

Supplemental Material

CBE—Life Sciences Education

Aragón et al.

Appendix

Serial mediation model testing of hypothesized model. We used a serial mediation model to test our hypotheses that the open-model (EPIC model without individual difference factors included) was viable. The serial mediation model tests the strength and direction of the relationships between each stage of the adoption process (e.g., the effect of exposure on persuasion, persuasion on identification, etc.) while controlling for relationships found at previous steps in the model. For example, we expect a relationship between exposure and persuasion, the first step in the model. In the second step we expect a relationship between persuasion and identification, *while controlling for* the relationships between exposure and persuasion and exposure and identification. The significant relationship between persuasion and identification under these conditions would indicate that persuasion not only has a relationship with exposure, but that persuasion makes a unique contribution to the next step of the model, identification over-and-above what exposure contributes. The serial process of mediation works in this way through each proposed step of the adoptions process: exposure, persuasion, identification, commitment and implementation.

If the model for the stages were to be established, we would then add the variable of instructor mindset, to test whether or not instructor mindset influenced each stage directly. This model included the steps for the EPIC process of implementation (exposure → persuasion → identification → commitment) and the additional factor of faculties' theory of intelligence.

Analysis 1: The overall process model of adoption. Data were summed for all active learning practices, for each step of the exposure-persuasion-identification-commitment (EPIC) adoption process. At any given step of adoption, scores ranged from 0 indicating no teaching

practices endorsed to 7 indicating all active learning teaching practices were endorsed. The steps of adoption were tested in a serial mediation model (Hayes, 2013; Process syntax, model 6 designed for use in SPSS), which allowed a test for a mediation pathway that would work sequentially through each step of the adoption process, while considering all previous steps in the model.

What follows describes the statistical parameters within which our data was analyzed. Serial mediation modeling estimated the total and direct effects of exposure to active learning practices through to implementation of these practices, as well as the total and all possible indirect effects of exposure on implementation through persuasion, identification, and commitment. Standard errors for the model coefficients are based on the HC3 heteroscedasticity-consistent standard error estimator. Process generates 95% bias corrected bootstrap confidence intervals for the indirect effects using 10,000 bootstrapped samples. Confidence intervals that do not include zero indicate significant pathways from the exposure through persuasion, identification, and commitment (EPIC) to predict implementation. As predicted, we found a significant serial mediation pathway and significant attrition through each step of the process (percentages of practices proceeding through each step of adoption): exposure (91%) → persuasion (85%) → identification (79%) → commitment (75%) → implementation (65%). The bootstrapped model (10,000 iterations) revealed, as hypothesized, a significant pathway from exposure to implementation through the predicted steps, $b = .15$, $SE = .03$, $LLCI = .0947$, $ULCI = .2220$ (see Table 1 and Figure 1).

