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A Mixed Methods Study of Undergraduate Research Motivations at the University of Nebraska Omaha (UNO)

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A MIXED METHODS STUDY OF UNDERGRADUATE RESEARCH MOTIVATIONS AT
THE UNIVERSITY OF NEBRASKA OMAHA (UNO)

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ABSTRACT

Undergraduate research provides unique experiences and skill sets that are applicable in various careers. However, there has been an increasing need for greater diversity among researchers, namely undergraduate researchers, and the motivations behind undergraduate research participation need to be further explored. The purpose of this study was to identify the demographic information of undergraduate students at the University of Nebraska at Omaha (UNO), and what motivations were the most prevalent in undergraduate research at UNO. A mixed-methods approach was utilized through a quantitative portion and a qualitative portion. The quantitative portion was a web-based survey which gauged for 22 independent variables, the central variables being race/ethnicity, gender, and severity of disability. The surveys acquired 111 respondents' and results were analyzed through correlations and ANOVA's. The qualitative portion utilized six in-depth interviews with UNO undergraduate students and were coded for common themes. Survey results indicated that there is a significant, negative correlation between the severity of disability and research interest among many other significant results with various independent variables. Common themes throughout the interviews included intrinsic motivation, gender bias, and racial/ethnic bias. Overall, this study confirmed that demographic factors affect who pursues research and that intrinsic motivation is a leading factor as to why undergraduate students pursue research. Accommodations in research spaces, increasing awareness of research opportunities on campus, positive faculty/student relationships, and funding for undergraduate research should be greatly considered.

Key terms: undergraduate research, diversity, bias, intrinsic motivation, extrinsic motivation

In the United States, minority groups have historically been denied opportunities in higher education and advancement in intellectual spaces, and more attention has been brought to this issue of a lack of minorities in research, often among people of color, women, people with disabilities, etc. (Carnevale, Smith, and Melton 2011). In a similar vein, individuals and families with lower household incomes tend to have less opportunities in extracurricular participation at universities for a variety of reasons, ranging from lack of funds for schooling to the access of networking opportunities provided by social institutions such as universities (Stevens 2019). This study will investigate the demographics and the motivations of undergraduate students conducting extracurricular research at the University of Nebraska at Omaha (UNO).

BACKGROUND

Although the rates of minorities in research have been steadily increasing over the years, there is still a call for greater attention on the subject (Eagan et al. 2013). People from more diverse backgrounds offer more diverse perspectives and opinions in research (Diaz 2012). Individuals from differing backgrounds typically offer insight in research spaces that may be otherwise missed. Institutions, such as universities and governmental institutions, offer access -or the lack thereof- in higher education, typically in the form of scholarships, funding, and networking. Such institutions may gate-keep access to resources and education which often create unequal opportunities for students, especially in the field of research (Perrella, Dam, Martin, MacLachlan and Fenton 2020).

Women and Racial Minorities in Research

The subject of women and racial minorities in research has been a long-contested subject for many decades. The National Center for Science and Engineering Statistics (2017) reports that only 31% of STEM (Science, Technology, Engineering, and Math) fields in the U.S. are

occupied by white women, and women in a racial/ethnic minority make up a much smaller percent of that statistic. Women and those in racial/ethnic minorities are less likely to remain in undergraduate research experiences than their male and white counterparts (Cooper et al. 2019). Students in underrepresented racial minorities (namely Native American, Black and Hispanic/Latino populations) are just as interested in research and STEM careers, but still struggle with finding undergraduate research experiences and even graduating with a bachelor's degree (Eagan et al. 2013). Undergraduate students with intersecting identities, such as black women, report even greater difficulty acclimating to research spaces and experience greater rates of bias and exclusion (Morton 2020).

Researchers with Disabilities

There is very little data regarding the role of researchers with disabilities within the field of research, especially at the undergraduate level. Lillywhite and Wolbring (2019) found that there is a deficit in literature when discussing student researchers with disabilities. Disabled undergraduate students typically find difficulties in research participation, and there is very little literature that can guide policy and accommodations for students with disabilities. Likewise, there is a dearth of faculty researchers with disabilities as well. Lillywhite and Wolbring (2019) mention financial assistance, lack of accommodations, bias, and stigmatization as being factors that deter undergraduate students with disabilities from pursuing research, and that there needs to be more research in this area to shape better policies surrounding this issue. Additionally, Gow, Mostert, and Dreyer (2020) found that undergraduate students with specific learning disabilities in South African higher education typically expressed a fear of stigmatization, varying experiences depending on the department of study, and greater community support leading to more successful outcomes.

Motivations

Varying levels of motivation contributes to research participation, namely extrinsic and intrinsic motivation. Intrinsic motivation is defined by the desire or passion to pursue something, whereas extrinsic motivation includes external factors that may move someone to complete an action, these factors possibly being money, food, credit, etc. (Reiss 2012). Intrinsic and extrinsic motivation is often thought of as separate concepts, buts they may work together to increase interest in a particular subject. It has been found that students with high levels of both extrinsic and intrinsic motivation are the most likely to pursue research. Similarly, students who fear failure (failure avoidant) are less likely to pursue research. Thus, understanding how to motivate students is important to understanding why they participate in research (Smith et al. 2014).

Faculty and Student Relationships

Faculty and student relationships are also found to be significant in undergraduate research. Morales et al. (2017) found that faculty mentors that enjoyed working with undergraduate students, had worked longer with undergraduate students, received more funding, had more research experience, and worked with more disabled or black undergraduate students were more likely to be productive in their research. In other words, strong faculty and undergraduate relationships are beneficial to both the faculty mentor and the undergraduate student, as the student gains more skills and experiences, and the faculty mentor tends to be more productive in their work. Faculty are found to have a profound impact on the facilitation of knowledge, research, and inquiry for undergraduate students, and faculty who focus on research participation and preparation are more successful in facilitating research and inquiry among undergraduate students (Perrella et al. 2020).

Regarding research within UNO, a study by Ammons, Barone, and Powell (2018) focuses on UNO undergraduate students and research. This study utilized a mixed methods approach to understand who is receiving FUSE grants (Fund for Undergraduate Scholarly Experiences), which is the largest source of funding for UNO undergraduate researchers. This review found that research among FUSE students is thriving at UNO, but women are receiving fewer FUSE grants compared to men, thus greater considerations need to be taken when considering women in research.

