

Preflection Survey, Annotated

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SURE survey was originally used by faculty and administrators to permit students to report their learning and attitudes following a dedicated research experience, often in the summer. It was a post-experience survey. Occasionally our partners suggested that having a Pre-experience reflection survey might help us better understand our students' experience. The title "preflection" is a neologism to help you remember the survey and its use.

Here is the introductory text used for the survey. The reader is assumed to be a student who is beginning a research experience.

Welcome to the preflection survey, a brief survey that helps us understand where you are in your plans, attitudes, and learning style as you begin an undergraduate research experience.

Your participation is voluntary. Your decision to participate or not will have no bearing on your academic standing. Your choice of answers will have no bearing on your academic standing. Your decision to submit the completed survey is your indication of consent for participating.

We begin with a section that asks about you. Notice that you do not have to identify yourself, but notice also that if you do we can better align your reflections with your later completion of the SURE survey. Notice also that for each question you can decline to answer that item while continuing to answer others, and that you can stop the entire survey by exiting without submitting it.

The remaining items ask about your experience with research, your plans, and your reflections on your strengths, your ideas about science, and your preferred learning style. Your thoughtful responses will be appreciated. At a later date, your preflection responses will be aligned with your SURE assessment of your research experience. Thanks very much for helping your institution make undergraduate research programs more effective. If you have any questions please e-mail Professor David Lopatto (lopatto@grinnell.edu).

Note that you should at least replace the "Lopatto" reference with a local reference, that you should decide if you will align the Preflection with the later SURE results, and if you need to convey Institutional Review Board information to your students. As a research initiative the student's cooperation was not connected with grading or other consequences. Instead, we offered a raffle for those who completed the SURE. Raffle winners were sent an Amazon gift certificate.

As the student begins, we ask for information that situates who they are and where they work. A name or identifier aids in matching Preflection information to SURE information. Notice that our questions allowed us to sort students into institutions and programs. If you are working with one program only you may not need all of these questions.

Please enter your name or program identifier:

Name or identifier _____

Please indicate the college or university where you are regularly enrolled:

Institution _____

Will you carry out your research at the institution where you are regularly enrolled?

- Yes
- No

If you answered "No" to the previous question, please select the institution, location, or laboratory where you will carry out your research:

Research institution _____

Please indicate the *funding source* for your research:

Funding source _____

If you have more than one source of funding, please enter the additional source of funding below:

Additional funding source _____

Many research programs, including those funded by grants, make statements about inclusion of all genders and ethnicities. Sometimes it is necessary to tally genders and ethnicities in the service of documenting inclusion. We conformed to the usually binary taxonomy of gender and to the NSF recommendations for ethnic categories. We also found it useful to ask students their educational level (“current status”). Change or keep as you see fit.

Gender:

- Male
- Female
- Prefer not to answer

Ethnicity:

- Alaskan Native
- American Indian
- Asian American
- Black or African American
- Filipino
- Foreign National
- Hawaiian
- Hispanic/Latino
- Pacific Islander
- White
- Two or more races
- Other
- Prefer not to answer

What is your current status?

- I am a high school student.
- I am a first-year college undergraduate.
- I am a second-year college undergraduate.
- I am a third-year college undergraduate.
- I am a fourth-year college undergraduate.
- I am a graduate or medical student.
- Other
- Not applicable / Prefer not to answer

For research purposes, as well as occasionally narrowing a comparison group, we asked the student two questions, their major and their research area (which are not always similar). Depending on the scope of your project you may or may not need this information.

What is your academic major (best fit):

- Biology
- Chemistry
- Physics
- Earth & Planetary Sciences
- Math
- Computer Science
- Biochemistry
- Bioinformatics
- Psychology
- Neurobiology
- Engineering
- Education
- Other: Social Sciences
- Other: Humanities
- Other: Natural Sciences
- Other
- Undecided
- Not applicable / Prefer not to answer

What is your field of research (best fit)?

- Biology
- Chemistry
- Physics
- Earth & Planetary Sciences
- Math
- Computer Science
- Biochemistry
- Bioinformatics
- Psychology
- Neurobiology
- Engineering
- Education
- Other: Social Sciences
- Other: Humanities
- Other: Natural Sciences
- Other
- Undecided
- Not applicable / Prefer not to answer

It is useful to know what previous experience the student has had.

Have you participated in research prior to your most recent research experience?

