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Assessment of students' perception of research in an honors thesis preparation course

Avaliação da percepção sobre pesquisa dos alunos de distinção do curso sobre pesquisa

Evaluación de la percepción investigadora de estudiantes distinguidos del curso a la investigación

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Abstract
Identifying student's perception of research activity can provide important practical implications to effectively recommend and facilitate research opportunities for students. Through two surveys applied at the beginning and end of an undergraduate honors orientation class we conducted a qualitative and quantitative study to assess the students' knowledge and perception of research. The survey questions were repeated in two different semesters, and students were taught research related content. Even though 48% of the students did not have any research experience and a minority (12%) had more than a year of research experience, a large portion of the students could explain many research related words, such as plagiarism, citations, google scholar, and primary source, but a few words could not be recognized by the students, such as predatory journal, preprint, ORCID and publons. The most frequent answers provided by students when asked about their perception of researcher skills included the word motivation, followed by creativity and communication. Students' confidence in their knowledge and research-related skills increased over the semester consistent with other studies that show the value of a structured introduction to research for building student confidence.
Keywords: Research experiences for undergraduates; REU; SoTL; Higher education; Perceptions of research.

Resumo
Identificar a percepção dos alunos sobre a atividade de pesquisa pode fornecer importantes implicações práticas para recomendar e facilitar oportunidades de pesquisa para os alunos. Por meio de duas pesquisas aplicadas no início e no final de um curso de orientação honrosa de graduação, realizamos um estudo qualitativo e quantitativo para avaliar a percepção dos alunos sobre a pesquisa. A pesquisa foi repetida em dois semestres diferentes, e os alunos aprenderam conteúdos relacionados à pesquisa. Embora 48% dos alunos não tenham experiência em pesquisa e uma minoria (12%) tenha mais de um ano de experiência em pesquisa, grande parte dos alunos conseguiu explicar muitas palavras relacionadas à pesquisa, como plágio, citações, google acadêmico, e fonte primária, mas algumas palavras não puderam ser reconhecidas pelos alunos, como periódico predatório, preprint, ORCID e publons. As respostas mais frequentes dadas pelos alunos quando questionados sobre sua percepção das habilidades de pesquisador incluíram a palavra motivação, seguida de criatividade e comunicação. A confiança dos alunos em seus conhecimentos e habilidades relacionadas à pesquisa aumentou ao longo do semestre, consistente com outros estudos que mostram o valor de uma introdução estruturada à pesquisa para aumentar a confiança do aluno.
Palavras-chave: Iniciação científica; IC; SoTL; Educacao superior; Percepções de pesquisa; Abordagens para aprender.

Resumen
Identificar las percepciones de los estudiantes sobre la actividad de investigación puede proporcionar importantes implicaciones prácticas para recomendar y facilitar oportunidades de investigación para los estudiantes. A través de dos encuestas aplicadas al inicio y al final de un curso de orientación de honores de pregrado, realizamos un estudio cualitativo y cuantitativo para evaluar la percepción de los estudiantes sobre la investigación. Esta investigación fue repetida en dos semestres y los estudiantes aprendieron contenido relacionado con la encuesta. Aunque 48% de los estudiantes no tiene experiencia en investigación y una minoría (12%) tiene más de un año de experiencia en investigación, la mayoría de los estudiantes pudieron explicar muchas palabras relacionadas con la investigación, como plagio, citas, google academic y fuente primaria, pero los estudiantes no pudieron reconocer algunas palabras,

como diario depredador, preprint, ORCID y publons. Las respuestas más frecuentes dadas por los estudiantes cuando se les preguntó sobre su percepción de las habilidades del investigador incluyeron la palabra motivación, seguida por creatividad y comunicación. La confianza de los estudiantes en sus conocimientos y habilidades relacionados con la investigación aumentó durante el semestre, en consonancia con otros estudios que muestran el valor de una introducción estructurada a la investigación para aumentar la confianza de los estudiantes.
Palabras clave: Curso de pregrado; SoTL; Educación superior; Percepciones de la investigación; Enfoques del aprendizaje.

