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How Novice Researchers See Themselves Grow

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How Novice Researchers See Themselves Grow

Abstract

Engaging in undergraduate research is identified as a High Impact Practice (HIP), an experience that improves student learning outcomes. In this paper, we report the differences in the relative rates of increase in skill and knowledge gains associated with early engagement in undergraduate research from students who have little to no prior research experience. We studied the relative rates of changes in novice researchers' perceptions of the progressive development of different research-related skills and conceptual understandings of their own projects, as well as how their attitudes, such as confidence in their own abilities as researchers, develop with continuous participation in mentored research. Knowing the progression timeline for various skills may help program administrators and faculty mentors plan for "just in time" provision of relevant resources and supports.

Keywords

Undergraduate research, High Impact Practice, Novice researchers, Rates of skills development, Resource allocation, Supporting students

Cover Page Footnote

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How Novice Researchers See Themselves Grow

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Engaging in undergraduate research is identified as a High Impact Practice (HIP), an experience that improves student learning outcomes. In this paper, we report the differences in the relative rates of increase in skill and knowledge gains associated with early engagement in undergraduate research from students who have little to no prior research experience. We studied the relative rates of changes in novice researchers' perceptions of the progressive development of different research-related skills and conceptual understandings of their own projects, as well as how their attitudes, such as confidence in their own abilities as researchers, develop with continuous participation in mentored research. Knowing the progression timeline for various skills may help program administrators and faculty mentors plan for "just in time" provision of relevant resources and supports.

UNDERGRADUATE RESEARCH IS A HIGH IMPACT PRACTICE

Engaging in undergraduate research is identified as a "High Impact Practice" (HIP), an experience that increases student retention and success (Kuh, 2008). Students who engage in undergraduate research demonstrate substantial gains in problem solving and research skills, report more satisfaction with their overall educational experience, and are more likely to pursue graduate studies (Brownell & Swaner, 2009; Crowe & Brakke, 2008; Hathaway, Nagda, & Gregerman, 2002; Lopatto, 2010). Participating in undergraduate research enhances students' critical thinking skills and intercultural effectiveness, and inculcates a positive attitude towards literacy (Kilgo, Sheets, & Pascarella, 2014). Students in Science, Technology, Engineering, and Mathematics (STEM) fields as defined by the National Science Foundation (NSF) tend to have more opportunities to engage in undergraduate research than students in non-STEM disciplines, thus its benefits tend to be documented in the context of STEM fields (e.g., Lopatto, 2009, 2010; Russell, Hancock, & McCullough, 2007; Sadler, Burgin, McKinney, & Ponjuan, 2010). However, all students, irrespective of disciplinary field, can benefit from undergraduate research (e.g., Healey & Jenkins, 2009; Ishiyama, 2002), though the specific benefits may vary from discipline to discipline (Craney et al., 2011). Because of the benefits of undergraduate research on student participants, the motivation to involve undergraduate students in research and inquiry has grown all around the world in recent years (e.g., Healey & Jenkins, 2009; Jenkins & Healey, 2010; Kinkead, 2003; Willison & O'Regan, 2007)

Undergraduate research promotes active and collaborative learning as well as a close relationship with a mentor. These factors are known to improve academic achievements and retention of under-represented minority (URM) students (e.g., Carpi, Ronan, Falconer, & Lents, 2017; Eddy & Hogan, 2014; Freeman et al., 2014; Nagda, Gregerman, Jonides, von Hippel, & Lerner, 1998; Sweat, Jones, Han, & Wolfgram, 2013; Yeager & Walton, 2011), even more than majority students. However, Finley and McNair (2013) pointed out that despite profound educational benefits of student-faculty collaborative research, first-generation and URM students are less likely to participate in those activities than other student groups. Intentionally recruiting students to participate in undergraduate research as early in their careers as possible, irrespective of their majors or GPA, is one way of addressing this issue. Following the successful model of the Undergraduate Research Opportunities Program (UROP) established at the University of Michigan (Gregerman, 2009), we implemented the Research Apprenticeship Program (RAP) on our campus in 2009 to promote early engagement of students in mentored research. This effort complemented our already existing undergraduate research program for advanced students. A detailed description of RAP, including our recruitment strategies for underserved students (the term "underserved" is used here to collectively indicate students from URM groups, first-generation backgrounds, those eligible for receiving Pell grants and/or subsidized federal loans, and transfer students), impact of RAP participation on those students in terms of retention and academic success, strategies for obtaining buy-ins from faculty mentors, and continued support from campus administration has been accepted for publication elsewhere (Chan, Bhattacharyya, & Meisel, 2018). We provide a brief summary of the background and rationale behind the establishment of the program below.

