Testing the Persuasiveness of the Oklahoma Academy of Science Statement on Science, Religion, and Teaching Evolution

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The Oklahoma Academy of Science (OAS) recently released a statement on science, religion, and teaching evolution. In the current study, the OAS statement was not a persuasive message for Oklahoma undergraduate students. Three predicted results were found. First, need for cognition was positively correlated with attitudes toward science. Second, future-event expectancies were positively correlated with how well participants expect other people to understand their views about evolution. Third, interpersonal expectancies were positively correlated with how well participants expect other people to understand their views about evolution.

INTRODUCTION

Mather and Mather (2006) recently called for more participation of psychological scientists in research that would benefit the Oklahoma Academy of Science (OAS). One area of psychological research that can directly benefit members of OAS is the area within experimental social psychology that examines attitudes. An attitude is an evaluation of an entity as positive or negative (Eagly & Chaiken, 1993). Given that many citizens of Oklahoma are currently in heated discussions over the teaching of science and religion, members of OAS would benefit from studies that examine the attitudes of Oklahoma students toward these issues. OAS promotes science to all citizens of Oklahoma and in doing so must be sensitive to the audience to which the message about science is delivered. Thus, a systematic understanding of the attitudes of Oklahoma citizens toward science is necessary for OAS to successfully educate citizens regarding science.

OAS (2007) recently released a statement on science, religion, and teaching evolution. This statement, among other things, addressed science, evolution, creationism, and intelligent design. What is the point of this statement? In his *From the Desk of the President…* column of the spring 2008 OAS newsletter, Ulrich Melcher contends that it is best conceptualized as a persuasive communication (Melcher, 2008)—that is, it is a message intended to change attitudes (Petty, 1995). In his column, Melcher states that, "It is my hope that this statement will tip the balance in the minds of enough people of power that, with due vigilance on our part, Oklahoma children and college students can enjoy a first class science education unfettered by religious intrusions for many decades into the future" (Melcher, 2008). Clearly, it is an important message that was carefully crafted. However, what is the persuasive impact of the message on Oklahoma students? Melcher (2008) suggests that it could be construed as a message to persuade people of power, but what about Oklahoma students who have attended high school and college in Oklahoma? Ideally, the message will be persuasive for the students as well as those in power. University students in Oklahoma are the future parents, teachers, and "people of power" of Oklahoma. Addi-

tionally, and perhaps most importantly, they are current and future voters. A message that is persuasive to the constituents of the people in power would be quite beneficial to OAS.

In addition to the potential persuasiveness of the OAS statement on science, religion, and teaching evolution, there are also several individual difference measures that may be related to attitudes towards science, evolution, creationism, and intelligent design. An individual's need for cognition, future-event expectancies, and interpersonal expectancies may all be related to these attitudes. The relationships of these individual differences in cognitions and expectancies to attitudes towards science, evolution, creationism, and intelligent design have not been previously tested. An examination of these possible relations would be of particular interest in Oklahoma, where much discussion over the relationship of science and religion is currently taking place.

The need for cognition (Cacioppo et al., 1986) measures how much an individual enjoys and engages in effortful thinking. People who are high in need for cognition are persuaded by strong, high quality arguments, while people who are low in need for cognition are persuaded by superficial cues such as the attractiveness of the messenger. Since science is a systematic thought process, we expect that need for cognition will be positively related to an individual's attitude toward science and evolution. We do not specifically expect that need for cognition will be negatively related to attitudes toward creationism or intelligent design.

Future-event expectancies are an individual's generalized expectancies of the likelihood of events happening to them in the future (Andersen, 1990). Optimists have positive future-event expectancies (i.e., they believe that there is a high probability that good things will happen to them in the future and a low probability that bad things will happen to them in the future) and pessimists have negative future-event expectancies (i.e., they believe that there is a low probability that good things will happen to them in the future and a high probability that bad things will happen to them in the future). Future-event expectancies should be positively related to how well an individual expects other people to understand their views about evolution. As optimism increases, an individual should have more positive expectancies about the empathy of other people with regard to their beliefs about evolution.

Interpersonal expectancies are what people generally think about other people's interpersonal behaviors, intentions, characteristics, capabilities, and outcomes (Reich et al., 2008). People with higher interpersonal expectancies are more optimistic about other people. This concept is related to the concept of future-event expectancies, but interpersonal expectancies are specific to other people. We expect that interpersonal expectancies will also be positively related to how well an individual expects other people to understand their views about evolution.

