

# Supplemental Material

*CBE—Life Sciences Education*

Limeri *et al.*

Supplemental online materials for  
*Knowledge or abilities? How undergraduates define intelligence*  
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## **Interview Guide**

The interview guide for semi-structured interviews conducted for this study. The interview questions are organized into five topics: introduction, terminology and definitions, difficulties in organic chemistry II, mindset and change in mindset, and domain specificity of intelligence.

### **Section 1 – Introduction**

Thank you for volunteering for our study about the development of beliefs about intelligence and how these beliefs may or may not change during a challenging course, like organic chemistry. There are no right or wrong answers and all of your perspectives are valid. Please feel free to share anything that you think is pertinent, even if I don't explicitly ask for it.

Before we begin, please carefully review this informed consent form. This form explains that you are about to participate in a research project. Your participation is completely voluntary, and you may stop answering questions and withdraw at any time without repercussions. Please take a few minutes to carefully read the form and do not hesitate to let me know if you have any questions if anything is confusing.

Do you have any questions for me before we begin?

All of your responses will be confidential. This means that your data will be de-identified and only researchers will have access to it. Is it okay with you if I record this interview?

*\*\*\*Begin recording*

### **Section 2 – Terminology & definitions**

- How do you define intelligence?
- How does it differ from knowledge?
- How does intelligence relate to academic performance?
  - What other factors contribute to academic performance?
  - How important are these factors to academic performance?
- When was the first time you thought about what intelligence means?
- What do you think about failures in general?
- How do you tend to react to setbacks or failures?

### **Section 3 – Academic difficulties during Organic Chemistry II**

- Please describe any academic difficulties you have encountered or are currently facing this year in CHEM 2212. Academic difficulties can include times when you didn't do as well on an assignment or exam as you would have liked, or felt like you did not understand material as well as you would have liked.
- Why did this difficulty occur?
  - What factors caused this difficulty?
- What did you do in response to this difficulty?
- How did this difficulty affect you?

- Did this difficulty affect your beliefs about intelligence?
  - Why or why not?
- Did this struggle affect any other attitudes or beliefs you have?
  - Why or why not?
- Did this struggle affect career plans?

(For the students who withdrew from the course)

- What factors influenced your decision to withdraw from the course?
- Are you going to be retaking the course?
- Have your career/post-grad plans changed because of this?

### **Section 3– Mindset and change in mindset**

- Do you think someone can change their intelligence level?
- Please describe how you came to believe this.
- Have you always thought this way?

If yes -

When were you first aware of this belief?  
How did this belief develop?

If no –

In what way did your beliefs change?  
When did your belief change?  
Why did your beliefs change? (What happened that caused the shift?)  
Did anything happen during the semester that made you question these beliefs?  
If yes – why didn't you change your beliefs?  
Have these beliefs changed throughout the semester? If yes, how have they changed?

### **Section 4 – Domain-specificity of intelligence**

- Do you think that chemistry intelligence differs from general intelligence?

If yes-

Why do you think that chemistry intelligence is different from general intelligence?  
Why do chemistry and general intelligence differ?  
How did you come to believe that?  
(if unclear, what have you experienced or heard that led you to think that?)  
Are there other kinds of intelligence that are different?

If no -

Why do you think that chemistry and general intelligence don't differ?  
How did you come to believe that?  
(if unclear, what have you experienced or heard that led you to think that?)  
Are there kinds of intelligence that are different?

- Have you always thought that?

If yes –

Where were you first aware of this belief?  
How did this belief develop?

If no –

When did your belief change?

What caused you to change?

(If intelligence in different subjects was brought up) How do you feel like [subject] intelligence relates to general/other intelligence?

\*\*\**End recording*

Thank you for participating and sharing your experiences with me! We will be emailing you your \$25 Amazon gift card. Which email would you like us to send it to?

### Survey questions

The survey consists of two versions of the mindset scale (Dweck, 2000) and two constructed-response questions. The first mindset scale asks students about their “chemistry intelligence” and the second scale asks about “general intelligence.” The items of the mindset scale were presented with a 7-point agreement scale and a “prefer not to respond” option. The survey also included demographic and consent questions at the end.