- No, I have not had a prior research experience.
- Yes, during one academic semester (typically ~10 hr/wk).
- Yes, during multiple academic semesters (typically ~10 hr/wk).
- Yes, during a summer research program (typically full-time for at least 5 weeks).
- Yes, during a prior academic semester (or semesters) and a summer.
- Yes, during prior years and/or several summers.
- Not applicable / Prefer to not answer

This question helps us understand the student's motivation. We ask the question again in the SURE and thus can look for change. Previous work (Lopatto, 2004 in CBE, 3, 270-277) includes information that students who changed their plans evaluated their experience differently from students who did not (see Table 5 in Lopatto, 2004).

Do you have plans to continue your education beyond your undergraduate degree?

Please check the most likely plan for what you will do *immediately following* graduation.

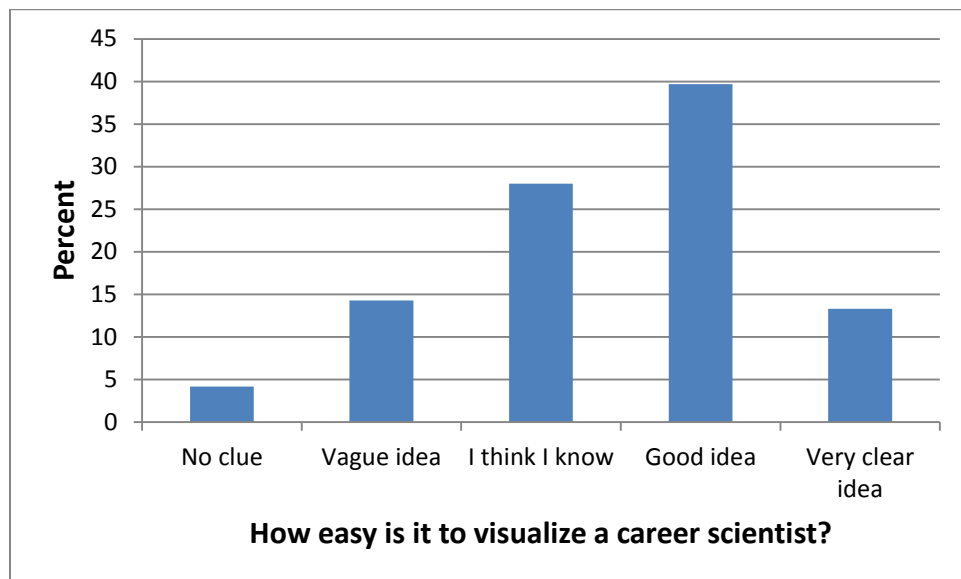
- My goal is to go to graduate school for a Ph.D. degree in a biology-related field.
- My goal is to go to graduate school for a Ph.D. degree in the physical sciences (including engineering, math, and computer science)
- My goal is to go to graduate school for an MA in the life sciences.
- My goal is to go to graduate school for an MA in the physical sciences (including math, engineering, computer science, etc.)
- My goal is to go to graduate school for an MA or Ph.D. degree in a field other than science
- My goal is to go to medical school for an M.D. degree.
- My goal is to go to school for an M.D./Ph.D.
- My goal is to go to school for other health professions.
- My goal is to go to school for a professional degree such as law or business.
- My goal is to teach or to go to school to obtain a teaching certification.
- My goal is to join the Peace Corps, Teach for America, or similar organization.
- My goal is to work, then go to school for my M.D., Ph.D., or other professional degree.
- I plan to work in a science related career without going to school after college.
- I plan to work in a non-science career without going to school after college.
- Not applicable / Prefer not to answer

This question explores how clearly the student may be thinking about the research experience and their possible future. Note that you could substitute a more specific term for “scientist” if your program is more focused.

When someone discusses "a career scientist," how easy is it for you to visualize a career of that sort?

- I don't have a clue as to what they are talking about.
- I have a vague idea of what they are talking about.
- I think I know what they are talking about, but I am not confident.
- I have a good idea of what they are talking about.
- I have a very clear idea of what they are talking about.

I have not yet published information about this question, and it does not appear in the SURE and so does not capture change. Here is one year’s data showing the overall distribution of student responses. The figure is based on 3,296 responses.



The SURE survey is centered on science experiences. Not all undergraduate researchers, however, are influenced only by a career in science. This exploratory section attempted to uncover the range of motives that might be influencing student behavior. If it is not of interest to you, delete it. I have not yet published any data from this section.

Life Choices

Below are some general categories of motives and intentions that influence choices of what to do with your life after graduation. Check the appropriate box to indicate the relative importance of the motive in your choices for post-graduation life. Make a choice for each topic.