Thus, there are three goals to this study. First, and perhaps most importantly, we seek to test persuasiveness of the OAS statement on science, religion, and teaching evolution on undergraduate students in Oklahoma. We use an experimental method to examine this first goal. Second, we will test specific hypothesized relationships between individual difference measures and attitudes toward science, evolution, creationism, and intelligent design, as well as an individual's expectation about the empathy of other people with regard to their beliefs about evolution. We use correlational methods to examine this second goal. Third, from an exploratory perspective, we examine other potential relationships among attitudes toward science/evolution/creationism/intelligent design and individual differences in cognitions and expectancies. We use correlational methods to examine this third goal. Additionally, measures of attitude certainty are included as supplementary measures to be consistent with previous research (Tormala

& Petty, 2004) and no hypotheses are made regarding the certainty measures.

METHOD

Participants

Eighty-five undergraduates (48 women; 37 men) at the University of Central Oklahoma participated in this experiment. All participants received credit toward their introductory psychology course. All participants attended high school (public, private, or home school) in Oklahoma.

Procedure

First, participants completed written consent forms and all subsequent materials for the experiment were administered through a computer. Participants initially completed several demographic questions. Following this, participants in the experimental group were presented with the entire OAS Statement on Science, Religion, and Teaching Evolution, while participants in the control group were not presented with the OAS Statement. All participants then answered questions regarding their attitudes toward the theories of evolution, science, creationism, and intelligent design (Table 1). Each of the attitude measures was followed by a measure of certainty (i.e., How certain are you of your opinion toward the theory of evolution?). Responses to all attitude measures were recorded on a scale of (0) "dislike very much" to (7) "like very much," while responses to all certainty measures were recorded on a scale of (0) "not at all certain" to (7) "extremely certain."

A scale of 0 to 7 on the attitude measures was used to force a choice at the neutral point of the scale; that is, there is no option with which to indicate a neutral response as there would be with a scale of 1 to 7 (4 would indicate a neutral attitude on a scale of 1 to 7). Thus, with our scale of 0 to 7, participants with a neutral attitude would have to make their selection near the midpoint of the scale, selecting either 3 or 4. There is no reason to believe that people who have a neutral attitude would systematically choose 3 instead of 4 or choose 4 instead of 3, so it should be randomly distributed in the few instances where someone might not know about the theory on which they were indicating their attitude. It is possible for an individual to have an attitude toward something that they have heard about but don't actually know about. This may describe many of the people who have a strong attitude toward science, religion, creationism, or intelligent design, as they may be familiar with only one theory and yet still hold strong attitudes about one or more of the other theories. Additionally, the OAS Statement addresses each of these theories, so participants in the experimental group are exposed to information about the concepts. Thus, participants who held neutral attitudes would be more likely to be persuaded in the experimental group. Furthermore, if neutral attitudes are prevalent, we would expect to find differences between the experimental and control groups on attitude measures.

Each pair of attitude and attitude certainty measures are presented with the attitude measure coming first, followed by the corresponding measure of attitude certainty. The order of presentation of each pair is randomly determined by the computer. Participants complete three individual difference measures presented in a random order following the completion of the attitude measures. These individual difference measures are the Interpersonal Expectancy Scale (IES) to measure interpersonal expectancies (Reich et al., 2008), the Future Events Scale (FES) to measure future-event expectancies (Andersen, 1990), and the Need for Cognition Scale (NCS) to measure need for cognition (Cacioppo et al., 1986).

Design

The design is a one-way (Message: OAS Statement, No OAS Statement) between-subjects Multivariate Analysis of Variance (MANOVA) that examines the persuasive impact of the OAS Statement on Science, Religion, and Teaching Evolution. The statistical procedure of MANOVA controls

Table 1. Table of Means for Attitude Measures. Standard Deviations are in Parentheses.