Research Apprenticeship Program (RAP): Exploring the Value of an Early Start in Undergraduate Research

Recent literature has shown the benefits of students' early engagement in undergraduate research, especially in areas of student retention, self-efficacy, and graduation rates (e.g., Ishiyama & Hopkins, 2002/2003; Kilgo, Sheets, & Pascarella, 2015; Nagda et al., 1998; Sams et.al., 2016; Thiry & Laursen, 2011). We designed RAP to be an early entry point into undergraduate research for beginning students, including those who may be academically at risk, as paid research assistants. Other reasons for implementing RAP included: (a) a need for incorporating undergraduate research experiences for our professional degree programs, particularly in the Colleges of Business and Economics, and Education and Professional Studies, and, (b) feedback from graduating seniors who have participated in mentored research and wished to have gotten engaged in research earlier in their college careers.

Since 2009, RAP grew from a small pilot program that included seven first- and second- year students to the current state where more than 90 students are served each year. Any student new to campus, such as freshmen and sophomore students, recent transfer students, or returning adult students meet the RAP eligibility criteria, irrespective of their majors, academic standing, GPA, SAT/ACT scores, or work-study eligibility. Most applicants self-select, though faculty/staff also take an active role in recruiting eligible students who demonstrate scholarly po-

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tential. We match student applicants with prospective mentors based on mutual research interests. Once matched, mentors and students collaboratively decide on the appropriate type(s) and level(s) of research-related activity(ies) for the student researchers. Common research activities include, but are not limited to: literature review, assisting senior undergraduates in lab or in the field for collecting and analyzing data, coding software, working with large datasets, developing computer models, creating educational materials and activities, transcribing interviews and surveying target audiences, etc., depending on the research projects and at the discretion of the mentor.

We require all RAP students to complete an on-line, self-paced course called "Research Methods and Ethics." This course gives students an overview of basic research skills that are common to most disciplines and discusses the importance of ethical conduct for researchers. All RAP students can potentially use these skills in a variety of contexts in and out of classroom, including further pursuit of additional research and experiential learning opportunities to continue their deep engagement with their disciplines and with the University after their RAP experiences have concluded.

> **Research Question:** What is the Dynamics of Skills, Attitudes, and Conceptual Understanding Gains Made by Novice Researchers from Conducting Mentored Research?

The pedagogical benefits of mentored research extend beyond improved retention and graduation rates. Current literature highlights the role of undergraduate research in developing important skills such as the ability to find or generate information necessary for answering research questions, critically evaluate information, analyze and synthesize data, effectively communicate research findings, etc. (e.g., Brew, 2013; Healy & Jenkins, 2009; Willison & O'Regan, 2007).

While collecting data on demographic breakdown of participants and various measures of their academic success, such as retention and graduation rates, are important means of assessing program effectiveness, it is also important to understand the dynamics of students' learning and skills gains as they progress through their RAP experience. Such assessment is valuable in terms of future resource allocation, not only for us, but also for any campus that encourages early immersion in undergraduate research. For example, if we find that students seem to develop confidence in their presentation skills early on, but need more time to feel confident in their written communication skills, then it may be optimal to invest in support infrastructure for developing discipline-specific writing skills over a sustained period, and place less emphasis on presentation skills as students progressively become advanced researchers.

Skills building is a time intensive and iterative process spanning the entire novice-expert continuum. Assessing whether students have gained those skills from participating in non-discipline-specific, extra-curricular research activities conducted during the academic year still remains a challenge. In addition, while rubrics and other objective instruments are frequently used for directly assessing the *products* of research, such as oral and/or poster presentations by student researchers, assessing the effectiveness of the research *process* for developing important skills and self-efficacy is still largely based on self-assessment reports by students and/or alumni (e.g., Sams et al., 2015; Schmitz and Havholm, 2015), which are indirect, and may be subjective and inflated. Furthermore, most of the commonly used survey instruments for assessing student learning gains from undergraduate research, such as URSSA (Hunter, Weston, Laursen, & Thiry, 2009) and SURE (Lopatto, 2004; 2008) focuses heavily on the experiences of students conducting research in the STEM disciplines, often as part of six- to ten-week long, intense summer research programs or formal "Research Experience for Undergraduates" or REU programs. The rarity of validated instruments used for assessing learning and skills developed from conducting research in all disciplines adds to the challenge.

