

Running Head: LITERATURE REVIEW

Literature Review

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**Abstract**

This paper seeks to answer the following question: What affect does modeling behavior have in the reception of scientific data, especially in regards to evolution and climate change? After an examination of recent studies on the effects of modeled behavior, with such behaviors identified either as science-positive or science-negative, by both educators and parents on the displayed attitudes of students, a phenomenological methodology is proposed in order to collected data via person-to-person interviews to construct a narrative. Specifically, the research seeks to examine two current discussion points in science and national science standards, evolution and anthropologically driven global climate change. Research results are then summarized, indicating modeled behavior create expectations of science reception in students, with negative attitudes by one or both models driving down the ability of the student to meet national science standards. All aspects of the paper are done with respect to examining the phenomena in West Virginia. Discussion is limited to specific results and transferability is noted.

### **Introduction**

The 2015 Bayer Facts of Science Education Surveys reveals a lack of science education in the schools of the United States while a report by Pennsylvania State Survey Research Center (SRC) and the National Center for Science Education (NCSE) reveal attitudes by science educators hindering proper science instruction. The 2015 survey reveals a consensus that more emphasis should be placed on science education, among educators (61%) and parents (40%). In regards to educators, the SRC-NCSE report reveal a lack of proper understanding on several important science standards, specifically global climate change, where 77.4% of educators report some form of refusal or inadequate teaching of this subject. In regards to attitudes of educators, 2% denied climate change exists, 15% believe it is completely natural, and 15% believe climate change is produced by both human and natural causes. In regards to evolution, 28% of educators consistently teach evolution compared to 13% who advocate for creationism. On the other hand, 60% of educators simply take no stand, which Berkman and Plutzer as playing a “far more important role in hindering scientific literacy” (Berkman & Plutzer, 2012). More locally, West Virginia has received a “D” in science preparation, noting that West Virginia “flirts with creationism” (Finn & MaGee, 2012, 191–195). In recent standards changes, West Virginia’s Board of Education is attempting to remove inferences and evidences of anthropologically driven climate change (Eyre, 2016).

While the author of this paper believes it is necessary to reform science curriculum, I also believe it is necessary to first examine the attitudes of both parents and educators and the role they play in reception of science education by students. This study will examine students, specifically in West Virginia, for transference of negative attitudes

towards science and ask the question: What affect does modeling behavior have in the reception of scientific data, especially in regards to evolution and climate change?

### **Review of Current Literature**

Berkman and Plutzer (2012) note that within the coming decade, the number of decisions based on science to be made by the public and leaders in the United States will greatly increase. They likewise note that students are increasingly seeing science as a matter of opinion. According to a 2005 Pew Research study, a majority (57%) of the American public believed creationism (that the earth is less than 10,000 years old) should be taught in public schools as science alongside evolution. Berkman and Plutzer (2012) note that according to the report, 33% of the American public believes creation should be taught as science, ignoring evolution completely. The authors draw the reason to religious fundamentalism. The Coalition of Scientific Societies likewise notes the role Christian fundamentalism plays in the public reception of evolution and other scientific data (2008). Miller, Scott & Okamoto (2006) are able to establish a direct correlation between the religious beliefs about science with its reception in the American public. The National Academy of Sciences believes that a positive teaching “offers educators a superb opportunity to illuminate the nature of science and to differentiate science from other forms of human endeavor and understanding” (1998). Taylor, Jones, Broadwell, & Oppewal (2008) showed the need for science instruction creativity, by introducing scientists to educators to foster a new teaching method, with educators indicating that after introduction, their understanding and instruction methods had changed.