Theoretical Framework

Much of the theoretical framework of this study draws on one of the three main theories of sociology: symbolic interactionism. More specifically, theory is drawn from Pierre Bourdieu and Michèle Lamont when discussing culture, group boundaries, and inequality. Theory drawn from James Coleman and the idea of self-determination is also considered in this study.

Symbolic power. Pierre Bourdieu's theory of inequality is of note to this study as it provides more context to how grand social structures are influential to the outcomes of individual lives. His main theory regarding symbolic power is particularly pertinent to this study. Bourdieu posits that culture and class are reinforced through capital, fields, and habitus, which could influence students to gravitate towards or away from research due to their social circumstances (Wynn 2021).). Capital is the status that is gained in some capacity (wealth, a college degree, etc.), fields are where capital is exchanged (i.e., universities), and habitus describes learned dispositions that play into how capital is obtained and what fields the individual enters. These three concepts are linked together, creating a triangular relationship (Wacquant 2006).

Bourdieu's theory on culture and class rests more on symbolic interactionism, where relationships between entities in society are interpreted through meaning, and that everything in

our society provides some meaning to its relevance and existence. Bourdieu particularly focuses on universities and academic institutions with how capital, fields, and habitus play a role in who participates in universities and how that is determined. The implication is that beyond wealth, people who are more likely to obtain degrees (capital) from universities are more likely to enter fields where they have more opportunities and are more likely to learn the habits (habitus) that make them more qualified candidates for careers (Wacquant 2006). One example of Bourdieu's theory can be applied to an individual who is code-switching. A minority who is unable to effectively code-switch in the proper environment risks their advancement and reputation depending on their environment (Wynn 2021).

Social capital. James Coleman also draws on the idea of capital, more specifically, the role of social capital in other forms of capital (human, physical, and financial). Social capital is defined as a variety of entities that generate relationships among each other which facilitates the function of society. Coleman (1988) discusses three forms of social capital: expectations, information channels, and social norms. Expectations are transactions of any sort will be repaid equally in some form, and less expectations lead to more social disorganization. Information channels are how information is distributed and obtained through relations, and norms are internalized rules in society (Coleman 1988). Undergraduate students who are unable to access the proper channels of information (such as professional connections), meet the expectations required of them, and are unaware of the norms of research spaces will find it much more difficult to pursue research than someone who is already familiar with research spaces.

Group boundaries. On a broader scale, Michèle Lamont's theory of group-thinking and the establishment of boundaries is also applicable to this study. Boundaries define the symbolic delineations that are adopted by social structures. Cultural markers serve as a reminder of group

boundaries and serve to demarcate groups from one another. For example, clothing may be used to delineate a wealthy person from a poor person. These also reinforce symbolic boundaries and how people use symbolism and intangible means to dictate their status and their mobility among classes. Symbolic boundaries may even become so important that they can become social boundaries, such as a rift between two nations and its citizens (Lamont and Molnár 2002). Lamont's theory on group boundaries relates to symbolic interactionism in that this theory analyzes the meaning of relationships in society and its reflection of social structures (Lamont and Molnár 2002). The study of how groups establish symbolic boundaries and how that plays into minorities, class, and status are important to understanding stigmatization and of our social structures (Lamont 2018). In essence, groups create boundaries and unequal access to resources, could also influence how certain groups have access to opportunities such as undergraduate research. For example, faculty mentors often serve as gatekeepers to who can pursue research and how they treat their undergraduate research mentees (Wynn 2021).

Self-determination theory. Similar to the theories of capital and group-thinking, the self-determination theory is a model which proposes that external factors could play a part in intrinsic motivation. In other words, having high levels of extrinsic motivation and intrinsic motivation is possible, and the two forms of motivation could play off each other. For example, a student could have the passion to research a specific topic, and proper funding and community support could motivate them further to pursue research. Likewise, a student may have the intrinsic motivation to pursue an opportunity, but the lack of support from their community may discourage them from pursuing the opportunity (Smith et al. 2014).

Current Research

Although there has been some literature pertaining to research motivations, there is a gap within the literature when specifically analyzing diversity within undergraduate research and the intersection between research motivations and demographics. There is an especially significant gap when researching the role of researchers with disabilities and if research opportunities provided to people with disabilities are accessible and equitable, let alone at the undergraduate level (Lillywhite and Wolbring 2019). This study aims to gain insight on the opportunities that UNO provides to undergraduate students for research and if they are equitable opportunities. It will also aim to understand the various perspectives of other students and what they may feel is important to them and their communities.

A mixed methods approach will be utilized for this survey, with a quantitative aspect and a qualitative aspect. For the quantitative portion, a short, internet-administered survey will be distributed to various research undergraduate students on campus by collecting simple demographic data (age, race/ethnicity, gender, year in school, major, severity of disability, financial support, employment, and political affiliation), as well as research experience. The demographic information of students, especially when pertaining to race/ethnicity, gender, and the severity of disability will provide insight on the opportunities that are made available to students based on their perceived identities and status.

For the qualitative portion, 6-8, one hour long, recorded in-depth interviews will be conducted with various current and former UNO undergraduate students who have conducted research and will gauge for their research experiences and motivations. Interviewing students about their personal experiences will also provide perspectives on other factors that may have influenced their decisions on pursuing research at UNO, such as intrinsic/extrinsic motivation and faculty/student relationships.

Analyzing the diversity of the undergraduate student population at UNO would be mutually beneficial for students who may not have had the chance to pursue research, and for faculty who may appreciate more diverse perspectives in their work. Inquiry of research motivations serve to find solutions to understanding how to reach out to more diverse populations at UNO as well as how to increase greater motivation for extracurricular work, especially when understanding how to reach out to those who typically do not have access to such opportunities.

METHODS

Sample

The target population for the first portion of this study were students who are currently enrolled as undergraduates from the University of Nebraska at Omaha (UNO) or were previously enrolled as undergraduate students at UNO within the past 10 years. Surveys were distributed electronically through convenience sampling by sending the survey link out in emails to students on the behalf of various UNO professors and organizations. The survey was open for 12 days, and a total of 111 undergraduate students completed the survey ($n = 111$).