In this paper we describe how we studied the relative rates of changes in novice researchers' perceptions of the progressive development of different research-related skills and conceptual understandings of their own projects, as well as how their attitudes, such as confidence in their own abilities as researchers, develop with continuous participation in mentored research. In the following sections, we present our study methodology, and analyze self-assessment of learning gains data collected from RAP participants. Finally, we discuss the implications of our findings in terms of logistical planning of allocation of support/resources at "just the right time" for programs designed for engaging students early in mentored research.

METHODS

We tracked self-assessment reports from three cohorts (2014-15, 2015-16, and 2016-17) of RAP participants at the beginning of their experience, at its midpoint, and at its end, to see whether there might be differential rates-of-gain across different skills, knowledge, and attitude. We used a template based on the "Student Assessment of their Learning Gains (SALG)" survey instrument accessed from www.salgsite.net (Seymour, Wiese, Hunter, & Daffinrud, 2000). This survey instrument was originally designed for evaluating student learning from courses, and allows instructors the necessary flexibility to adapt the template to reflect student perceptions of gains made in course-specific learning goals. We retained the original structure of the template questionnaire, but modified it to reflect learning and skills gains made by participating in extra-curricular, non-discipline specific mentored research. The modified SALG was comprised of 23 five-response Likert scale questions that assessed four domains: understanding (how well did the students understand their project, and how well could they relate its concepts to other subjects and subject areas?); skills (how confident were the students in their ability to find and evaluate information relevant to their projects, and communicate their projects to others?); attitudes (how comfortable, confident, interested, and enthused were the students with regard to their projects?); and learning (how well did the students feel they could connect what they learned from the experience to other experiences, and apply their learning to other domains?). The questions in the skills domain generally adhered to the six facets of research as listed by Wilison and O'Regan (2007) in their Research Skills Development (RSD) framework, which is a commonly used instrument for assessing progressive development of research skills and student autonomy in context of inquiry- or research-based courses. However, RSD framework does not cover the other domains (understanding, attitude, and learning) that we tracked. The questionnaire is provided in the Appendix.

We hypothesized that the students' responses on most, if not all, items would move toward increasing confirmation of greater learning gains as time progressed. However, we were unsure as to whether that self-reported growth in learning gains would proceed at the same pace for all items. If different skills and areas of understanding grow at different rates, it would affect the optimum timing for additional resource allocation, such as peer tutoring at the writing center, for RAP participants.

Participant Characteristics

Our goal for establishing RAP was to engage students in research who might not otherwise see themselves as researchers, as opposed to rewarding high academic achievements before or during college. Acceptance in RAP is not contingent upon academic standing, GPA, ACT/SAT scores, prior research experience, or major programs of study. We do not collect high school performance data or other evidence of academic achievement as part of our application process. Detailed descriptions of the characteristics of the RAP participants and their motivations for joining the program are included in a manuscript recently accepted for publication (Chan, Bhattacharyya, & Meisel, 2018).

Participants in the current study conducted mentored research over a wide variety of disciplines, ranging from biology and computer science to social work and music education. Each year, study participants completed the questionnaire at three time points: When they joined the program early in the fall semester (pre-RAP), in January, midway through their RAP experience (mid-RAP), and in May, near the end of their yearlong RAP experience (post-RAP). The first self-assessment was completed during the students' mandatory orientation to the program, and the subsequent assessments were distributed via emails to all program participants. There was no tangible benefit to students for completing the surveys. Survey completion was completely voluntary, though strongly encouraged. To maintain anonymity during data analysis, participant responses were coded by a student-supplied identifier code. Students' names were collected only to match their responses with their respective research mentors, and were only available to the PI. After the initial survey, we requested that students complete the subsequent surveys voluntarily. Due to the small number of students belonging to certain under-represented minority groups, such as Native Americans or Native Hawaiian/Pacific Islanders, within each cohort, we did not collect any demographic data from survey participants to protect their identities as per the suggestion of our campus Institutional Review Board, who reviewed and ultimately approved all data collection procedures (IRB Protocol Number: B14509018Q).