According to Scheitle (2011), undergraduates are likely to come to understand that science and religion are not necessarily at odds as they progress through coursework. But, this conflict narrative is identifiable earlier, especially in middle school where the views about science are starting to be determined (Kitts, 2009). Long notes that it is during this time educator's attitudes, either science-positive or science-negative, begin to affect the students (2012). Further, Long notes that the inculcation of religious views against science begin to firm up in early adolescence, so much so that the worth of later attempts to improve science-positive metacognitions is questioned (Long, 2011; Winslow, Staver, & Scharman, 2011). Science-negative attitudes may emerge early and thus become ingrained not because of active enforcement by guardians, but because of a passive form of control (Long, 2011, p. 72). However, the same passive perspective manipulation may be used to produce science-positive attitudes. Mooney (2011), in examining how perspectives can be changed via science-positive attitude notes that "Conservatives are more likely to embrace climate science if it comes to them via a business or religious leader, who can set the issue in the context of different values than those from which environmentalists or scientists often argue."

Yalacki (2010) argues that rather than looking beliefs and practices of educators, assessors should examine value and value systems, so that while Yalacki understand the role educators play in forming the attitudes of the students, countering it must begin with the value placed on science rather than particular beliefs or instruction method on any particular topic. It is this value system that must be examined in light of Losh & Nzekwe (2010) who found that future educators saw little to no value in science, which informed belief systems in as much as they saw no point in educating themselves, mirroring,

somewhat, the adolescent view as identified by Kitts (2009). This view is that while middle school students saw value in scientists, expressing admiration, they saw little to no value in studying science. In one study, pre-service educators showed an unwillingness to engage in critical literacy on controversial topics (Smith & Lennon, 2011), leading the researchers to recommend various new instructional methods.

Thus far, I have attempted to establish the opinion that educators are in fact playing a part in science reception among students. What is revealed is that an identifiable portion of educators does not teach controversial topics, hold to what may be called pseudoscience, or place little to no value on science as a whole. As noted above, these methods aid in enforcing the lack of need for appreciating science among students. I will now turn to the role of parents in devaluing scientific education.

As noted above, parental control is sometimes passive, but even in this it has a purpose beyond passing down generational views and family traditions. As Stokes & Regnerus (2008) has pointed out, when parents and their children share the same religious beliefs, family discord is reduced. I therefore suggest that the value of the child, to be accepted by the parents, is greater than the value of science, especially if science is not the value of the parents or if science is counter the values of the parents.

Bartkowski, Xu, & Levin (2007) have shown that religion does have a cognitive effect on the development of children and adolescents. They note that the difference comes from the difference between discussion and argument, “The frequency of religious discussions significantly bolsters children’s cognitive development in the household setting, while arguments about religion significantly undermine it” and “Frequent parent-child discussions about religion often yield positive effects on child development, while

any effects associated with family arguments about religion are deleterious for children.” Therefore, I propose that the more rigid a religious sect is, the more likely arguments are to occur, leading to a more science-negative attitude in the home.

Christian fundamentalism, specifically of the Protestant variety, has been shown to shape children and adolescent views in relation to education. Sherkat & Darnell (1999) have shown how religion places constraints on educational options. Values dictate that college preparatory curriculum is avoided, especially in the more fundamentalist (strict sectarian) households, producing students avoiding certain subjects altogether. Evans (2000) is able to establish a pattern of beliefs regarding the origin of life as a merge of “community beliefs and age-related changes.” Regnerus (2003), after a review of more recent research, has produced similar results. Unfortunately, there has been little recent research in this area, which is now necessary given not only increased issues with such things as climate change, but so too a paradigm shift in information availability which has created a different social world for adolescents (Mesch & Talmud, 2010).

Given the need for scientifically literate adults, the need for understanding how science-positive attitudes are nurtured is prevalent. The research will examine two role models in the adolescent’s life, the educator and the parent, in order to access where the most effective intervention may lie, in order that proper interventions may be developed to address science-negative attitudes.

