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# Attitudes in Chemistry

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# Attitudes in Chemistry

Caitlin Loeffler, Catherine M. Bohn Gettler, Kate Graham, and Annette Raigoza



## Introduction

This study examined attributions about success and failure in science, encouraging productive achievement emotions, identity as a scientist, and self-efficacy in science. Previous studies indicate that the tutoring process, including both peer and cross-age tutoring, results in an increase in academic achievement, and fosters positive attitudes and better classroom behavior (see Robinson *et al.*, 2005). While these studies provide insight about tutees, less is known about the benefits of being a tutor. To provide justification for tutoring programs in college and university settings, there should be clearly defined benefits for both tutors and tutees that extend beyond achievement and attitudes. For example, most studies examining tutors and tutees focus on academic achievement, yet many other variables play a role in learning, including achievement emotions, attributions, self-efficacy, and identity. This study more deeply examined such in both tutors and tutees.

## Hypotheses

1. Increase in effort, and decreases in ability, context, and luck attributions.
2. Increases in self-efficacy for cognitive abilities, psychomotor skills, and everyday applications.
3. Increases in identity as a scientist.
4. Increases in productive achievement emotions (e.g., enjoyment, hope, pride, and anxiety), and decreases in negative achievement emotions (e.g., anger, shame, hopelessness, and boredom).

## Method

Type of Survey	Number of Participants
Tutors	38
Tutees, 125 Class	118
Tutees, 125 Tutoring	116
Total	272

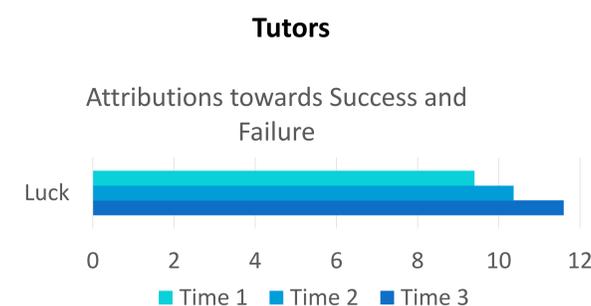
## Measures

1. Multidimensional-Multiattributonal Causality Scale (Lefcourt, 1979)
2. College Chemistry Self-Efficacy Scale (Uzuntiyaki & Aydin, 2009)
3. Identity as a Scientist (Robnett *et al.*, 2015)
4. Achievement Emotions Questionnaire (Pekrun *et al.*, 2005)

## Time Course of Data Collection

1. Time 1: All measures plus demographics
2. Time 2: All measures to tutors only
3. Time 3: All measures plus achievement data

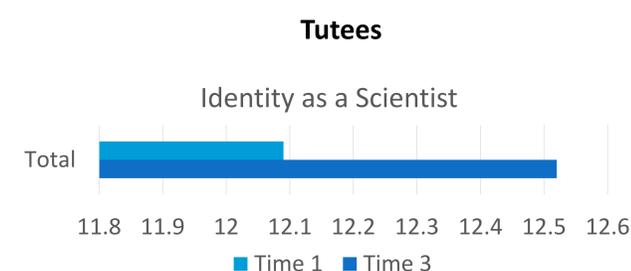
## Results



**Figure 1.** Statistically significant results ( $p < 0.05$ ) from the Multidimensional-Multiattributonal Causality Scale (MMCS) for tutors. For each phase of the survey, the attribution towards luck and its role in successes and failures increased. This goes against our hypothesis hoping to see a decrease in luck throughout the semester.



**Figure 2.** Statistically significant results ( $p < 0.05$ ) from the Achievement Emotions Questionnaire (AEQ) for tutors. The AEQ showed a decrease in both hope and anxiety over the course of the three surveys for tutors. Both of these results go against hypothesis looking for an increase in hope and a decrease in anxiety.



**Figure 3.** Statistically significant results ( $p < 0.05$ ) from the Identity as a Scientist Test for CHEM 125 tutees. Between the beginning and the end of the semester, identity as a scientist increased. This result agreed with our hypothesis stating that identity should increase over the course of the semester.



**Figure 4.** Statistically significant results ( $p < 0.05$ ) for the Achievement Emotions Questionnaire for tutees. The tutees' AEQ show an increase in hopelessness and boredom, and a decrease in enjoyment, hope, pride, and anxiety between the beginning and the end of the semester. None of these results agreed with the hypothesis looking for an increase in enjoyment, hope, pride, and anxiety with decreases in hopelessness and boredom.

## Discussion

Tutors demonstrated increases in identity as a scientist, context, luck, and a slight increase in self-efficacy in cognitive skills. There was a decrease in ability and effort attributions, self-efficacy in psychomotor skills and everyday applications, and the following achievement emotions: enjoyment, pride, anger, anxiety, shame, hopelessness, and boredom. There was a slight decrease in hope as well.

Tutees showed increases in luck attributions, self-efficacy towards cognitive skills, psychomotor skills, and everyday applications, identity, and the following achievement emotions: anger, shame, hopelessness, boredom. Tutees demonstrated a decrease in ability, effort, and context attributions, enjoyment, and anxiety achievement emotions. There were slight decreases in hope and pride ( $n < 0.01$ ), but stayed fairly stable over the semester.

The results indicated mixed effects of tutoring on non-cognitive variables for both tutors and tutees. One possibility for this is that while chemistry demand increases during the semester, it increases in other classes. Students may think they don't have the time to participate as fully in the class as they previously did, and their efforts towards chemistry decrease.

The results suggest that training tutors in attribution theory and how to foster more favorable attributions, self-efficacy, identity, and achievement emotions would be beneficial. Further studies will be conducted to examine the difference between training programs.

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