DATA ANALYSIS

Because Likert-based data are ordinal, a standard parametric repeated measures analysis of variance is not appropriate for analyzing these data. In addition, examination of descriptive statistics and normality tests for each questionnaire item at each assessment time point revealed significantly non-normal (usually negatively skewed) score distributions, also obviating the use of a parametric analysis. Instead, we used Friedman's test – the non-parametric equivalent of a repeated measures single factor analysis of variance – to examine changes in the students' responses to each of the 23 questionnaire items across the three assessment time points. A separate analysis was run for each item. If Friedman's test revealed a significant change in ratings over time for a particular item, we used Wilcoxon's signed rank test with the appropriate Bonferroni correction ($\alpha = 0.05/3 = .017$ for null hypothesis rejection) as a post-hoc test. Friedman's test ranks each individual's response to a given item across the three assessment time points; lower ratings are given low-value ranks and higher ratings are given high-value ranks. The ranks are then averaged across individuals at each time point, and evaluated for significant differences in the mean ranks. If the students' Likert scale responses for a particular item increase over time – as we hypothesized they would for most items – then the mean ranking for that item should also increase over time. Note that mean ranking for the Friedman's test is not the same as the median Likert response for that item. Because of the relative "bluntness" of a median as a measure of central tendency, it is possible for the median Likert responses for two time points to be the same, but for the Wilcoxon post-hoc test to show the ratings for those two time points to be significantly different. Therefore, we report below the Friedman rankings of each item rather than the median Likert responses for that item.

RESULTS

Across the 2014-15, 2015-16, and 2016-17 academic years, 68 students completed the modified SALG assessment at all three time points. (N = 20 for year 1, N = 21 for year 2, and N = 27 for year 3). The data analysis included data from only these 68 students, which may bias the outcomes toward positive results: there is a higher probability that students who completed all three assessments were more invested in their RAP experience than those who did not. The surveyed students participated in a broad range of research projects spanning both STEM and non-STEM disciplines, thus justifying our use of the modified SALG instrument instead of a STEM-focused instrument like the URSSA (Hunter et al., 2009).

The Friedman's analyses indicated a significant effect of assessment time for all 23 questionnaire items. Eighteen of the items showed a pattern we describe as "early gains", i.e., a significant increase in the item's mean ranking from the pre-RAP to the mid-RAP assessments, then no significant increase from mid-RAP to post-RAP. The other five items showed a pattern we describe as "continual gains", i.e., significant increases from pre- to mid-RAP and again from mid- to post-RAP.

Table 1 shows the items for which we observed continual gains, along with the mean ranking of that item in the Friedman's test at each time point. These tended to be items that required students to develop somewhat sophisticated skills or conceptual understanding. Relating their projects' concepts and ideas to classes *outside* of their research topic's area requires students to develop a fairly advanced understanding of the topic and of the concepts in the unrelated courses. Similarly, being able to identify patterns in data requires developing general skills in pattern recognition. Being able to recognize and develop sound arguments based on evidence and knowing how to write documents in discipline-appropriate style require continual, consistent practice.

Table 2 shows the items for which we observed early gains. In contrast to the skill items that showed continual gains, students showed early gains in the somewhat simpler skills of preparing presentations about their research and in working effectively with others, a skill that may have developed prior to college. However, the students also showed early gains in skills that

Table 1. Questionnaire items showing continual gains. The numbers in the last three columns are the mean ranking of that item in Friedman's test. Item ID numbers indicate the item domain: U= items that assessed students' understanding of their project; S= items that assessed students' acquisition of skills

Item #	Item text	Pre	Mid	Post
U3	At this point of my research project, I understand how the ideas in my project relate to ideas I have encountered in classes outside of this subject area.	1.46	2.06	2.49
S3	At this point of my research project, I can identify patterns in data.	1.44	2.11	2.45
S4	At this point of my research project, I can recognize a sound argument and appropriate use of evidence.	1.46	2.10	2.44
S5	At this point of my research project, I can develop a logical argument.	1.53	2.03	2.44
S6	At this point of my research project, I can write documents in discipline-appropriate style and format.	1.55	2.07	2.38

Table 2. Questionnaire items showing early gains. The numbers in the last three columns are the mean ranking of that item in the Friedman's test. Item ID numbers indicate the item domain: U= items that assessed students' understanding of their project; S= items that assessed students' acquisition of skills; A = items that assessed students' attitudes toward their projects; L= items that assessed the students' ability to integrate what they learned from the RAP experience into other experiences.