	Not important	Important	Very important
Continue your education	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Get work or financial independence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Perform public service/work for social change	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Be with a partner and start your own family	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Be free to travel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Manage your health	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pursue spiritual values	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Live near your parents or siblings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teach elementary or high school students	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Become a well-known scientist	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Helping people with their physical or mental health	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Return to your home community	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Some of the items in this section originated from a dissertation by Laura Wenk (2000)¹ subject to considerable discussion and revision by colleagues who helped develop the CURE survey. The section first appeared in the CURE. One in-depth analysis of the items is provided in Perera, et al. (2017)². Using some same and similar items, Hoskins, et al. (2011) looked at epistemological changes following experience with the C.R.E.A.T.E. program³. You will note that I have highlighted some items in green and some in red. The 5 items in italics reliably factor together in a principal component factor analysis, or, if you prefer, show a high Cronbach's Alpha for inter-item consistency. I have found it useful to add these 5 scores to create a scale value that reflects a positive attitude toward science learning. The scores positively correlate with student reported learning gains. The 6 items underlined also emerge as related. I have summed them as a scale of negative perceptions of science learning, and find negative correlations with student reported learning gains. They are not published yet.

Learning Context

It has become common to say that no student is an empty bucket, waiting for a teacher to pour in knowledge. Research on learning acknowledges that students approach a course with well-formed opinions of themselves and of the subject matter. In this section we present questions about science and questions about you. These will help us put learning in context.

For each item below please rate your agreement with the item.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	N.A.
<i>Even if I forget the facts, I'll still be able to use the thinking skills I learn in science.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
You can rely on scientific results to be true and correct.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>The process of writing in science is helpful for understanding scientific ideas.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When scientific results conflict with my personal experience, I follow my experience in making choices.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students who do not major/concentrate in science should not have to take science courses.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

¹ Wenk, L. (2000). Improving Science Learning: Inquiry-based and traditional first-year college science college science curricula. Doctoral Dissertation.

² Perera, V., et al. (2017). CBE-LSE, Winter, 16:ar60.

³ Hoskins, S. G., et al. (2011). CBE-LSE, Winter, 10, 368-378.

Interest in “learning styles” may have declined in recent years. When the earlier versions of our surveys were constructed we were struck by the article by Romero, et al. (1992)⁴, in which learning styles (concrete vs abstract; reflective vs active) were predictive of college major. The items below are optional. Students sometimes have difficulty with them because they are bi-directional, with students moving their score to the left or the right depending on how they describe themselves. How you can score the results is described below the items.

Paired Statements

Below are ten pairs of statements. The number scale between them is used to indicate how well a statement or a pair of statements describes you. For example, on the first pair, a "6" would indicate you are very action oriented, while a "4" would indicate you were more action-oriented than reflective, but somewhat reflective. **For each pair of statements, choose a number that indicates how well the statement describes you.** Do not worry that some pairs are not opposite.

Paired statement responses

	1	2	3	4	5	6	NA	
I would describe myself as reflective.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I would describe myself as action oriented.
I prefer subjects with precise answers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I prefer subjects with multiple interpretations.
I value patience.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I value getting things done.
I like things to be varied and colorful.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I like to be exact and precise.
I would describe myself as a doer.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I would describe myself as an observer.
I take a creative and imaginative approach to solving problems.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I take a precise and calculated approach to solving problems.
I would describe myself as evaluative and logical.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I would describe myself as receptive and accepting.

⁴ Romero, J.E., Tepper, B.J., Tetrault, L.A. (1992). Development and validation of new scales to measure Kolb’s (1985) learning style dimensions. *Educational and Psychological Measurement*, 52, 171-179.

I like to watch what is going on.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I like to see the results of my actions.
I strive for versatility.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I strive for accuracy.
I am reserved.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I am prepared.

Five items (1, 3, 5, 8, and 10) measure reflective observation versus active experimentation. Five items (2, 4, 6, 7, and 9) measure concrete experience versus abstract conceptualization. Some items (2,5, and 7) are reversed for scoring purposes. After several items are reflected (reverse scored) the relevant items are summed to create two scores for each individual. The range of scores is 5 to 30. On the reflective/active dimension a low score corresponds to a reflective learning style. On the concrete/abstract dimension a low score corresponds to a concrete learning style. In theory, the two dimensions are orthogonal. In real data sets, I have found the two dimensions to correlate slightly ($r = .10$ to $.20$). Following Romero, et al., each dimension is split at the median. Then the two scores are conjoined to classify each student respondent into one of four “quadrants” of learning style. In our reports, the results are displayed as coordinates on a graph. Here are the two dimensions of learning style, with typical majors as suggested by Romero, et al. The sciences typically are located in the “Assimilator” or “Converger” quadrants.