Items:	Statement	No Statement	Overall
Attitude Measures			
To what extent do you like or dislike the theory of evolution? (0-7; dislike very much/like very much)	4.62 (2.30)	3.88 (2.36)	4.27 (2.34)
To what extent do you like or dislike science? (0-7; dislike very much/like very much)	6.31 (1.33)	5.73 (1.80)	6.04 (1.59)
To what extent do you like or dislike the theory of creationism? (0-7; dislike very much/like very much)	5.53 (2.02)	5.63 (1.88)	5.58 (1.94)
To what extent do you like or dislike the theory of intelligent design? (0-7; dislike very much/like very much)	5.33 (1.71)	5.15 (1.55)	5.25 (1.63)
How well do you expect other people to understand your beliefs about evolution? (0-7; not at all well/very well)	5.04 (1.46)	5.13 (1.84)	5.08 (1.64)
Attitude Certainty Measures			
How certain are you of your opinion toward the theory of evolution? (0-7; not at all certain/extremely certain)	5.78 (1.95)	6.03 (2.27)	5.89 (2.10)
How certain are you of your opinion toward science? (0-7; not at all certain/extremely certain)	6.24 (1.26)	6.25 (1.72)	6.25 (1.49)
How certain are you of your opinion toward the theory of creationism? (0-7; not at all certain/extremely certain)	5.80 (1.73)	5.55 (1.72)	5.68 (1.72)
How certain are you of your opinion toward the theory of intelligent design? (0-7; not at all certain/extremely certain)	5.33 (1.88)	4.60 (1.99)	4.99 (1.96)

for inflation of Type I error that occurs if separate *t*-tests are conducted on each of the dependent variables (Tabachnick & Fidell, 1996). The dependent variables for this analysis were the attitude and attitude certainty measures. Correlational analyses are conducted on the attitude measures and the individual difference measures.

RESULTS

Analysis indicates that the assumption of homogeneity of variance was met. Wilks' Lambda was not significant, $F(9, 75) = 1.03$, $p > .40$. Results of the MANOVA indicated that none of the univariate tests revealed significant differences between the OAS

Statement group and the control group on the attitude and attitude certainty measures. Means and standard deviations for each question are presented in Table 1.

Participants selected the forced choice neutral options with relative equality. For the evolution attitude measure, 22% selected either 3 (10 participants) or 4 (9 participants). For the science attitude measure, 25% selected either 3 (5 participants) or 4 (9 participants). For the creationism attitude measure, 38% selected either 3 (15 participants) or 4 (17 participants). For the intelligent design attitude measure, 45% selected either 3 (17 participants) or 4 (21 participants). Indeed, these numbers indicate that more participants selected the neutral options when indicating their attitudes toward creationism and intelligent design than did participants indicating their attitudes toward science and evolution.

Correlations among the attitude and attitude certainty measures revealed several significant correlations. Attitudes toward evolution were positively correlated with attitudes toward science ($r = .32$, $p < .01$) and certainty of attitude toward science ($r = .23$, $p < .05$). Attitudes toward evolution were negatively correlated with attitudes toward creationism ($r = .43$, $p < .01$). Certainty of attitude toward evolution were positively correlated with certainty of attitude toward science ($r = .24$, $p < .05$) and how well participants expected other people to understand their views about evolution ($r = .43$, $p < .01$). Attitudes toward science were positively correlated with certainty of attitude toward science ($r = .52$, $p < .01$) and certainty of attitude toward intelligent design ($r = .28$, $p < .01$). Certainty of attitude toward science was positively correlated with certainty of attitude toward creationism ($r = .23$, $p < .05$), certainty of attitude toward intelligent design ($r = .28$, $p < .01$), and how well participants expected other people to understand their views about evolution ($r = .25$, $p < .05$). Attitude toward creationism was positively correlated with certainty of attitude toward creationism ($r = .56$, $p < .01$) and attitude toward intelligent design ($r = .45$, $p < .01$). Attitude toward intelligent design was positively correlated with certainty of attitude toward intelligent design ($r = .45$, $p < .01$). Certainty of attitude toward intelligent design was positively correlated with how well participants expected other people to understand their views about evolution ($r = .22$. $p < .05$).

The need for cognition was positively correlated with attitudes toward science ($r = .26$, $p < .05$) and certainty of attitude toward science ($r = .28$, $p < .05$). Future-event expectancies were positively correlated with certainty of attitude toward creationism ($r = .26$, $p < .05$) and how well participants expected other people to understand their views about evolution ($r = .22$, $p < .05$). Future-event expectancies were negatively correlated with attitudes toward evolution ($r = -.24$, $p < .05$). Interpersonal expectancies were positively correlated with certainty of attitude toward creationism ($r = .30$, $p < .01$) and how well participants expected other people to understand their views about evolution ($r = .24$, $p < .05$). Interpersonal expectancies were negatively correlated with attitudes toward evolution ($r = -.26$, $p < .05$).

