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Testing the Effect of Aquarium-Based Learning on Patron Acceptance of Evolutionary Theory

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Data Description Document

This file contains data taken from a pre-quiz and post-quiz surrounding a reconciliation intervention at a public aquarium in Idaho. Here is the methods section from the paper:

Materials and Methods

Implied Consent

Permission for this study was obtained from Brigham Young University's institutional review board, and directly from the executive director of the Aquarium. Subjects were informed their responses were part of a research study and gave implied consent.

Venue Selection and Recruitment

To determine whether effective teaching strategies can shift public opinion of evolution, we collected data at a small, 501-C3 non-profit public aquarium in the western US. This venue was selected because of their regular live-animal presentations that the public can attend (these occur in a small classroom, in which anywhere from 10 to 25 guests typically attend), and the willingness of the executive director to have the aquarium participate in this project. Our evolution presentation was adapted to the format of a regularly occurring live animal show. Guests were recruited through social media posts by the Aquarium, and announcements made at the Aquarium. Participants were compensated with a cup of food to feed fish in one of the Aquarium's exhibits.

Sample population

Our sample population of Aquarium patrons was of diverse backgrounds. Demographic information, including religiosity (which is measured on a scale of 8 to 40) is summarized in table one.

[**Table 1 near here**]

Presentation Protocol

To create a presentation that followed the Aquarium's already established live-animal shows, and to keep both children and parents engaged, we chose the theme of 'How to be a Biologist'. This presentation used a constructivist approach and included teaching about the nature of science, teaching the facts of evolution, and encouraging a reconciliation of evolution and religion. The full protocol is described in the Supplemental Materials.

Experimental Design

Prior to the presentation, aquarium guests who were willing to participate in our study began filling out our survey. This survey could be filled out in paper form, or via a QR code participants could scan. Only 6 participants (7.69%) chose to use the QR code. As most participants had children with them who were eager to return to viewing animals at the aquarium, both brevity and accuracy were given high consideration when developing our instrument.

Religiosity

Religiosity was measured using an 8 question, 5-point Likert scale (see Supplemental Materials), that has been validated for measuring religiosity in college students [1]. This scale was filled out immediately prior to the presentation.

Demographics

To determine what type of individuals already had a positive view of evolution, or what type of individuals were inclined to change toward a more positive view of evolution we asked respondents about their religious denomination, political affiliation, age, and educational attainment (see Supplementary Materials). These answers were used in conjunction with religiosity scores for statistical analysis. Participants answered these questions before the presentation began.

View of Evolution

To measure participants' view of evolution, and how our presentation was affecting it, we used a modified version of the 100-point instrument of self-defined acceptance [2]. This scale has respondents use a 100-point slider scale to answer the questions (1) "To what extent do you accept evolution?" (2) "To what extent do you believe evolution?" and (3) "To what extent do you think evolution is true?" [3]. Because of the redundancy of questions two and three, we changed the third question to ask about participant openness to evolution, as we felt it would capture a broader portion of participant view of evolutionary theory. We also divided evolution into categories of (1) adaptation (2) speciation and (3) human evolution to determine where the change was occurring in participants' view of evolution (if it changed at all). Subjects filled out this portion of the instrument both before and after the presentation (see Supplemental Materials).

Statistical Analysis

Survey analysis

In addition to the answers to each individual question of our modified version of the 100-point scale of self-defined acceptance, total acceptance, total belief, and total openness score was calculated for each individual from the sum of the adaptation, speciation, and human evolution score for each category (max 300). A total score was calculated from the sum of all of the answers (max 900).

Predictors of Pre-Acceptance

We ran a multiple regression analysis using religiosity, religious denomination, political affiliation, age, and educational attainment as predictors of a composite score for the total answer of the pre-evolution survey. 64 complete responses that were included in the analysis.