### **Methods**

For this study, I will need to utilize in-depth interview techniques to understand “how human beings make sense of experience and transform experience into

consciousness” (Patton, 2014, p. 115) given that it is very much the phenomena of modeling attitudes I propose affecting attitudes of science reception. As I research I will conduct pointed interviews with participants, gathering needed data that will be coded using an established model. Participants will be selected based on grades and classroom performance after a short interview with the educator, where the focus questions will be two fold. First, I will want to identify likely students based on the above-mentioned guidelines. I will look at high achievers and students who make average grades, assuming a 5-letter grading scale. The sample size will seek to represent equally male and female students, students across various economic statuses, and students who stand in various religions or forms of their particular religion. Once the initial students are chosen, I will from among those create a sample where students are then selected based on their grades in other classes, so that the student who is averaging a “C” in science classes will be selected if their other classes show high achievement. Exclude will be students who identify with certain disabilities and those with established behavioral issues. Following Polkinghorne (1989), my sample size will be at least 25 of those who have approximately similar phenomenological experiences (Green & Christensen, 2006). After a sample has been secured, I will then ask the educators as to their views and instruction methods on science as a whole and then in regards specifically to evolution and global climate change.

To ensure safety and privacy, I will ask a school counselor, whom I will also inform of the methodology of this study, to be present during student interviews. Students will not be named in the study, but identified by a randomly assigned number. Parents will be informed and consent sought.



I will collect data via individual interviews, with each interview focusing on two aspects, the educator's attitude as well as the parental. In regards to the latter, parental involvement in homework assignments will be measured as well as political and religious viewpoints, or lack thereof. This will be gathered through informational queries, such as asking specific questions regarding evolution and global climate change and the views representative of different viewpoints of those issues, such as "Evolution states the earth is four billion years old. Is this true or false in your opinion?" Key words, such as "bible" or "young earth" or misuse of the word "theory" will be noted and catalogued. Particular care will be given to note facial reactions as well as body language in regards to specific lines of questioning. Data review will follow the outline for phenomenological interpretation established by Merriam & Associates (2002).

I note my bias against science-negative attitudes as well as my pro-religion and spirituality stance. I have attempted to write the question prompts to emit any bias by soliciting advice from the local IRB, engaging educators, religious leaders, and other counselors.

### **Discussion of (Possible) Outcome**

After the examination was completed, a narrative was constructed. I found 63% of students who exhibited science-negative attitudes via grades had had those attitudes modeled by a parent while 35% of students reported negative modeling by educators. Only 5% of students who received negative modeling from both parents and educators were able to earn above average grades only 2 students reported they "lied to get an A,"

and action their science-negative parents encouraged. This comports with previous studies conducted by Long (Long, 2011, p. 36).

Educators who exhibited science-negative attitudes did so by shrinking instruction time, removing hands on activities, and by presenting counter arguments, often times with a 3-to-1 time difference. Further, educators would note that if they did not accept current theories on evolution and/or global climate change, they would often grade students easier on particular questions. Finally, 73% of educators with science-positive attitudes would teach according to science standards but admitted to not engaging controversial statements by students in the classroom or on tests because of the political climate. This must be examined in future studies, since this study sampled students by grades *prima facie*. Following the suggestion of Taylor, Jones, Broadwell, & Oppewal (2008), this study supports the suggested need for continued interaction between educators and scientists to develop not only positive instructional methods, but to also help change science-negative attitudes among educators.

The outcome reveals that modeled attitudes by authority figures, especially in regards to science and major scientific theories, are transferred to students at least in West Virginia. On the issue of transferability of this study, it is recommended cautiously, given that the study was accomplished with a near strict dichotomy applied to viewpoints by the author of this report. Further, the research was conducted only in West Virginia, a largely rural, Christian, and White state. I also note that parents were not interviewed.

This research should help not only school counselors and curriculum counselors identify and prioritize values among educators, but should serve mental health counselors in understanding the role religious attitudes of authority figures in the life of developing

adolescents. It is a given that mental health counselors will have adolescents in their care, directed either by parents or the courts. It would be helpful to understand the cognitive environment fostering some of the client's development and reception to science or perceived scientific methods. Future studies should examine the perception of medical and counseling professions among adolescents in strict sectarian families.

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