The Context for an Undergraduate Research Program at Western Michigan University

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The Context for an Undergraduate Research Program at Western Michigan University

A three-phase investigation into the state of undergraduate research

Nathan Browning, Sociology ‘18
Lee Honors College
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Abstract

This thesis is an investigation into undergraduate research, experiential learning, and creative scholarship as it relates to Western Michigan University (WMU). Data mining was used to analyze the state of undergraduate research activity (URA) nationally. Surveys, interviews, and focus groups were used to examine both faculty and undergraduate opinion of the state of URA specifically at WMU. The goal of this thesis is to help establish a framework for what a successful undergraduate research program would look like at WMU.

Previous literature shows benefits for both institutions and students, including higher retention rates, stronger graduate outcomes, and increased satisfaction levels for students and faculty. National results show that institutions with better URA rankings had better US News Rankings and retention rates; WMU could stand to gain over $350,000 in tuition per year from the increase in retention rate due to a program like this. While WMU does offer undergraduate opportunities, positions often prefer junior/senior candidates, negating institutional benefits of increased retention for underclassmen. Faculty fear the workload of mentorship but do see benefits in including undergraduates in research. However, they do not trust 1st and 2nd year students, who lack experience and training. Meanwhile, undergraduates are frustrated about the small number and poor advertising of opportunities. They say the opportunities are strong and valuable, but attaining them proves most difficult, even for highly qualified students.

Recommendations: Have a third party collect project opportunities from faculty, curating opportunities targeted toward 1st and 2nd year students who work in a team. Offer specific, short trainings about research (methodology, programs) for varied disciplines. Assign peer research mentors as a buffer between faculty and undergraduates, reducing faculty burden. Compensate students with either academic credit or pay. Lastly, make sure the program is beneficial for all parties involved, as the success of such a program could significantly affect WMU's standing.
Introduction & Background

Western Michigan University (WMU) is one of 334 other universities in the United States that have been classified as a “research institution” by the Indiana University School of Education’s Center for Postsecondary Research. These classifications are called the Carnegie Classifications. While there are many classifications, the classifications for research activity are separated into three tiers: moderate research activity (R3), higher research activity (R2), and highest research activity (R1). These categories are determined by a number of variables, including number of doctoral degrees conferred and research & development expenditures (The Carnegie Classification of Institutions, 2017). Western Michigan University belongs to the higher research activity (R2) category along with 106 other institutions throughout America (The Carnegie Classification of Institutions, 2017).

Some institutions have taken steps toward furthering the involvement of undergraduates in research efforts. One such program, the Undergraduate Research Opportunity Program at the University of Michigan, has been studied repeatedly by researchers. It has shown great benefits for students themselves, but also for the institutions that harbor those students. Biren Nagda et al. have been able to show that first-year students, particularly black students, were more likely to retain at the institution if they had participated in UROP during their first year. For sophomores, average retention among students increased if they had participated in UROP (Nagda, Gregerman, Jonides, von Hippel, & Lerner, 1998). A separate study found that students of color that participated in UROP were...

- 39% more likely to pursue graduate education
- 82% more likely to pursue professional education
- 96% more likely to be involved in research activity after graduating
- 159% more likely to receive a recommendation from a faculty member for a job
than students of color that did not participate in UROP (Hathaway, Nagda, & Gregerman, 2002). In other studies, researchers have shown many more benefits. One study found that “extended participation in research for more than a single semester is correlated with an increase in GPA, even after using SAT to control” (Fechheimer, Webber, & Kleiber, 2011). Others were able to replicate the results from Nagda et al.’s 2002 study, finding that alumni of the University of Delaware’s Undergraduate Research Program (URP) were more likely to pursue graduate education. A survey of University of Delaware alumni was also able to show that URP participants were significantly more satisfied overall than their non-URP counterparts (Bauer & Bennett, 2003).

Meanwhile, Umi Jensen theorizes that there are four major factors that influence retention: Academic Performance (having a high GPA and strong course load), Attitudes and Satisfaction (feeling positively about academics, having a “sense of belonging and social connectedness”), Academic Engagement (undergraduate research activities and clubs), and Social and Family Support (faculty, staff, and familial support, sense of importance/purpose) (2011). If done correctly, an undergraduate research program could tackle each of these, and make a very strong impact on retention rates. These findings are good news for institutions that are looking to retain more students and produce excellent alumni.

Recently at WMU, the new president, Dr. Edward Montgomery, made the announcement to fund two programs through the Transformational Initiative Fund. These programs, called Success @ WMU and Esports @ WMU, are both part of a larger effort by the administration to increase student retention rates. Dr. Montgomery is right to target this issue, as WMU has some work to do in relation to in-state competition:
One way to help our standing in relation to retention is to institute an undergraduate research program, among other initiatives. This thesis will explore in-depth the national status of undergraduate research and its effects, the climate and opinions of faculty members at WMU, and the experiences of students at WMU. All of this will be done to aid in the creation of a more structured undergraduate research program through the Office of the Vice President for Research (OVPR).
Phase 1: National Perspective of Undergraduate Research Activity

Introduction and Methodology

In order to understand how WMU’s undergraduate research activity (URA) stacks up against the URA of other institutions, data was collected from colleges and universities similar to WMU. A ranking system was created with the intention of measuring the strength of an institution’s URA. The system determined rankings for 5 individual variables: Internal Listings, Seminars and Workshops, External Opportunities, Student Compensation, and Program Type. A ranking of 1 was the best ranking that could be given for a variable, a ranking of 2 was the middle outcome for a variable, and a 3 was the worst ranking that could be given. To determine the institution’s overall ranking, the average (mean) of all 5 variables was calculated for the school. The table below demonstrates how the ranking system works and goes into more detail about the qualifications for each respective variable.