1. Introduction

Student participation in the learning process as part of a group provides numerous benefits to the student's professional formation. Studies have shown that some of these benefits are increasing engagement, motivation, and facilitating the analysis of problems (Chinaglia & Paula, 2022; Greenberg & Martins 2022; Martins et al. 2021). These skills are only part of a global set that are sought by professionals in the marketplace.

Undergraduate research is one way to achieve such skills while still in school, and it is a high impact educational practice where students can have hands-on experience with a particular subject and increase their employability (Carpenter et al., 2021). Research experiences for undergraduates (REU) can be defined as any teaching and learning activity in which undergraduate students are actively engaged with the research content, process, or problems of their discipline (Zimbardi & Myatt, 2012). In addition to increasing student's employability, multiple recent studies have shown many other student benefits from REU, such as improvements in student learning, satisfaction, and higher levels of graduation (Brown et al. 2020; Fischer et al. 2021; McMahan, 2015). There are also some challenges and barriers to REU implementation (Brew & Mantai, 2021). For instance, there are not enough research positions for all the students who should engage in research as undergraduates and those from advantaged backgrounds are more likely to engage in research (Pierszalowski et al. (2020). Identifying students' perception of research activity can provide important practical implications to effectively motivate and facilitate research opportunities for students.

High achieving students may seek out research opportunities that allow them to complete a thesis project to graduate with honors. Other students may be high achieving in their courses but do not have the knowledge or mentoring needed to seek out research experience, thus losing out on this important skill set and the opportunity to achieve honors status. The objective of this study was to evaluate perception of research by high-achieving students who are interested in completing a thesis and achieving high or highest honors.

2. Methodology

2.1 Research method

This research was conducted at University of Florida, United States, a large research-intensive university, where research opportunities for teaching and learning are a priority. To assess student perceptions of research we conducted two surveys during two semesters (Fall 2021) and (Spring 2022) in an undergraduate course offered in the College of Agriculture and Life Sciences (CALS), ALS3923 "Honors Orientation". The survey questions followed recommendations of Pereira et al. (2018). The course is required for the CALS Honors Scholars Certificate, which is offered to students with a declared major in the college who have at least 60 credits towards graduation (upper division status), and a GPA of 3.75 or greater. To complete the 9-credit Honors Certificate, students must take additional honors courses and complete an honors thesis. Identical pre- and post-course surveys were used to identify areas where students lacked knowledge and confidence regarding research. The students in the course were expected to be involved with research or to arrange to start participating in research during or the semester following the course. Students were from more than 12 different life and social science majors. This was a hybrid course; therefore, the surveys were distributed both with physical and electronic copies. Students were asked to answer 13

questions related to research (Table 1).

Table 1 - Open-ended and multiple-choice questions employed in the reflection part of this study. For the multiple choice, the answer options are written in italics. *Students were not timed to complete the surveys, and participation was voluntary.

Question number	Question & *Answer Options* (*italics*)*
1	Have you conducted any research before and for how long? *a. None; b. Yes, for less than 6 months; c. Yes, more than 6 months and up to a year; d. Yes, more than 1 year*
2	Do you have any experience with scientific writing? *a. Yes, I even have peer review publication(s); b. Yes, but I don't have a scientific publication, although I am working on one now; c. Yes, I have written research proposal(s); d. Yes, I have a publication. Not a peer reviewed publication, but abstracts published in conferences/symposiums, capstone, articles in magazines, etc.*
3	Have you ever presented the results of your research? *a. Yes, in an international conference; b. Yes, in a national conference; c. Yes, in a conference in my state; d. Yes, in a local conference/symposium/meeting; e. Never presented the results of a scientific research.*
4	Underline all the names you are familiar with: *Editor; Digital Object Identifier (DOI); ResearchGate; Preprint; Loop; GoogleScholar; Google Academic; Web of Science; Peer Review Process; h-idex; Mendeley; Citations i10-index; ORCID; Open access; Publons; Impact factor; Predatory Journal; Editor-in-Chief; EndNot Web*
5	From question 4, how many of the names do you have firsthand experience with? For example, you know what DOI is and you have one DOI associated with your name.
6	What skills do you consider essential to start a research project?
7	On a scale of 1(low) to 10 (high), how do you rate your knowledge as a Researcher?
8	In order of importance, list three characteristics that you believe are important in a researcher.
9	On a scale of 1(low) to 10 (high), how confident are you in evaluating the credibility of an information source?
10	On a scale of 1(low) to 10 (high), how confident are you in your scientific writing skills?
11	On a scale of 1(low) to 10 (high), how confident are you in verbally communicating scientific ideas?
12	On a scale of 1(low) to 10 (high), how do you rate your knowledge of the contents of an honors thesis?
13	What is the purpose of an honors thesis? List 1 to 3 reasons one might complete an honors project.