Table 1. Linear Regression models		F statistic	R	F change statistic	R change
Model 1: predicting Persuasion					
Step 1					
<i>Exposure</i>	$B = 0.79, SE = .04, \beta = .65, t = 21.11, p < .0001$	$F(1, 618) = 445.77$	0.42		
Model 2: predicting Identification					
Step 1					
<i>Exposure</i>	$B = .44, SE = .05, \beta = .34, t = 8.95, p < .0001$	$F(1, 618) = 80.05$	0.34		
Step 2					
<i>Exposure</i>	$B = -.09, SE = .06, \beta = -.07, t = -1.58, p = .114$	$F(2, 617) = 161.44$	0.34	$F(1, 617) = 215.09$	0.23
<i>Persuasion</i>	$B = .67, SE = .05, \beta = .63, t = 14.66, p < .0001$				
Model 3: predicting Commitment					
Step 1					
<i>Exposure</i>	$B = .32, SE = .04, \beta = .23, t = 7.49, p < .001$	$F(2, 617) = 309.05$	0.50		
<i>Identification</i>	$B = .65, SE = .03, \beta = .60, t = 19.77, p < .001$				
Step 2					
<i>Exposure</i>	$B = .01, SE = .05, \beta = .00, t = .10, p = .91$	$F(3, 616) = 287.63$	0.58	$F(1, 616) = 122.79$	0.08
<i>Identification</i>	$B = .45, SE = .04, \beta = .42, t = 13.00, p < .001$				
<i>Persuasion</i>	$B = .51, SE = .05, \beta = .44, t = 11.08, p < .001$				
Model 4: predicting Implementation					
Step 1					
<i>Exposure</i>	$B = .23, SE = .06, \beta = .15, t = 3.52, p < .0001$	$F(3, 616) = 132.05$	0.39		
<i>Persuasion</i>	$B = .49, SE = .05, \beta = .42, t = 10.80, p < .0001$				
<i>Identification</i>	$B = .23, SE = .06, \beta = .18, t = 3.74, p < .0001$				
Step 2					
<i>Exposure</i>	$B = .22, SE = .06, \beta = .14, t = 3.94, p < .0001$	$F(4, 615) = 168.25$	0.52	$F(1, 615) = 168.87$	0.13
<i>Persuasion</i>	$B = .22, SE = .05, \beta = .19, t = 4.77, p < .0001$				
<i>Identification</i>	$B = -.09, SE = .06, \beta = -.07, t = -1.45, p = .15$				
<i>Commitment</i>	$B = .61, SE = .05, \beta = .56, t = 13.00, p < .0001$				

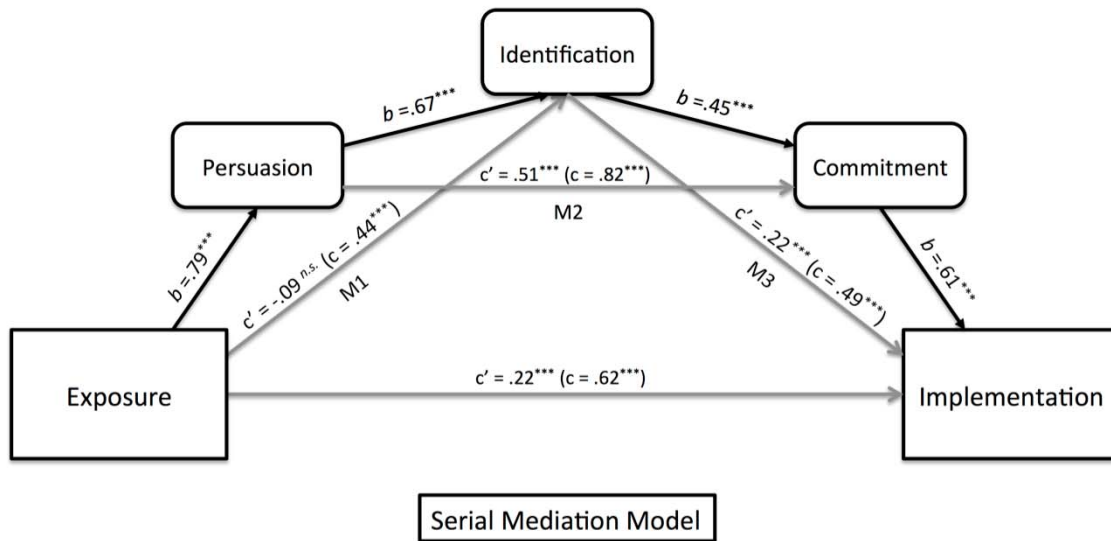


Figure 1. The serial mediation model illustrates that exposure predicts identification through persuasion (M1: mediation, relationship between exposure and identification is no longer significant with persuasion in the model), persuasion predicts commitment through identification (M2: partial mediation, the relationship between persuasion and commitment is reduced from .82 to .51 when identification is in the model), and identification predicts implementation through commitment (M3: partial mediation, the relationship between identification and implementation is reduced from .49 to .22 when commitment is in the model). Overall, the relationship between exposure and persuasion is reduced from .62 to .22 when the proposed mediators are entered into the model. In the figure, b indicates unstandardized coefficients, c' indicates pathway after proposed mediators have been included in the model, c represents the direct path between variables, *n.s.* represents not significant, and $***$ represents $p < .001$.