The second portion of this study focused on current or previous UNO undergraduate students who have completed research in some capacity during their time as an undergraduate. The interviews were set up through snowball sampling by reaching out to students that I know who have conducted research at UNO. Six total interviews were conducted within a one-week window ($n = 6$).

Data Collection

The data for the first portion of this study was conducted through a short online survey set up through Qualtrics, gauging for demographic information, research participation, and extrinsic motivation for research. A survey was best suited for this portion of the study as a short electronic survey is straightforward, short, and relatively simple to distribute as it was shared online (refer to Appendix A).

The second portion of this study utilized interviews to collect data on research motivations (refer to Appendix C). The interviews were approximately 1 hour long, recorded through Zoom (a virtual meeting software), and were transcribed using machine-generated captions through VidGrid. Interviews were best for this portion of the study as it allowed a deeper exploration of research experiences and motivations which can be gained through in-depth conversation and drawing common themes and connections.

Measures

For the survey portion, two dependent variables were measured:

- *Research Participation*: defined as whether the student participated in any form of undergraduate research outside of the classroom setting.

- *Research Interest*: defined as the undergraduate students' interest in pursuing research, whether or not they have completed undergraduate research.

The survey measured 22 independent variables. The main three variables of focus were race/ethnicity, gender, and severity of disability.

- *Age:* The age of the participant in years.

- *Race/ethnicity*: Race is a social construct which is defined as the physical characteristics that are shared among individuals within a group. Ethnicity is defined as groups of people who are identifiable by their shared culture, language, and norms.

Race and ethnicity were grouped into one category as it broadens the category and allows the participant more freedom to self-identify. Multiple races/ethnicities were allowed to be selected (i.e. Hispanic/Latino, Asian, etc.).

- *Gender*: A socially constructed norm that typically classifies people as man, woman, or a nonbinary individual. Participants were allowed to self-identify as well.

- *Chronic illness/Disability status*: Disability is defined as a socially perceived impediment that may or may not affect the individual in a significant capacity in their daily life. Chronic illness is a disease or condition that is pervasive and enduring in an individual's daily life that affects them for at least a year or longer. Chronic illness and disability were grouped because they both have the potential to significantly affect the health and daily life of an individual. Participants were able to mark "yes" or "no" when asked if they have a chronic illness or disability.

- *Chronic illness/Disability severity:* If the participant reported having a chronic illness/disability, they were asked how much their illness/disability affects their daily life on a 5-point scale, ranging from "Not impact" to "A great deal".

- *Year in school:* The number of years the participant completed while enrolled as an undergraduate student at the University of Nebraska at Omaha. Participants were selected from seven categories, ranging from "First year" to "Fifth year or more", and also included "Non-Traditional" and "Alumni" options.

- *College major*: The subject or area of focus that the participant chose to pursue while completing their Bachelor's degree. This survey specifically measured the categories of majors (i.e., grouping biology and chemistry in the "natural sciences" category).

Participants were allowed to select from 11 categories (i.e. business/finance, social sciences, etc.).

- *Financial support:* The amount of perceived monetary support that the participant either receives from their family or if the participant is able to sufficiently support themselves. Participants were asked if they felt they were sufficiently financially supported.

- *Political affiliation:* The perceived political identity of an individual on the political spectrum. Five answer choices ranging from "Very conservative" to "Very liberal".

- *Hours worked a week:* The number of hours that the participant spent at their place of employment. Six answer choices were provided, ranging from "40 hours or more" to "Not employed".

- *Extracurricular participation:* The number of extracurricular activities that the participant was engaged in, excluding coursework, employment, and research experiences. Four answer choices were provided, ranging from "1" to "4 or more".

Participants who participated in research at UNO were asked about their relationships within the lab:

- *Relationship with lab mentors*: The individuals' perceived importance of their interactions with their lab mentor (either faculty or graduate mentors) and how that impacted their research experience.

- *Relationship with lab peers*: The individuals' perceived importance of their interactions with their colleagues in the research lab and how that impacted their research experience.

The respondents who answered the two questions above were given three answer choices ("Somewhat important", "Very important", and not working with peers/mentors). Participants who did not participate in research at UNO were asked how significant in their decision to not pursue research from three answer choices, ranging from "Very important" to "Not important at all", from the following categories:

- *Work obligations:* The commitment of attending to and completing the duties of employment.

- *Family obligations*: The commitment of attending to the duties of the family.

- *Stress within the lab*: The perceived amount of tension or pressure that an individual may receive in the research environment.

- *Health issues:* The individual's perceived difficulties in maintaining their wellness.

- *Excessive coursework:* The amount of coursework the participant receives.

- *Perceived bias from faculty/peers*: The participant felt that faculty or peers favored some students over others, either within the lab or when choosing who will participate in the lab.

- *Lacking connections:* The participant did not know who to contact or where to access information regarding research opportunities at UNO.

- *Lack of interest in research***:** The participant is not interested in research.

- *Lack of interest in UNO research opportunities:* The participant is not interested in the research offered at UNO.

- *Unrelated to career goals:* Research experience is not relevant for the career path of the participant.

The main dependent variables in the interviews were research motivations and the quality of research experiences. Research motivations are intrinsic and extrinsic motivation, as well as other factors that may influence undergraduate students' participation and experience in research. The quality of research experiences includes positive or negative research experiences, how the research was pursued, safety and representation on campus, and the possibility of bias. Independent variables included gender status, disability status, race/ethnicity, age, majors/minors, extracurricular participation, year in school, financial status, and the type of research the participant engaged in (FUSE grant, assisting a professor or graduate student, thesis/capstone work, research through employment, individual research, etc.).

Analysis

The surveys were analyzed through the IBM SPSS software using bivariate analyses, specifically using Pearson's correlations and the analysis of variance (ANOVA). Bivariate analyses were used to gauge whether there was a relationship between undergraduate research participation or research interest and the 22 independent variables that were being tested (i.e. race/ethnicity). Statistical significance testing was utilized to confirm the significance of the correlations and ANOVA, specifically if the relationships found had a high likelihood of occurring. The interviews were initially open-coded, and then were further analyzed through focus-coding to observe common themes among the interviews. Themes of interest included motivations, demographic factors, and experiences in research.

Ethics and Safety

Informed consent was provided to all participants in both the interviews and the surveys. All participants in the final survey agreed to the terms of the informed consent. Both interview and survey participants were able to retract their participation at any time during the study (refer

to Appendix B). Interview participants were provided the consent form both before and during the interviews, and verbal consent was also obtained (refer to Appendix D). There are no risks associated with this research study.