Source: Authors.

2.2 Data collection and data analysis

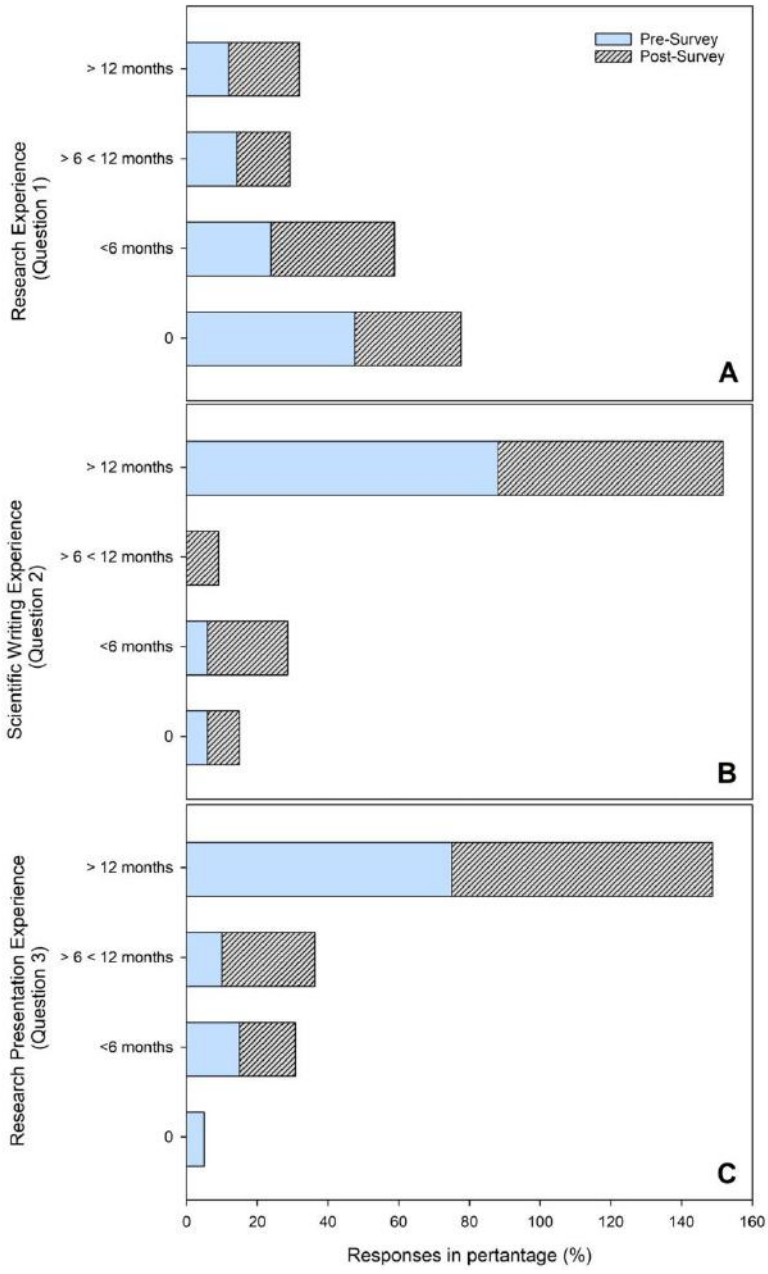
All activities conducted in this research were approved by the Institutional Review Board, with the service survey number IRB202102903. Qualitative data included open-ended and multiple-choice questions to understand student experiences with the research topic. Quantitative analysis of the data was performed by Mann-Whitney Rank Sum test to compare the answers to questions 7, 9, 10, 11, 12 in the pre- and post-surveys. Pearson's correlation coefficients (r) were applied to evaluate the strength of the relationships between the answers to questions 7, 9, 10, 11, 12 and students' individual grades. SigmaPlot® version 14.5, RStudio (RStudio Team, 2020), and wordcloud package (Ian Fellows, 2018) were used for data analysis and artwork.