DISCUSSION

Using an experimental method, we tested the persuasiveness of the OAS Statement on Science, Religion, and Teaching Evolution on undergraduate students in Oklahoma. Using correlational methods, we tested specific hypothesized relationships between individual difference measures and attitudes toward science, evolution, creationism, and intelligent design, as well as individual's expectation about the empathy of other people with regard to their belief regarding evolution. Finally, we examined other potential relationships among these attitudes and individual difference measures from an exploratory perspective.

Persuasiveness of the Message

The results of the MANOVA indicated that the OAS statement was not a persuasive message for Oklahoma undergraduate students—participants who were exposed to the OAS statement did not differ from participants who were not exposed to the message in their attitudes towards theories of evolution, science, creationism, and intelligent design, nor did they differ in the certainty of these attitudes. Participants came to the experiment with their attitudes in place and strongly held, and subsequent exposure to a message did not lead to attitude change. What can we learn from this? In the future if a message is intended to be persuasive, it is best crafted using established principles of persuasion that develop a message that is best suited to the audience to whom it is intended to persuade. It may very well be that this message is intended for "people of power," as Melcher suggested in his 2008 Presidential Column. Still, the results of this experiment indicate that the message was not persuasive to our sample of undergraduate college students in Oklahoma. Since undergraduate college students are current and future citizens of Oklahoma with current power as voters and potential power as parents, teachers, etc., we believe that it is important for this message to be persuasive to this audience.

Attitudes Measures

In examining the individual difference measures and their relationships to the various attitudes included in this study, the correlations reveal much about the attitudes of the participants in this study.

Attitudes toward evolution. Attitudes toward evolution predicted attitudes toward science and certainty of attitude toward science, such that the more positive attitudes were towards evolution, the more positive attitudes were towards science and the more certain participants were of those attitudes. Thus, participants who had more positive attitudes toward evolution were also likely to have positive attitudes towards science and be very certain of those attitudes. Attitudes toward evolution negatively predicted attitudes toward creationism, such that the more positive attitudes toward evolution were, the more negative attitudes toward creationism were. Thus, participants who had positive attitudes toward evolution were likely to have negative attitudes toward creationism, and participants who had negative attitudes towards evolution were likely to have positive attitudes towards creationism. This is not surprising, as the two theories are conceptually incompatible and are currently at the center of much political controversy within Oklahoma.

Certainty of attitude toward evolution predicted certainty of attitude toward science and how well participants expected other people to understand their views about evolution, such that the more certain participants were of their attitude toward evolution, the more certain they were of their attitude toward science and the more they expected other people to understand their views about evolution. The more an individual believes others will understand their beliefs, the closer they appear to be to a consensus and the more certain they become of their belief. This effect was likely the result of normative influence in which the perception of agreement among other people contributes to conformity to group norms.

Attitudes toward science. Attitudes toward science predicted certainty of attitude toward science and certainty of attitude toward intelligent design, such that the more positive a participant's attitude toward science, the more certain they were of that attitude and the more certain they were of their attitude toward intelligent design. This means that as an individual's attitude toward science became more positive, their certainty of their attitude toward science became stronger and their certainty of their attitude toward intelligent design became stronger. This does not imply direction of attitude toward intelligent design. We only have evidence that as attitudes toward science get more positive and the individual

becomes more certain of that attitude, they also become more certain of his or her attitude toward intelligent design, regardless of the positive or negative nature of the attitude toward intelligent design. Certainty of attitude toward science predicted certainty of attitude toward creationism, certainty of attitude toward intelligent design, and how well participants expect other people to understand their views about evolution. Thus, as a participant's certainty of his or her attitude toward science became more positive, he or she became more certain of his or her attitude toward creationism and toward intelligent design and he or she had more positive expectations about whether or not other people would understand their views about evolution. They had strong attitudes toward science, creationism, and intelligent design, and strong beliefs that others understood their beliefs about evolution.

Attitude toward creationism. Attitude toward creationism predicted certainty of attitude toward creationism and attitude toward intelligent design, such the more positive a participant's attitude toward creationism, the more certain they were of that attitude and the more positive their attitude was toward intelligent design. Thus, participants with positive attitudes toward creationism were highly certain of their attitudes toward creationism and intelligent design, while participants with negative attitudes toward creationism were less certain about their attitudes toward creationism and had less positive attitudes about intelligent design.