Five of the six interviews were completed through a virtual, recorded Zoom call and one interview was recorded in a public location (the campus library) using Zoom software. Recordings and transcriptions of the interviews were only used for coding purposes and were only visible to me. The surveys did not collect any names or any personal identifying information. Since the survey was completed electronically, I was not able to see who completed the survey, so the results are anonymous.

RESULTS

Quantitative

The survey gathered a total of 111 responses. Pearson correlations were used for independent ordinal variables and a one-way analysis of variance (ANOVA) were used for independent nominal and interval variables. As seen in Table 1, a majority of the respondents were white (71.0%) and female (70.6%). 33.3% of the respondents in the sample identified as having a chronic illness or disability. 30 respondents conducted research while being an undergraduate student at UNO.

Table 1: Frequencies for Central Variables

Variable	*f*	*%*
Research Participation		
Yes	30	29.4
No	72	70.6
Total	102	100.0
Research Interest		
Not interested at all	15	14.7
Slightly interested	37	36.3

Moderately interested	15	14.7
Very interested	20	19.6
Extremely interested	15	14.7
Total	102	100.0
Race/Ethnicity		
White	71	71.0
Hispanic/Latino	16	16.0
Non-White	13	13.0
Total	100	100.0
Gender		
Female	72	70.6
Male	21	20.6
Other	9	8.8
Total	102	100.0
Disability Status		
Yes	34	33.3
No	68	66.7
Total	102	100.0
Severity of Disability		
No impact	1	2.9
Some impact	10	29.4
Moderate	15	44.1
A lot	8	23.5
Total	34	100.0

Table 2: Descriptive Statistics for Demographic Variables

Variable	*M*	*SD*	*Range*	*N*
Research Participation	.29	.46	0-1	102
Research Interest	2.83	1.31	1-5	102
Race/Ethnicity	1.45	0.76	1 – 3	100
Gender	1.48	.92	1 – 5	102
Disability Status	1.67	.47	1-2	102
Severity of Disability	2.97	.97	1-5	34
Age	20.6	36.0	1 – 112	107
Year	4.14	1.76	1-7	102
Major	3.74	1.56	1 – 6	102
Financial Support	1.85	1.09	1 – 4	102
Political Affiliation	3.56	0.78	1 – 4	102

Central Variables. The central independent variables for this study were race/ethnicity, gender, and severity of disability. Of the three central variables and the two dependent variables, there was one significant result, in which there was a significant, negative correlation between severity of disability and interest in research, $r(100)= -.27$, $p < .01$. There were no significant results between research participation and severity of disability [$F(3, 28) = 1.450$, $p = 0.233$], but respondents with more severe disabilities were less likely to pursue research than respondents with less severe disabilities.

Although the results of race and participation research were not statistically significant, there was a trend in which respondents who identified as white were less likely to participate in research (28.2%) compared to respondent's who identified as Hispanic/Latino (37.5%) or non-white (30.8%). Similarly, results of research interest and race were not found to be statistically significant [$F(2, 97) = 0.125$, $p = 0.883$], and Hispanic/Latino respondents were slightly more likely to be interested in research than white respondents and non-white respondents.

The relationship between research participation and gender was not found to be significant [$F(2, 99) = 0.529$, $p = 0.59$], but female respondents were slightly less likely to have conducted research (27.8%) compared to male respondents (28.6%) and respondents who self-identified as other genders (44.4%). Respondents who identified as other genders were less likely to be interested in research (66.6%) than male respondents (38.1%) and female respondents (52.8%).

Remaining independent variables. Of the 19 remaining independent variables that were measured, four yielded significant results through correlations. It was found that there were significant, positive correlations with research interest and greater lab stress ($r(100)= 0.32$, $p <$ .01) and research interest and research being unrelated to their career goals ($r(100)= 0.32$, $p <$

.01), such that respondents were less likely to be interested in research if they experienced

greater stress in the research lab or if they did not find that research was related to their career

goals. There was a significant, negative correlation with research interest and lacking

professional connections ($r(100)$= -0.30, p < .01), such that respondents who lacked professional

connections were less likely to be interested in research. The fourth variable with a significant

correlation with research interest was the number of hours worked per week, but this variable

was not counted as the question was not mutually exclusive and did not consider the hours

worked per week of the alumni who answered the survey.

Among the 19 remaining independent variables that were measured, six yielded

significant results through a one-way ANOVA.

Table 3: Between-Group ANOVA for Significant Variables

Dependent Variable	Independent Variable	Df	Sum Sq.	Mean Sq.	F-Value	P-Value
Participation	Extracurricular participation	2	1.959	0.979	5.046	.008
Participation	Political affiliation	2	1.566	0.783	3.953	.022
Interest	Financial support	1	12.9821	12.981	8.053	.006
Interest	Lack of connections	2	10.958	5.479	3.673	.031
Interest	Stress in lab	2	11.018	5.509	3.722	.030
Interest	Unrelated to career	2	11.466	5.733	3.869	.026

It was found that there was a significant effect on greater extracurricular participation and

research participation [F(2, 99) = 5.046, p = 0.008], such that respondents who participated in

more extracurricular activities tended to participate in conducting research. There was also a

significant effect on political affiliation and research participation [F(2, 99) = 3.953, p = 0.022],

such that respondents who identified as having liberal beliefs participated in research more than

participants who did not identify as liberal.

There were also observable effects with research interest. It was found that there was a significant effect on greater financial support and research interest [$F(1, 100) = 8.053$, $p = 0.006$], such that respondents who were financially supported tended to be more interested in conducting research. Significant effects were also observable between interest and the following variables: connections [$F(2, 64) = 3.678$, $p = 0.031$], stress within the research lab [$F(2, 63) = 3.722$, $p = 0.030$], and relation to career goals [$F(2, 64) = 3.869$, $p = 0.026$]. Respondents who either lacked professional connections, experienced stress within their research lab, or did not see research being applicable to their career goals also tended to be less interested in research.

Respondents who reported being involved in conducting research were also asked the importance of the relationships in their research lab. Of the 28 out of 30 respondents who conducted research, 71.4% of them of reported that they found their relationships with their lab mentors as "very important", whereas 7.1% of them did not work with any mentors. 57.1% of the 28 respondents also reported finding the relationship with their lab group as being "very important", while 17.9% did not work with any lab groups.