3. Results and Discussion

3.1 Student hands-on research experiences

When students were asked about their research experiences, at the beginning of the course 48% did not have any experience, and a minority (12%) had more than a year of research experience (Figure 1A).

Figure 1A-C - Multiple choice questions 1 (A), 2 (B), and 3 (C) from the survey applied at the beginning (pre-survey) and end of the course (post-survey) (Table 1). The surveys were applied in two semesters (Fall 2021 and Spring 2022) for an honors orientation undergraduate course.



Source: Authors.

However, by the end of the course, 20% of students reported having more than a year of research experience, and 30% did not have research experience, suggesting that about one fifth of students who did not have any research experience starting their research experiences during the course. Indeed, students who are not involved in research are highly encouraged to find an opportunity during the course. Some students work in research programs as employees and may not consider themselves researchers, but are encouraged to transition to independent research to prepare for their thesis project.

Regarding the scientific writing experience, most of the students reported having more than a year of experience (88% in the pre-survey and 64% in the post-survey) (Figure 1B). Additionally, there was an increase in writing experience by the students for the amounts of 6 and 12 months by the end of the course. Because more students reported experience with scientific writing than with research, they are likely including course-required writing, including writing a mock introduction to their thesis that is required in this course.

Likewise, most of the students indicated that they had more than 12 months of research presentation experience (75% in the pre-survey and 74% in the post-survey) (Figure 1C). Moreover, an increase in research presentation experience was observed by the students for the 6- and 12-month periods, likely because the course also required a short presentation on their proposed research.

3.2 Student experiences with research related words

Students were also asked about research related words that they could explain (Table 2).

Table 2 - Summary of the responses for question 4 from the survey. The values varied from 0 to 100 (%) for words that students could explain. The surveys were applied in two semesters (Fall 2021 and Spring 2022) for an honors orientation undergraduate course at the beginning and end of the course. *Students could only choose from the words provided in question 4 (Table 1).

*Keywords	Could explain	
	Beginning (%)	End (%)
Plagiarism	100.0	78.9
Citations	93.8	63.2
Google Scholar	87.5	78.9
Primary source	81.3	63.2
Review Article	31.3	47.4
Peer Review Process	25.0	57.9
Pubmed	25.0	52.6
Open Access	18.8	47.4
EndNote Web	12.5	42.1
Zotero	12.5	26.3
Web of Science	6.3	57.9
Mendeley	6.3	0.0
Predatory Journal	0.0	10.5
Preprint	0.0	0.0
DOI	0.0	31.6
ORCID	0.0	0.0
Publons	0.0	0.0

Source: Authors.

Some of the terms were covered in the course, but others were not. Many of the students could explain the words plagiarism, citations, google scholar, and primary source (100 to 81%), and that percentage was maintained at the end of the course (79 to 63%), although with slight differences (Table 2). The students assessed in this study belong to a research-based institution and many were already involved in research or likely exposed to these topics in other courses, including research methods courses. Overall, there was an increase in the percentage of students who could explain the words assessed. A portion of students over the course of the semester decided that they could not explain the word that they thought they could explain. One example is the word citation that at the beginning 94% could explain the word, but this percentage decreased to 63% at the end of the course, suggesting that increased exposure to this term introduced complexity to their understanding. No student could explain the words predatory journal, preprint, DOI, ORCID and publons at the beginning of the course, and these topics were largely not discussed in the course. Topic explicitly covered in the course included citations, Google Scholar, primary source, review article peer review process, EndNote Web, and Web of Science. Exposing students to these terms, even if not explained, may trigger recognition when they see them in other contexts and increase familiarity.