### Response scale:

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Prefer not to respond
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### Survey:

The following questions ask about your beliefs about intelligence. There are no right or wrong answers; we are just interested in your views. Please rate the extent to which you agree or disagree with following statements about **chemistry intelligence**.

1. Your chemistry intelligence is something about you that you can't change very much.
2. No matter who you are, you can significantly change your chemistry intelligence level.
3. To be honest, you can't really change how intelligent you are in chemistry.
4. You can always substantially change how intelligent you are in chemistry.
5. You can learn new things, but you can't really change your basic chemistry intelligence.
6. No matter how much chemistry intelligence you have, you can always change it quite a bit.
7. You can change even your basic chemistry intelligence level considerably.

Please describe in as much detail as possible why you hold these beliefs. You may want to discuss how you came to hold these beliefs or anything that has happened that affects your beliefs about intelligence. Please write at least 4-5 sentences, if possible, so that we can understand your thoughts.

The following questions ask about your beliefs about intelligence. There are no right or wrong answers; we are just interested in your views. Please rate the extent to which you agree or disagree with following statements about **general intelligence**.

1. You have a certain amount of general intelligence and you can't really do much to change it.
2. Your general intelligence is something about you that you can't change very much.
3. No matter who you are, you can significantly change your general intelligence level.
4. To be honest, you can't really change how intelligent you are in general.
5. You can always substantially change how intelligent you are in general.
6. You can learn new things, but you can't really change your basic general intelligence.
7. No matter how much general intelligence you have, you can always change it quite a bit.
8. You can change even your basic general intelligence level considerably.

Please describe in as much detail as possible why you hold these beliefs. You may want to discuss how you came to hold these beliefs or anything that has happened that affects your beliefs about intelligence. Please write at least 4-5 sentences, if possible, so that we can understand your thoughts.

What year are you?

- Freshman
- Sophomore
- Junior
- Senior
- Prefer not to respond



In what field(s) is/are your major(s)?

- Chemistry
- Life Sciences
- Environmental / Earth / Agricultural Sciences
- Physics
- Engineering
- Mathematics
- Psychology
- Humanities
- Other major: \_\_\_\_\_
- Prefer not to respond

What are your post-graduate plans?

(Note: STEM = Science, Technology, Engineering, and Math, and includes health care)

- Graduate or professional studies in a STEM field
- Graduate or professional studies in a nonSTEM field
- Employment in a STEM field
- Employment in a non-STEM field
- Other: Please explain \_\_\_\_\_
- Prefer not to respond

What is your current GPA? Please enter on a 4.0 scale.

- My GPA is: \_\_\_\_\_
- Prefer not to respond

What is the highest level of education your parent(s)/guardian(s) has completed?

1. Mother: [drop down list]
2. Father: [ drop down list]
3. Other guardian: [drop down list]

Options in the drop-down list:

- Not applicable
- Some high school
- High school / GED
- Some college
- Trade/technical school degree
- Associate's (2 yr) degree
- Bachelor's (4 yr) degree
- Master's degree
- Doctorate degree
- Professional degree
- Other
- I don't know
- Prefer not to respond

With which race(s) and ethnicity/ies do you most closely identify? Please choose all that apply.

- African American or Black
- White
- Native American or Alaskan Native
- Chinese
- Filipino
- Japanese
- Korean
- Vietnamese
- Middle Eastern
- South Asian
- Other Asian
- Latina / Latino / Hispanic
- Native Hawaiian or other Pacific Islander
- Other: Please explain \_\_\_\_\_
- Prefer not to respond

What is your gender?

- Male
- Female
- Other
- Prefer not to respond

\_\_\_\_\_ Page Break \_\_\_\_\_

Please enter your university email address so that you can be assigned extra credit. You will receive extra credit whether or not you agree to participate in the study: \_\_\_\_\_

We would like to interview some students to gain a more in-depth understanding of your beliefs about general intelligence and chemistry intelligence. Interviews will occur in the second half of the semester, last 45-60 minutes, and participants will be compensated with a \$25 Amazon gift card. If you are willing to be interviewed confidentially, please enter your name and email address.

Name \_\_\_\_\_

Email \_\_\_\_\_

## References

Dweck, C. S. (2000). *Self-theories: Their role in motivation, personality, and development*. New York, NY, Psychology Press.