Qualitative

Six total people were interviewed about their undergraduate research experiences (URE's). Five participants identified as female and were between 20-22 years of age. One participant identified as male and was 27 years of age. Three out of six respondents were in a racial minority, and two respondents reported having a chronic illness.

Table 4: Participant Information.

Participant Number	Age	Racial/Ethnic Identification	Gender Identity	Disability Status	Year at UNO	Major
1	21	Asian (Indian)	Female	No	4th	Bioinformatics, Biology

2	22	Asian (Chinese)	Female	No	Masters, 1st	Molecular and Biomedical Biology
3	22	White/Hispanic	Female	Yes	Masters, 1st	Psychology
4	21	White	Female	No	4th	IT Innovation, Communication Studies
5	22	Hispanic/Latino /White	Female	No	5th	Political Science, Sociology
6	27	White	Male	Yes	Masters, 1st	Biology, Neuroscience

Primary Themes

Among the themes that were noted throughout the interviews, intrinsic motivation, perceived bias against gender, and the need for greater racial/ethnic representation in URE's were brought up repeatedly across the interviews conducted.

Intrinsic Motivation. When asked about the main motivations to pursue research, it was found that intrinsic motivation was one of the greatest motivating factors for pursuing undergraduate research. A common point that was brought up throughout all interviews was that the participants were curious or passionate about a certain subject and wanted to learn more about the subject. Participant 1 noted that they were interested in increasing technological literacy and accessibility in clinical work which motivated them to pursue research.

> I really ended up liking bioinformatics and one of the major ways that it fits into clinical practice is through research. Also, working in those research labs, you notice like there's some people that don't understand the computer literacy involved in research nowadays. So, making those tools more accessible in the clinical sphere basically it leads to better research outcomes and thus better patients.

Participants also indicated that they enjoyed the atmosphere of research and how it expands on their skill set. Participant 2 noted that they enjoyed the skills that were attained through research.

> What I learned so far has been pretty fun for me. What I love about research is the push for critical thinking and the many variables that you're juggling, considering when it goes into solving a problem or troubleshooting an issue that you may have when answering a question. I really love how detailed focus you have to be about [research] and how much stock goes and intention goes into each choice that you make.

Extrinsic motivation was also a subject of interest, although it was not the first motivation that was mentioned when participants were asked about research motivations. Generally, research being required for the major, program, or career goal of the participant contributed to the participant's decision to pursue research. Participant 1 notes that "My motivation for research] kind of started out in that it's a requirement, like one of those requirements for pre-med." Similarly, Participant 3 stated that they wanted to go to graduate school for their degree, and that they incidentally were accepted into a research lab when researching their degree.

> I knew I wanted to go to grad school by the time I got to UNO, and I learned about the program and stuff. I'm also just kind of a, what do they call it? A yes man, I say yes to everything. I was sitting in my Psych 2 lecture, and we got an email, which said that [a professor] was looking for undergraduate research assistants. I was like, I like IO Psychology, so I should do that. So I just showed up to a little interview with her. At first, [research was not related to my career goals]. And then I realized when it got [to the research lab], [research] what I was supposed to be doing. I really got lucky that I just like stumbled upon this opportunity.

Gender Bias. As five out of the six participants identified as female, gender bias in the undergraduate career and research was a common sentiment. Four of the six participants have mentioned that gender representation was important in their undergraduate research, and two of these participants reported that they have felt some form of gender discrimination on campus. One evident theme was that STEM majors tended to lack the representation of women which made it more difficult for some participants to feel a sense of belonging with their field.

Participant 4 spoke about how the lack of female representation in STEM majors discouraged her from pursuing the engineering field.

> I felt unrepresented. I used to be an electrical engineering major in my first year and there was probably only one person who did not identify as a man in my classes. And even my professor like would make comments about [me] and how I'm not typical engineering major, and the way that [my major] was set up did not seem conducive for me to excel. So I constantly felt like I had to prove myself and my gender, which was really annoying, especially when I wanted to change majors. For computer science, again, there were majority men in those classes and it's like they don't know how to talk to people of other identities. My goal was learning, but sometimes [it was difficult]. I was having to deal with that very different culture compared a lot of my other non-computer science classes.

Participant 6 also noted that they observed gender bias in research spaces, especially considering who is leading the research space.

> I feel like I saw some favoritism of male students over female students, depending on who might be heading a lab research project. All I can say is, there obviously was more of one and the other in each lab.

Certain participants felt more represented in their research labs regarding their gender, as having female faculty mentors and peers made them feel more comfortable in their research. Participant 3 emphasizes that having more female peers in their lab was beneficial for them with the support and care they provided throughout their undergraduate career.

> I've talked to [my mentor] about like imposter syndrome feeling guilt and things that are typically more with women, like apologizing too much. I asked her for feedback, and she built up my confidence a lot. They were telling me that I was doing the job right and they were really understanding… [My lab] has really good intentions for me and also wants to push me outside my comfort zone.

All participants reported that they felt safe on campus. However, one participant reported that they were sexually harassed by their boss in their research lab, and when the harassment was reported, the report was not taken seriously, and that the participant was to continue working with the boss. For the sake of confidentiality, this participant does not wish to be identified.

Racial/Ethnic Representation. Participants in a racial minority generally reported it being more difficult to pursue or remain in research. Generally, the lack of racial/ethnic representation related to the participants' race and ethnicity made the participants feel that they did not belong, especially when their peer's displayed ignorance towards their racial and ethnic identity. Participant 1 mentioned two experiences in which they felt singled out due to their race and ethnicity when on campus, which tainted their undergraduate experience.

> There were a couple of other things… [Once], I was sitting down taking a break and this guy came up to me and he asked, oh, where are you from? And I said, Omaha. And then he asked, oh, where were you born? And I said, you're Switzerland. And he asked, oh, where were your parents, parents from? He kept going. I just felt like this kind of weird and rude.

The lack of representation of racial and ethnic minorities tended to be obvious for interviewee's who were in racial/ethnic minority, which led to feeling underrepresented. Participant 2 noted that they felt a lack of representation on campus.