Analysis 2: With the inclusion of the fixed mindset variable. We conducted a serial mediation model to relate where along the process of adoption fixed mindsets might be

related. This model included the steps for the EPIC process of implementation (exposure → persuasion → identification → commitment) and the additional factor of faculties' theory of intelligence, to test for relationships between theory of intelligence and each step of the adoption process. Once again, the bootstrapped model indicated a significant pathway from exposure to implementation through our predicted process of adoption, $b = .15$, $SE = .03$, $LLCI = .09$, $ULCI = .22$.

The first step of exposure takes into account memory for Summer Institute for Scientific Teaching curriculum materials, i.e. exposure to active learning principles. The material was remembered at equal rates for those high and low in fixed-entity theories of intelligence. More relevant to our hypotheses, we found that instructors with a higher fixed mindset predicted specifically at the second step of the adoption process, i.e., *persuasion*. Specifically, instructors who reported high fixed theories of intelligence were persuaded that fewer active learning teaching practices were a good idea than those who were low fixed-theories of intelligence, $b = -.112$, $SE = .04$, $t = -2.85$, $p = .005$. A second effect of fixed theory of intelligence appeared at the stage of *implementation*. Those who reported high fixed-theories of intelligence reported implementing fewer active learning teaching practices than those who were low fixed-theories of intelligence, $b = -.108$, $SE = .05$, $t = -2.36$, $p = .018$. We remind the reader that this is a significant serial mediation pathway of adoption; therefore attrition or endorsement at any point impacts subsequent steps in the model. That is, effects at later stages are over-and-above the effects at earlier stages. See Figure 2.

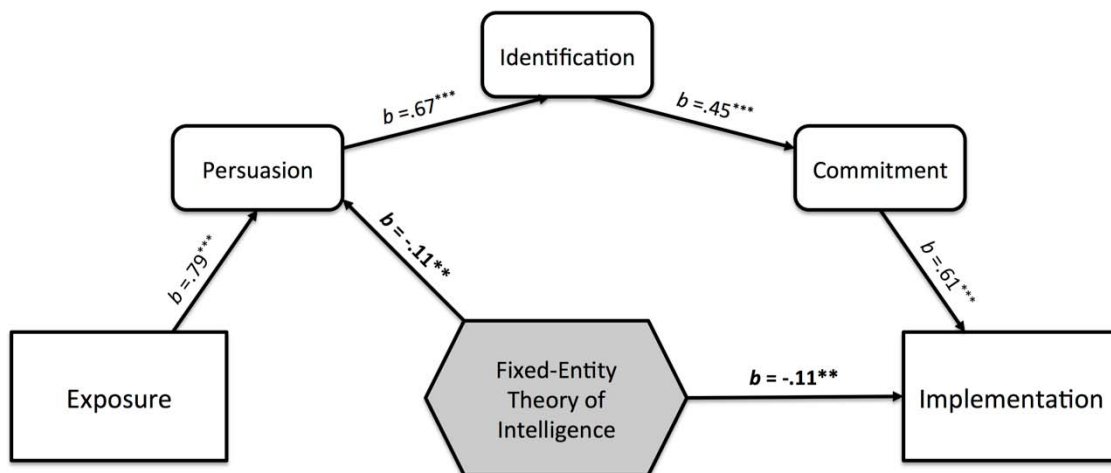


Figure 2. Illustrates the serial mediation model and where along the process of adoption theories of intelligence are related, while accounting for all prior steps in the adoption process. Arrows indicate locations along the pathway where fixed-entity theory of intelligence predicted attrition. $**p < .01$, $*** p < .001$

Reference

Hayes, A. (2013). *Introduction to mediation, moderation, and conditional process analysis*. New York: Guilford.