Item #	Item text	Pre	Mid	Post
U1	At this point of my research project, I understand the main concepts of my project.	1.25	2.26	2.49
U2	At this point of my research project, I understand how the ideas in my project relate to ideas I have encountered in other classes within this subject area.	1.38	2.20	2.42
U4	At this point of my research project, I understand how my research project can help me address real world issues.	1.53	2.22	2.26
S1	At this point of my research project, I can find articles relevant to a particular problem in professional journals or elsewhere.	1.42	2.21	2.37
S2	At this point of my research project, I can critically read articles about specific issues.	1.46	2.18	2.37
S7	At this point of my research project, I can work effectively with others.	1.71	2.07	2.23
S8	At this point of my research project, I can prepare and give oral and poster presentations.	1.59	2.04	2.37
A1	At this point of my research project, I am enthusiastic about my project topic.	1.66	2.18	2.16
A2	At this point of my research project, I am interested in discussing my project topic with friends or family.	1.70	2.13	2.18
A3	At this point of my research project, I am interested in taking or planning to take additional classes in this subject.	1.68	2.15	2.18
A4	At this point of my research project, I am confident that I understand project topic.	1.40	2.21	2.40
A5	At this point of my research project, I am confident that I can work in this topic.	1.54	2.14	2.32
A6	At this point of my research project, I am comfortable working with complex ideas.	1.59	2.13	2.29
A7	At this point of my research project, I am willing to seek help from my mentor and/or other students working with the same mentor.	1.71	2.13	2.16
L1	At this point of my research project, I am in the habit of connecting key ideas I learn in my project with other knowledge.	1.33	2.26	2.40
L2	At this point of my research project, I am in the habit of applying what I learn in my project to other situations.	1.38	2.23	2.40
L3	At this point of my research project, I am in the habit of using systematic reasoning in my approach to problems.	1.41	2.18	2.40
L4	At this point of my research project, I am in the habit of using a critical approach to analyzing data and arguments in my daily life.	1.40	2.20	2.40

one might have expected would need time to develop: finding and critically reading literature relevant to their projects.

DISCUSSION

The "understanding" items in the "early gains" category require the students to either understand the basic concepts of their projects – which understanding should be obtained relatively early – or to relate project ideas to more familiar experiences than unrelated classes. The students also showed early gains in all of the items that assessed their attitudes (enthusiasm for; interest in; confidence with) about their projects. For three of these items (A1, 2, and 7) this appeared to result from a ceiling effect: Median response to these items increased from a 4 to a 5 from pre- to mid-RAP assessment and could go no higher in the post-RAP assessment. These items were more subjective in nature, in that they reflected the student's excitement about the project and their comfort levels with the mentor. The other attitude items reflected the students' confidence in their work and comfort with complex ideas, and their interest in taking additional classes in the subject of the research project which, presumably, was either in or related to their majors.

All four items that assessed the students' ability to integrate what they learned in the RAP experience with their other academic experiences showed early gains. This is somewhat surprising, as each of these items asked the students to assess the degree to which they had attained certain habits of mind. Presumably, this would need time to develop, particularly in freshmen and sophomores. Perhaps the significant increase in responses to these items from pre- to mid-RAP reflects a better understanding of the questions rather than early gains in those habits of mind.

It is important to remember that these data are self-reported; students may not be the best estimators of how well they have achieved each of the assessed skills and knowledge areas.

For instance, the observed early gains in finding and critically reading literature relevant to the RAP projects may reflect students' overestimation of their growth in those skills rather than a true rapid maturation. In the future it will be useful to correlate students' self-reported skill and knowledge development with similar ratings from mentors, much as Hunter, Laursen, and Seymour (2007) did to qualitatively assess summer research programs in the STEM disciplines on four different campuses. In order to do so we would need to develop a parallel assessment instrument and/or interview protocol for mentors, particularly one that applies to research within and outside of STEM disciplines. There are plans to implement this step in the near future, examine the points of congruence and incongruence between the students' and mentors' evaluations, create testable hypotheses about any observed incongruences between those, and ultimately develop a better support system for both mentors and mentees. We already have data (Chan, Bhattacharyya, & Meisel, 2018) to show that participation in RAP significantly impacts student retention, especially for underserved student populations. We also plan to assess other long-term educational impacts of RAP, as well as evaluate whether students' perceptions of skills gain change as they continue with their college careers.

