who are involved with testing or handling data, unless already on file with the IRB Training link: (http://phpb.nihrtraining.com/users/login.php).

1) Principal Investigator:
   [Gareth Mitchell]
   Dept: Human Sciences and Education
   Ph: [ ]
   E-mail: [gmitch@lsu.edu]

2) Co Investigator(s) please include department, rank, phone and e-mail for each:
   [Dr. Angela Webi, Human Sciences and Education, awwebi@lsu.edu, (225)578-2476]

3) Project Title:
   The Louisiana Science Education Act’s Impact on Secondary Science Classrooms

4) Proposal? (yes or no) [ ] If Yes, LSU Proposal # [ ]
   Also, if YES, either
   [ ] This application completely matches the scope of work in the grant
   [ ] More IRB applications will be filed later
   OR

5) Subject pool (e.g., Psychology students)
   [ ] High school Biology teachers in Louisiana
   *Circle any “vulnerable populations” to be used: (children <18; the mentally impaired; pregnant women; the aged; other). Projects with incarcerated persons cannot be exempted.

6) PI Signature: [ ] Date: [02/27/14] (one per signature)

** I certify my responses are accurate and complete. If the project scope or design is later changed, I will resubmit for review. I will obtain written approval from the Authorized Representative of all non-LSU institutions in which the study is conducted. I also understand that it is my responsibility to maintain copies of all consent forms at LSU for three years after completion of the study. If I leave LSU before that time the consent forms should be preserved in the Departmental Office.

STUDY EXEMPTED BY:
Dr. Robert C. Mathews, Chairman
Institutional Review Board
Louisiana State University
130 David Boyd Hall
225-578-8692 / www.ls.edu/irb

Exemption Expires: 3/4/2017

Screening Committee Action: Exempted [ ] Not Exempted [ ] Category/Paragraph [ ]

Signed Consent Waived? [ ]
Reviewer: [Mathews]
Signature: [ ] Date: [3/5/14]
VITA

Gareth Mitchell received his B.S. in Environmental Biology and a minor in Philosophy in 2010 from Tulane University. Upon graduation, he completed TeachNola and worked at a high-needs charter school for two years where he taught middle school science. He is currently pursuing a M.Ed. in Curriculum and Instruction for Secondary Science that he expects to complete in May 2014.