> I would say [that I don't feel represented] … I definitely feel like that obviously there's not a lot of Asian Americans that attend UNO…I think I felt kind of like underrepresented in that realm, but at the same time, it's like, it's been my entire life just growing up in Omaha.

Participant 5 noted that racial and ethnic representation was necessary in the field of research, especially when the research revolved around other minority groups.

> I feel like there really needs to be more representation of minorities doing research. Because right now, I feel like research is predominantly white people doing this research for minorities. And I feel like that's bias and it doesn't feel very personal to [the researchers]. It doesn't necessarily have to be that way, but to me, it just feels like if you're going to learn something about in an area of expertise, you kind of have to represent the community or have some background information [of that community].

Secondary Themes

Among the primary themes, there were a few underlying themes that were uncovered throughout the interviews, including time and funding, requirements across majors, professional connections, and relationships within the lab.

Research funding and time. When asked about factors that could have influenced their decision to pursue research, three out of the six participants mentioned that funding for research was needed throughout their undergraduate research experiences. Participant 4 noted that the FUSE grant (Fund for Undergraduate Scholarly Experience) was integral for them to continue their undergraduate research.

> The FUSE grant is kind of a game-changer, especially for me. My funding was running out for my position. And so that was kind of a way for me to continue to be connected [to research]. I think being able to do [research] and being able to do [research] more than once is really great.

Participant 1 also noted that funding was important for them to continue their research and that the lack of funding made them feel exhausted for the amount of work they conducted in the lab.

> I think what would have made me more motivated to do more work in my research lab is to be paid, to be honest…I would say not getting paid is a big, really big thing for me. [For me], there is especially like almost a $10,000 [difference] compared to other the other students that they are paying… I feel like it's a lot of work on top of what they expect us to do, especially for me, they're not paying me much compared to the other students. On top of that, you have to work [unpaid] for 40 hours a week in the summer.

Differing Requirements. Each major and program had varying requirements which tended to be consistent among interviewees with similar academic backgrounds. Participants in a STEM field often reported that. Participant 1, who was in the pre-medicine program at UNO, stated that they initially pursued research because "it's a requirement for pre-med". Participant 5, who was in a non-STEM major, reported that they pursued research as they saw the need for greater accessibility to basic resources and wanted to research how to increase equitable access to various opportunities geared for success.

> I saw a lot of issues that were happening everywhere around me… I went through a lot of different situations in my personal life that made me ask for a lot of assistance. I felt like I needed to do more to inform people off all these different opportunities that are available all around them.

Connections. Having professional connections, or the lack thereof, aided undergraduate students in finding research opportunities. Interviewees who tended to lack connections reported that finding research opportunities were more difficult. Participant 6 felt that lacking connections made it more difficult for them to find research opportunities.

> I had no idea who to reach out to. It just seemed like in general, a lot of people don't have the time or funding built in to take people on… [One of my professor's] just happened to have the right connections. I think one of the barriers [in research] is not having connections. If I wasn't in the Honors Program and I didn't have connections with a faculty member, it would have been a huge barrier. I don't know how a student would reach out to 30 different professors who may or may not even see your email. I think another big barrier is if what you're really interested is not something that's at the institution you're in, it makes it that much harder as an undergraduate to do any research on it.

Lab Relationships. All participants reported that relationships with peers, mentors, and advisors were very important to them. Generally, positive relationships with their lab and mentors generally made the participants feel more comfortable with asking questions about their research projects and aided in the success of their research. Alongside commenting on racial and ethnic representation on the UNO campus, Participant 2 also noted that the encouragement from her peers and professor motivated her to continue research.

> Yes, there is an under-representation in that atmosphere it's been in place that it hasn't really like prevented me from doing anything, if that makes sense. It's a weird thing because if you place me in a different atmosphere with maybe more representation, maybe I'd be a little more courageous and to starting, but at the same time, other factors of just a professor believing in me and having that encouragement and one-on-one that UNO offers, I think has led me into starting as early as I did.

However, some participants reported feeling anxious when approaching their faculty mentor and may not have met their faculty mentor often as they worked with graduate students. Participant 3 reported feeling scared to approach their faculty mentor and that it made their research environment more "nerve wracking".

> My relationship with my faculty advisor was a healthy fear. I was very scared of like any meeting I had with her. I was like super nervous. She's the director of the program I wanted to apply to, so

the stakes were really high. I did not want to embarrass myself… If I needed like help understanding something, I'd always ask my [graduate] mentor because it was just less intimidating.

DISCUSSION

The findings of this study support the first hypothesis that certain demographic factors affect who pursues research, and the second hypothesis that intrinsic motivation is a leading factor as to why people pursue research. A consistent theme among the survey and the interviews is the need for funding in undergraduate research, need for professional connections and opportunities, intrinsic motivations driving the pursuit of undergraduate research, and positive faculty/student relationships.

An important takeaway from the quantitative portion of the study was that the severity of disability affects people's decision to pursue research. This calls for considerations of how research labs and spaces are accommodating people with disabilities, and if their concerns are being taken seriously. The need for researchers with disabilities in the research space is much needed, in which inclusive and empowering research strategies would greatly contribute to the number of people with disabilities in research (Kitchin 2010). A study conducted by Grundy, McGinn, and Pollon (2005) employed inclusive practices for researchers who were hard-of-hearing (HOH) or deaf, which including transcribing interviews and meetings, lowering voices during meetings, recording meetings, and informing other members of the research team of the applicable accommodations. Ultimately, the efforts for greater inclusion and accessibility for the researchers that were HOH or deaf contributed to greater success in their research study, which displayed that awareness and inclusion of researchers with disabilities would create more successful outcomes in the realm of research.

Unfortunately, there was not a strong link between race/ethnicity and research participation and interest, and likewise for gender status. A few factors may have contributed to this. The survey received a majority of respondents who identified as white or female, which may not have been representative of the general population. Factors such as age, major, and year in school may have also contributed as confounding factors as a majority of the survey respondents were between the ages of 20-22, were in the social sciences, and were in their fourth year. However, slight effects were observed, in which Hispanic/Latino students were more likely to be in research and have greater interest for research, and students who did not identify as male or female were also more likely to display interest in and participate in research. This is unusual compared to existing literature on minorities as researchers, but the finding is interesting nonetheless and may signal that the rate of minorities in research is steadily increasing which would be promising in the rates of diversity and diverse perspectives in undergraduate research.