3.3 Student perception of research

The open-ended questions 6, 8, and 13 from the survey (Table 1) were applied to the students to determine what skills the students believe to be essential to start a research project (question 6), what are important researcher skills (question 8), as well honors thesis skills (question 13) (Figure 2).

Figure 2 - Open-ended questions (# 6, 8, and 13) from the survey applied at the beginning (pre-survey) and end of the course (post-survey) (Table 1). The size of each word is proportional to the number of times students cited it. For example, bigger words are the ones that were cited more times. The surveys were applied in two semesters (Fall 2021 and Spring 2022) for an honors orientation undergraduate course.

Source: Authors.

At the beginning of the course, students believed that the characteristic understanding research followed by motivation are most important for researchers. By the end of the course, student perception reduced to a small number of keywords, and the top characteristics were critical thinking and motivation, followed by organization and communication.

Students may have realized during the semester that research is about gaining understanding through critical thinking rather than having that skill at the outset.

Regarding researcher skills, motivation was the most frequent answer both at the beginning and end of the course, followed by creativity and communication, respectively, for the post- and pre-survey. Surprisingly, the word motivation appeared at the beginning and end of course surveys for both questions 6 and 8 in the survey, which are related to the research project and research skills. These students typically fill their schedules with courses, paid work, and volunteer/leadership activities, therefore, prioritizing research over their other activities can be challenging. Their choice of the word motivation shows that they understand that the research product can be proportional to the time and energy invested.

When students were asked about the importance of an honors thesis the most frequent word was experience, which appeared both at the beginning and at the end of the course. Additionally, the words, graduate, discover, and networking were mentioned in both surveys. Most of the students in the course will go on to graduate or professional school, and they view gaining research experience as an important or required experience for their career goals. Similar responses have been obtained from students from different cultures. For example, a study with Japanese students about their research perception showed that the words and themes collaboration, learning process, and knowledge construction process were present among students (Imafuku et al. 2015).

3.4 Student self-rated research performance & course performance

In the pre- and post-survey from Table 1, students were asked to use a scale, which varied from 1 (low) to 10 (high) to rate the following subjects: (1) their knowledge of research (question 7); their confidence in evaluating the credibility of an information source (question 9); their confidence with scientific writing skills (question 10); their confidence with verbally communicating scientific ideas (question 11); their knowledge of the contents of an honors thesis (question 12). A summary of student answers to each question is presented in Table 3.

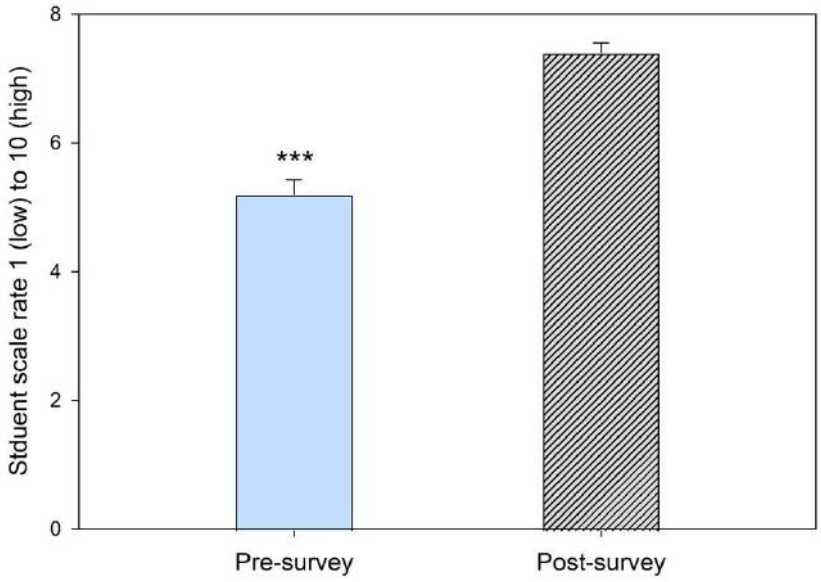
Table 3 - Summary of the responses for questions 7, 9, 10, 11, and 12 from the survey. The values varied from 1(low) to 10 (high) for the questions and 0 to 100 for the grades (last column on the right). The color gradient varied from red (lower values in each question) to blue (higher values in each question). The surveys were applied at two semesters (Fall 2021 and Spring 2022) for an honors orientation undergraduate course. *nr = no response was obtained from the student in the survey.