Predictors of change

We ran a multiple regression analysis of the 48 individuals who did not have the maximum composite score of 900 to start using religiosity, religious denomination, political affiliation,

[1] Cohen, Shariff, and Hill, "The Accessibility of Religious Beliefs."
[2] Barnes et al., "Different Evolution Acceptance Instruments Lead to Different Research Findings."
[3] Barnes et al.

age, level of education, and total openness to evolution as predictors for the change from the pre-total to post-total score. One data point that was outside of 8 standard deviations and was not included in the regression**.**

Measuring change from pre to post

Pre- and post-scores were compared to determine the change in participants' views of evolution. Because our data did not meet the assumption of normality, we used the sign test, which determines the probability that the difference between median values is equal to zero, thereby signaling if the number of individuals who changed was significant. For the individuals who did not have a pre-score of 900 (N=48) we compared pre- and post-scores for each individual question (i.e., accept adaption, open to human evolution, etc.), total acceptance, total belief, and total openness. The participants who had a pre-score of 900 were not included in this analysis because none of their scores shifted.

Description of Data

Column label	Description
ID	Anonymous identifier
Religiosity	Measure of religiosity (High = 40; Low = 0)
Denomination	Religious denomination
PolAffiliation	Political affiliation
Age	Reported age
Education	Level of educational attainment
PreAcceptAdapt	Acceptance of microevolution (small adaptations) prior to intervention; measured on a 0 – 100 scale
PostAcceptAdapt	Acceptance of microevolution (small adaptations) after the intervention; measured on a 0 – 100 scale
PreAcceptSp	Acceptance of macroevolution (speciation events) prior to intervention; measured on a 0 – 100 scale
PostAcceptSp	Acceptance of macroevolution (speciation events) after the intervention; measured on a 0 – 100 scale
PreAcceptHuman	Acceptance of human evolution prior to intervention; measured on a 0 – 100 scale
PostAcceptHuman	Acceptance of human evolution after the intervention; measured on a 0 – 100 scale
PreTOTALAccept	Sum of all pre-acceptance scores (out of 300)
PostTOTALAcccept	Sum of all post-acceptance scores (out of 300)
PreBeliefAdapt	Belief in microevolution (small adaptations) prior to intervention; measured on a 0 – 100 scale
PostBeliefAdapt	Belief in microevolution (small adaptations) after the intervention; measured on a 0 – 100 scale
PreBeliefSp	Belief in macroevolution (speciation events) prior to intervention; measured on a 0 – 100 scale

PostBeliefSp	Belief in macroevolution (speciation events) after the intervention; measured on a 0 – 100 scale
PreBeliefHuman	Belief in human evolution prior to intervention; measured on a 0 – 100 scale
PostBeliefHuman	Belief in human evolution after the intervention; measured on a 0 – 100 scale
PreTOTALBelief	Sum of all pre-belief scores (out of 300)
PostTOTALBelief	Sum of all post-belief scores (out of 300)
PreOpenAdapt	Openness to microevolution (small adaptations) prior to intervention; measured on a 0 – 100 scale
PostOpenAdapt	Openness to microevolution (small adaptations) after the intervention; measured on a 0 – 100 scale
PreOpenSp	Openness to macroevolution (speciation events) prior to intervention; measured on a 0 – 100 scale
PostOpenSp	Openness to macroevolution (speciation events) after the intervention; measured on a 0 – 100 scale
PreOpenHuman	Openness to human evolution prior to intervention; measured on a 0 – 100 scale
PostOpenHuman	Openness to human evolution after the intervention; measured on a 0 – 100 scale
PreTOTALOpen	Sum of all pre-openness scores (out of 300)
PostTOTALOpen	Sum of all post-openness scores (out of 300)
PreHumanTotal	Sum of pre- human evolution acceptance, belief, and openness (out of 300)
PostHumanTotal	Sum of post- human evolution acceptance, belief, and openness (out of 300)
PreAdaptTotal	Sum of pre- Microevolution acceptance, belief, and openness (out of 300)
PostAdaptTotal	Sum of post- Microevolution acceptance, belief, and openness (out of 300)
PreSpecTotal	Sum of pre- Macroevolution acceptance, belief, and openness (out of 300)
PostSpecTotal	Sum of post- Macroevolution acceptance, belief, and openness (out of 300)
PreTotal	Sum of all pre-scores (out of 900)
PostTotal	Sum of all post-scores (out of 900)