Results for faculty and student relationships were consistent across the interviews and surveys, in that relationships within the research lab were found to be very important for undergraduate researchers. Moreover, positive relationships between faculty and students led to more successful research outcomes. This could be attributed to students feeling more comfortable asking questions to their mentors, feeling that it is okay to make mistakes, and feeling that they could approach their mentor when needing guidance. This confirms existing literature on faculty and student relationships and the success of research, in that faculty, in a sense, gatekeep knowledge and access to research opportunities (Perrella et al. 2020). Universities should consider how their faculty structure their research labs and how accessible faculty are towards their students.

Professional connections in the university were revealed to be important when accessing research opportunities. Students who did not know who to contact or how to get into a research lab reported it being more difficult to pursue research. One issue to consider is how faculty are informing their students of research opportunities, if faculty are approachable enough to inform inquiring students of research opportunities, and if universities are advertising their research opportunities frequently. Although results for bias and favoritism in research spaces were insignificant, both in the surveys and interviews, it would be interesting to further analyze if undue bias was perhaps a factor as to how students are chosen to participate in certain research labs.

Financial compensation for research work should also be greatly considered. Generally, participants in this study reported that funding was important for them to continue their research, and that participants who did not receive funding or have enough financial support were less likely to be interested in pursuing research. This confirms existing studies in which faculty mentors and students that received more funding tended to have more successful research outcomes (Morales et al. 2017). One reason for this may be that undergraduate students who have little financial support often must work during their undergraduate career to pay for their tuition and living expenses, which may limit their available time for extracurricular research. Research opportunities that offer funding or job benefits (such as healthcare, living expenses, etc.) would be more beneficial for undergraduate students who need greater assistance paying for their bills and expenses.

A particular strength of this study is the mixed-methods approach in understanding the undergraduate research and participation at UNO. The quantitative portion of this study gathered base details and demographic information on undergraduate students at UNO, whereas the

interviews expanded on the themes that were discovered in the surveys and served to confirm many of the survey findings. The mixed-methods approach allowed for greater insight into the realm of undergraduate research and what is required to increase greater participation in research at UNO.

Limitations and Future Directions

There are a few limitations to this study. A majority of the respondents in the surveys and interviews were either white, female, in their early 20's, or a social sciences major. It would be preferable to survey and interview a wide range of respondents so that results could be more generalizable. Gathering more responses for the survey and the interviews would have created a more generalizable sample to the population, and due to the time constraints of this study, there was a limited number of respondents that could have been acquired.

Some of the survey questions were also not applicable to certain respondents. For example, the question regarding the hours of work per week were only geared towards current undergraduate students and did not consider alumni students. Alumni students are more likely to work in full-time employment than current undergraduate students, so the connection between research participation and hours worked per week were skewed. However, the results of these questions were not considered in results.

Future directions for this study may include further analyzing the intersections of minority status and extracurricular participation, such as what motivations may be more prevalent across certain minority groups and how certain demographic factors (gender, race, age, etc.) may intersect to create unique experiences in research spaces. A longitudinal study on minorities conducting research over a few years to observe the rates of minorities entering research would be another future proposal and would contribute to existing literature on

minorities in research. Another potential study may observe the effects between financial compensation and undergraduate research. Regarding the gap in literature regarding researchers with disabilities, much needed studies could gather data on the experiences of researchers with disabilities in the research lab, as well as the prevalence of accommodations in research and research motivations.

Conclusion

Undergraduate research is an important asset to students, professors, and universities at large. Increasing diversity and ultimately, diverse perspectives within research allow for greater insight on complex subjects. Likewise, increasing access to research opportunities on university campuses also allow for undergraduate students to further their careers and gain an invaluable set of skills. This study found a relationship between demographic variables and undergraduate research participation, as well as highlighting the prevalence of intrinsic motivation and extrinsic factors that contribute to undergraduate research experiences. A call for greater accommodations in research spaces and garnering inclusive practices would increase the number of minority students and especially people with disabilities in research spaces. Increasing awareness of research opportunities, a greater focus on positive faculty and student relationships, and providing more funding for undergraduate research opportunities are also factors that should be considered when approaching the subject of undergraduate research.

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APPENDICES

Appendix A: Survey Questions

<u>Research Motivations Survey</u>

1. What is your age, in years?
    a. *Drop-down menu ranging from 19-85 or older. 18 was marked as ineligible to take the survey.*
2. What gender identity do you best identify as?
    a. Female
    b. Male
    c. Nonbinary
    d. Prefer to self-identify: _____
3. What is your race/ethnicity (check all that apply):
    a. American Indian or Alaskan Native
    b. Asian
    c. Black or African American
    d. Native Hawaiian or Other Pacific Islander
    e. Hispanic or Latino
    f. White
    g. Other: _____
4. What year are you currently completing?
    a. First Year
    b. Second Year
    c. Third Year
    d. Fourth Year
    e. Fifth year or more
    f. Non-traditional student
    g. Alumni-graduated within the past 10 years
5. What major(s) are you completing at UNO? (Check all that apply)
    a. Humanities
    b. Social Sciences
    c. Natural Sciences
    d. Business/Finance
    e. Engineering
    f. Information Sciences & Technology
    g. Fine Arts
    h. Communications
    i. Public Affairs/ Community Service
    j. Education Health/Human Sciences
    k. Other: ____
6. Are you currently working?
    a. Yes, more than 40 hours a week
    b. Yes, 30-40 hours a week
    c. Yes, 20-30 hours a week
    d. Yes, 10-20 hours a week

  e. Yes, less than 10 hours a week

  f. No

7. Do you feel that you are properly supported financially, either by yourself or from your family members?

  a. Yes

  b. No

8. Do you currently have any chronic illnesses or disabilities?

  a. Yes

  b. No

9. (Yes to 8) How much does your illness or disability impact your daily life?

  a. No impact

  b. A little

  c. A moderate amount

  d. A lot

  e. A great deal

10. How would you describe your political affiliation?

  a. Very conservative

  b. Somewhat conservative

  c. Moderate/Center

  d. Somewhat liberal

  e. Very liberal

11. How many extracurricular activities are you involved in (excluding job or research experiences)?

  a. 1

  b. 2

  c. 3

  d. 4 or more

12. How interested are you in pursuing research?

  a. Not interested at all

  b. Slightly interested

  c. Moderately interested

  d. Very interested

  e. Extremely interested

13. Are you currently conducting any extracurricular research at UNO, or have conducted research in the past? This includes but is not limited to: any research grants (i.e. FUSE), assisted a professor or student in research, or completed a poster presentation.