Student	Question #7		Question #9		Question #10		Question #11		Question #12	
code	Beginning	End	Beginning	End	Beginning	End	Beginning	End	Beginning	End
12-F	4	5	7	8	6	8	4	7	3	8
14-S	*nr	5	nr	7	nr	6	nr	6	nr	9
7-S	2	4	3	7	1	4	4	8	2	7
4-F	3	7	7	8	6	7	6	8	3	8
7-F	2	6	4	7	3	7	3	7	2	8
10S	nr	7	nr	8	nr	6	nr	7	nr	4
9-S	nr	6	nr	7	nr	4	nr	8	nr	6
6-F	4	7	6	7	4	6.5	5	7	1	8
1-S	5	nr	5	nr	5	nr	5	nr	5	nr
12-S	4	6	8	9	7	7	9	10	4	8
2-S	5	nr	7	nr	7	nr	7	nr	6	nr
10-F	6.5	6	4.5	6	6	7	7	6	4.5	8
13-F	6	6	8	8	9	8	4	7	5	5
1-F	3	6	8	9	9	9	10	9	2	9
3-F	2	8	5	9	4	7	3.5	8	1	9
5-F	4		9	nr	5	nr	5	nr	6	
15-F	nr	4	nr	8	nr	7	nr	7	nr	8
8-S	nr	8	nr	9	nr	10	nr	8	nr	9
6-S	nr	9	nr	10	nr	8	nr	10	nr	10
3-S	6	4	4	8	6	6	4	7	3	8
2-F	3	8	7	10	7	8	7	7	6	9
8-F	6	7	8	9	6	8	6	7	3	nr
4-S	6	nr	7	nr	6	nr	9	nr	8	nr

Source: Authors.

Student ratings increased by 43% in the post-survey compared to the pre-survey, suggesting that the course content contributed to increasing students' knowledge and their confidence on the topics examined (Figure 3).

Figure 3 - Mann-Whitney Rank Sum test was used to compare the answers to questions 7, 9, 10, 11, and 12 between the pre- and post-surveys. The value used was the average among the questions for each student. The data presented are from surveys that were applied in two semesters (Fall 2021 and Spring 2022) for an honors orientation undergraduate course. ***Significant at the 0.001 probability level by Mann-Whitney Rank Sum test. The line on each bar represents ±SE.



Source: Authors.

Although different definitions can be found in the literature, according to Panadero et al. (2016), self-assessment can be defined as a "wide variety of mechanisms and techniques through which students describe (i.e., assess) and possibly assign merit or worth to (i.e., evaluate) the qualities of their own learning processes and products" (p. 804). Andrade (2019) added that the purpose of self-assessment is to generate feedback that promotes learning and improvements in performance. In this course, students are involved in peer review activities that promote critical thinking and are intended to help students in the assessment of their own work. In the process, they may also gain confidence in their knowledge and ability to present their research in written and verbal forms.

4. Conclusion

In this study we assessed student perception of research in an undergraduate course that prepares students to complete an honors thesis. More than half of the surveyed student were already involved in research when they joined the course and the students were familiar with most of the research related words, across a diversity of students' majors. Therefore, these high-performing students at a research-intensive university were already in good position to successfully complete honors thesis research. The course promoted engagement by the students who had not yet pursued a research position and an increase in confidence in their knowledge of research-related skills. The learning gains may be expected to be even greater when offered to a more varied student population. Course-based undergraduate research experiences (CURE) are another mechanism by which students can be engaged in research early in their academic career. The findings from this study are consistent with research on CURE courses that shows the value of a structured introduction to research for building student's confidence in their ability to conduct research (Martin et al. 2021; Szteinberg et al. 2013). Future studies of students' perception regarding research in other countries and education systems will complement the findings obtained in this study.

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