Attitude toward intelligent design. Attitude toward intelligent design predicted certainty of attitude toward intelligent design, such that the more positive a participant's attitude towards intelligent design, the more certain they were of that attitude. Certainty of attitude toward intelligent design predicted how well participants expect other people to understand their views about evolution, such that the more certain a participant's attitude toward intelligent design, the more positive expectations they had about whether or not other people would understand their views about evolution. Again, this indicates a normative influence in which the individual perceives agreement among other people and conforms to those group norms.

Individual Difference Measures

As predicted, need for cognition was positively correlated with attitudes toward science. Additionally, need for cognition was positively correlated with certainty of attitude toward science. As an individual's need to engage in effortful thinking became more positive, their attitudes toward science also became more positive and they became more certain of that attitude. Thus, the more thinking that individuals chose to engage in, the more likely they were to have a positive attitude toward science and be highly certain of that attitude. Conversely, the correlations also indicated that the less thinking in which individuals chose to engage, the less likely they were to have a positive attitude toward science and the less certain they were of that attitude.

As predicted, future-event expectancies were positively correlated with how well participants expect other people to understand their views about evolution. Future-event expectancies were also positively correlated with certainty of attitude toward creationism. Thus, as expectations of future events became more optimistic, attitudes toward creationism became more positive and people had more positive expectations for how others would understand their views on evolution. Conversely, the correlations indicated that as expectations of future events became more pessimistic, attitudes toward creationism became more negative and people had more negative expectations for how others would understand their views on evolution. Additionally, future-event expectancies were negatively correlated with attitudes toward evolution, such that the more pessimistic a participant's expectations, the more positive their attitudes toward evolution.

As predicted, interpersonal expectancies were positively correlated with how well participants expect other people to understand their views about evolution. Interpersonal expectancies were also positively correlated with certainty of attitude toward creationism. Thus, the more positive the interpersonal expectancies, the more certain participants were of their attitude toward creationism and the more positive their expectations that other people would understand their views on evolution. Interpersonal expectancies were also negatively correlated with attitudes toward evolution, such that the more pessimistic the interpersonal expectancies, the more positive the attitudes toward evolution. Thus, people who had more positive attitudes toward evolution had more negative expectancies of other people. Conversely, people who had more negative attitudes toward evolution had more positive expectancies of other people.

Future Research

The current study generated several issues for future research. Particularly relevant to this study are the issues of extremity of attitudes and methodology.

Extremity of attitudes. More participants selected the neutral options when indicating their attitudes toward creationism and intelligent design than did participants indicating their attitudes toward science and evolution. Future research could examine differences in changing attitudes toward these theories for individuals who have neutral attitudes. Given the strength of attitudes on these issues, a persuasive message that is targeted at the neutral participants would likely be ideal, as people who hold strong attitudes are less likely to change their attitudes (Eagly & Chaiken, 1993). The current study does not have the statistical power to examine the issue of the persuasive susceptibility of participants who hold neutral attitudes towards specific theories.

Methodology. The current research is based on self-reported attitudes. That is, participants indicate their own attitudes in response to an explicit question about their attitudes. One of the widely documented difficulties with self-report as a measurement method is its susceptibility to social desirability and a participant's lack of introspective access into his or her own thoughts, feelings, and behaviors (Nisbett & Wilson, 1977). However, self-reported attitude measures are acceptable and valid measures of explicit attitudes of which individuals have self-awareness. Future measures could use implicit measurements of the attitudes examined in this study. Such studies could use reaction times, electroencephalography, electromyography, or the Implicit Association Test (IAT) (see Mather & Romo, 2008). Such measures would enhance the current project by providing data on the attitudes without conscious social desirability or introspective access, which can sometimes weaken the accuracy of attitude measures. Given the emotional nature of the attitudes toward these controversial theories, implicit measures on these attitudes would be interesting future research. Additionally, a design with a pre-test and a post-test of the attitudes examined in the current study could provide an interesting test of the questions regarding the persuasiveness of a message.

SUMMARY

The OAS statement was not a persuasive message for Oklahoma undergraduate students in our sample. Three predicted results were found. First, need for cognition was positively correlated with attitudes toward science. Second, future-event expectancies were positively correlated with how well participants expect other people to understand their views about evolution. Third, interpersonal expectancies were positively correlated with how well participants expect other people to understand their views about evolution.

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