Despite the shortcomings described above, self-reporting of learning gains remains a generally accepted method for assessing learning from undergraduate research (e.g., Hunter et al., 2009; Schmitz & Halvholm, 2015), and as such, our work can help inform further development of RAP or similar programs on other campuses. For example, it would be useful for mentors to know that they need to work consistently over the course of the project with their students' skills in developing sound arguments based in evidence, whereas students feel more confident in their basic presentation skills relatively early in the experience. Tracking the effects of student engagement in one or more HIPs at different stages of college career is becoming an important assessment tool on our campus, and it would be beneficial to be able to document the long-term effects of early engagement in undergraduate research.

Most published work assessing learning gains from undergraduate research (e.g., Hunter et al., 2007; 2009; Lopatto, 2004; Seymour, Hunter, Laursen, & DeAntoni, 2004) describe self-reported gains by students after a period of immersion in research activities. While these works demonstrate the benefits of research-related activities, to our knowledge, this is the first reported attempt to assess differences in the relative *rates* of increase in skill and knowledge gains associated with early engagement in undergraduate research. To develop these important skills fully, both students and mentors need appropriate support. Knowing the timeline of progression allows program administrators to advocate for and secure the necessary resources to procure these supports.

CONCLUSION

Early engagement in research is beneficial for students, especially for students of opportunity on multiple levels (e.g., Carpi et al., 2017; Eddy & Hogan, 2014; Freeman et al., 2014; Laursen, Seymour, & Hunter, 2012; Lopatto, 2010; Nagda et al., 1998; Sweat et al., 2013; Yeager and Walton, 2011). While most of the published work has focused on undergraduate research in the STEM disciplines, here we show that even novice researchers working on a wide range of STEM and non-STEM projects with little or no disciplinary background or prior research experience can perceive the gains they made in skills and content knowledge from being engaged in mentored research for an extended period of time.

Students experiencing early immersion in undergraduate research showed different rates of self-perceived gain in relevant skills, attitudes, and conceptual understanding. Some gains, such as increased confidence in presentation skills, were made within a relatively short time. Other gains, such as improved ability to identify patterns in data and to develop logical arguments, took longer. Mentors might optimize their guidance of research students by, for example, providing early support of presentation skills, and then shifting focus toward the development of logical arguments later in the experience. Such selective focus should make the experience more manageable for mentors and also provide "just in time" support and instruction for developing researchers.

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Appendix: Survey Questionnaire

(we used a Likert-like scale as shown below for the following questions)

N/A	Not at all	Just a little	Somewhat	A lot	A great deal

Understanding

U. At this point of my research project, I understand...

- U1 The main concepts of my project
- U2 How the ideas in my project relate to ideas I have encountered in other classes **within this subject area**
- U3 How the ideas in my project relate to ideas I have encountered in classes **outside of this subject area**
- U4 How my research project can help me address real world issues

Skills

S. At this point of my research project, I can...

- S1 Find articles relevant to a particular problem in professional journals or elsewhere
- S2 Critically read articles about specific issues
- S3 Identify patterns in data
- S4 Recognize a sound argument and appropriate use of evidence
- S5 Develop a logical argument
- S6 Write documents in discipline-appropriate style and format
- S7 Work effectively with others
- S8 Prepare and give oral and poster presentations

Attitudes

A. At this point of my research project, I am...

- A1 Enthusiastic about my project topic
- A2 Interested in discussing my project topic with friends or family
- A3 Interested in taking or planning to take additional classes in this subject
- A4 Confident that I understand project topic
- A5 Confident that I can work in this topic
- A6 Comfortable working with complex ideas
- A7 Willing to seek help from my mentor and/or other students working with the same mentor

Integration of learning

L. At this point of my research project, I am in the habit of...

- L1 Connecting key ideas I learn in my project with other knowledge
- L2 Applying what I learn in my project to other situations
- L3 Using systematic reasoning in my approach to problems
- L4 Using a critical approach to analyzing data and arguments in my daily life

Major (optional; possible responses: "Yes" or "No")

What best characterizes your major in college?

1. Major in the same discipline as your project
2. Not a major in the same discipline as your project
3. Undecided at this time
4. Plan on becoming a major in the same discipline as your project
5. Plan on becoming a major in another discipline