  a. Yes

  b. No

14. If you answered "yes" to question 13, what type of research have you pursued?

  a. FUSE grant

  b. Assisted professor or student in research

  c. Honors contract

  d. Work-related research

  e. Personal research outside of the course

  f. Other: ____

15. *If answered "yes" to question 12:* In regards to the success of your research, how important was your relationship with your mentor(s)? Mentors include professors, graduate students, or any other individual that you worked under.
    a. Somewhat important
    b. Very important
    c. I did not work with any mentors.
16. *If answered "yes" to question 12:* In regards to the success of your research, how important was your relationship with your lab group?
    a. Somewhat important
    b. Very important
    c. I did not work with any lab group.
17. How easy do you feel it is to partake in conducting research?
    a. Extremely difficult
    b. Somewhat difficult
    c. Neither easy nor difficult
    d. Somewhat easy
    e. Extremely easy
18. *If answered "no" to question 12:* How much did the following items factor into your decision not to pursue research? (matrix question; very important, somewhat important, not important at all):
    a. Work obligations
    b. Family obligations
    c. Health-related issues (including mental health/stress related issues)
    d. Too much coursework
    e. Lacking connections with professors or students
    f. Too much stress within research lab
    g. Favoritism or bias from professors or peers
    h. Lack of accommodations in lab
    i. The research I am interested in is not supported by UNO.
    j. Research is unrelated to career goals
    k. Not interested in the research opportunities offered at UNO
    l. Other: _____
19. What are some suggestions you have to make it easier for UNO undergraduates to partake in research?
    a. Open ended: _____

Appendix B: Survey Consent Form

This research study is part of the course requirement for my Senior Thesis course, taken by all UNO Sociology majors. I am collecting original data because I would like to know more about the association between undergraduate demographic information and extracurricular research motivations. In order to participate in this study, you must be either **1) <u>currently enrolled</u> as an undergraduate at the University of Nebraska at Omaha (UNO)**, or **2) was previously enrolled as an undergraduate student <u>within the past 10 years</u> at UNO. Additionally, you need to be at <u>least 19 years of age</u> to take this survey.**

You will be asked to provide demographic information about yourself and information regarding your participation at UNO. This study asks you to provide information about yourself. There are no known risks to this study. Instead of being in this research study, you can choose not to participate. Additionally, you can withdraw from this research study at any time before, during, or after the research begins.

Reasonable steps will be taken to protect your privacy and the confidentiality of your study data. The only persons who will have access to your research records are myself and my instructor. The information from this study may be published in a research paper for course credit, but your identity will be kept strictly confidential.

You are freely making a decision whether to be in this research study. Clicking "yes" below means that you have read and understood this consent form, and you have decided to be in the research study. If you have any questions during the study, you should talk to one of the investigators listed below.

- Yes, I am a current college student or college graduate within the last 10 years and I agree to be part of the study.
- No, I am a current college student or college graduate within the last 10 years, but I do not agree to be part of the study.
- No, I am not a current college student or college graduate within the last 10 years.
- No, I am under 19 years of age and cannot take this survey.

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Appendix C: Interview Questions

1. Tell me a little bit about yourself.
    a. Probes: How old are you? What is your race/ethnicity? What are your pronouns/What gender do you identify as?
    b. Do you currently deal with any chronic illness or disabilities? Are you registered for accommodations?
2. Tell me about your time at UNO.
    a. Probes: What are your majors/minors? Are you in any programs? What year are you? What are your career goals? Do you plan to pursue any graduate/post-graduate programs?
    b. Do you engage in any extracurricular activities (i.e. sports, research, organizations, etc.)?
    c. Do you feel represented on campus? Do you feel safe on campus?
3. Do you currently work?
    a. Probes: What is your job? How many hours do you work a week? How much do you earn? Do you enjoy your job?
4. Outside of your annual income, do you receive financial assistance through other means?
    a. Probes: Do you receive any financial support from your family or guardians, and how much support do they provide to you?
5. Do you have any research experience?
    a. If so, how much experience do you have?
        i. What research have you conducted?
        ii. What motivated you to pursue research?
            1. What might make you more or less motivated to pursue research?
        iii. Is your decision to pursue research related to your career goals? How so?
    b. Are there any pitfalls to pursuing research?
        i. How important were your relationships with your lab mates and mentors?
        ii. Do you feel that it is "easy" to pursue research?
        iii. What factors might make it difficult to pursue research? Could favoritism or bias be involved?
    c. Would you recommend your research experiences to others? Why or why not?
6. What are some other activities that you partake in?
    a. Probes: I.E. extra job or side-gig, hobbies, extracurriculars, religious service, volunteering, etc.
    b. Do you have any obligations outside of school and work, such as familial obligations?
7. Do you have any suggestions for UNO?

Appendix D: Interview Consent Form

This research study is part of the course requirement for my Senior Thesis course, taken by all UNO Sociology majors. I am collecting original data because I would like to know more about the association between undergraduate demographic information and extracurricular research motivations. In order to participate in this study, you must have completed some form of research at UNO **AND** either 1) currently enrolled as an undergraduate at UNO**,** or 2) was previously enrolled as an undergraduate student at within the past 10 years. **Additionally, you need to be at least 19 years of age.**

You will be asked to provide demographic information about yourself, information regarding your participation at UNO, and personal views & experiences regarding research at UNO. There are no known risks to this study. The possible benefits of this study includes better understanding the experience of pursuing research as an undergraduate and how to increase equitable opportunities at UNO.

Instead of being in this research study, you can choose not to participate. Additionally, you can withdraw from this research study at any time before, during, or after the research begins. Reasonable steps will be taken to protect your privacy and the confidentiality of your study data. The only persons who will have access to your research records are myself and my instructor. The information from this study may be published in a research paper for course credit, but your identity will be kept strictly confidential.

You are freely making a decision whether to be in this research study. Signing this form means that you have read and understood this consent form, and you have decided to be in the research study. If you have any questions during the study, you should talk to one of the investigators listed below.

Signature of Subject: _____   Date: _____

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