*Figure 2: Ranking system for undergraduate research activity among Carnegie-classified research institutions*

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Internal Listings</strong></td>
<td>Private, competitive program to apply to, OR &gt; 15 public project listings</td>
<td>1-15 public project listings that students can apply to</td>
<td>No project listings or private program to apply to</td>
</tr>
<tr>
<td><strong>Seminars and Workshops</strong></td>
<td>Workshops/seminars are abundant (&gt; 10 per year) or required for program</td>
<td>2-10 seminars/workshops relating to undergrad research per year</td>
<td>Little to no (0-1) seminars/workshops relating to undergrad research</td>
</tr>
<tr>
<td><strong>External Opportunities</strong></td>
<td>&gt; 15 external undergraduate research opportunities listed</td>
<td>2-15 external undergraduate research opportunities listed</td>
<td>Little to no (0-1) external undergraduate research opportunities listed</td>
</tr>
<tr>
<td><strong>Student Compensation</strong></td>
<td>Students guaranteed credit or pay for participation, OR &gt; 5 undergrad grants offered</td>
<td>Students can potentially receive credit or pay, but not guaranteed, OR 2-5 grants for undergrad are offered</td>
<td>No opportunities to get paid or get credit, little to no (0-1) grants offered for undergraduates</td>
</tr>
<tr>
<td><strong>Program Type</strong></td>
<td>Different tiers of undergrad research programs for different class standings. E.g, one program for freshman/sophomores and another for juniors/seniors</td>
<td>A single designated undergraduate research program</td>
<td>No designated undergraduate research program</td>
</tr>
</tbody>
</table>
To show how this system plays out, here is a breakdown of WMU's rankings:

*Figure 3: WMU's ranking under the proposed ranking system*

<table>
<thead>
<tr>
<th>WMU's Ranking</th>
<th>Internal Listings</th>
<th>Seminars and Workshops</th>
<th>External Opportunities</th>
<th>Student Compensation</th>
<th>Program Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 - WMU has no centralized database of internal research assistantships or projects</td>
<td>2 - WMU offers a seminar every month pertaining to undergraduate research</td>
<td>1 - WMU is a member of the Student Opportunity Center, with opportunities for grants, REUs, and research opportunities</td>
<td>2 - WMU offers several grants to students that can be used as a stipend for research</td>
<td>3 - WMU has no centralized program designated to undergraduate research...yet</td>
<td></td>
</tr>
</tbody>
</table>

After taking the mean of all 5 rankings, WMU's overall ranking for their undergraduate research activity is 2.2.

After developing the tool used to rank each school, a sample of schools was taken. Since the long-term goal of an institution like WMU would be to eventually transition from an R2 institution to an R1 institution, a stratified random sample of R1 and R2 schools was taken, with equal allocation to each stratum. To make the comparisons between schools more accurate, certain variables were controlled for. Only public, not-for-profit, and undergraduate majority institutions were selected from the list of R1 and R2 schools, qualities of in line with WMU. Overall, 65 R1 and 66 R2 institutions were analyzed, which consisted of scanning through each institution’s website to determine a ranking for each variable. Finally, correlations were analyzed between the rankings and other publicly available variables such as retention rate, graduation rate, endowment, age of the institution, US News rank, and many more (including some more desperate variables like college football ranking). Not every variable was included in the results.

The validity of the ranking metric was tested by comparing the rankings of R1 and R2 institutions after collecting all of the data. Since R1 schools tend of have more research activity under them, it would follow that their ability to involve undergraduates in that activity would be
In the form of a hypothesis test, the null hypothesis is that the rankings of R1 and R2 schools are the same. The alternative hypothesis is that R1 and R2 schools do have significantly different rankings. A chi-square test of independence was conducted to determine if rankings (rounded to the nearest integer to create 3 total categories) were significantly different from one another. The results are shown in the table below:

**Figure 4: Chi-square test between R1 and R2 institutions for each individual ranking variable**

<table>
<thead>
<tr>
<th>Ranking Variable</th>
<th>Chi-Squared Statistic</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Ranking</td>
<td>18.066</td>
<td>.000***</td>
</tr>
<tr>
<td>Internal Listings</td>
<td>11.816</td>
<td>.003***</td>
</tr>
<tr>
<td>Seminars and Workshops</td>
<td>13.634</td>
<td>.001***</td>
</tr>
<tr>
<td>External Opportunities</td>
<td>27.437</td>
<td>.000***</td>
</tr>
<tr>
<td>Student Compensation</td>
<td>3.111</td>
<td>.211</td>
</tr>
<tr>
<td>Program Type</td>
<td>7.488</td>
<td>.024**</td>
</tr>
</tbody>
</table>

**results significant with 95% confidence**

**results significant with 99% confidence**

As shown in Figure 4, each variable except for student compensation variable were significantly different. This means either the instrument is inaccurate for this variable, or R1 and R2 institutions do not compensate students differently. Otherwise, rankings for R1 institutions were better on average than the rankings for R2 institutions. The mean ranking for each variable can be seen in Figure 5 below (keep in mind that the only non-significant difference is in student compensation):

**Figure 5: Comparison of URA mean rankings between R1 and R2 institutions**
Based on these findings, the null hypothesis is rejected in favor of the alternative hypothesis. The ranking system is a valid measurement tool, since R1 and R2 institutions significantly differ in their rankings, with R1 institutions having better rankings across the board. With validity established, the rankings were compared with other variables to determine correlations between them. Variables were taken from sources like US News, College Scorecard. The same source was used for each individual variable, to avoid any variance that might come from using different sources.

Results

Overall, 8 variables were regressed against the overall rankings determined for the R1 and R2 institutions. The results of the linear regressions are in Figure 6 below.

<table>
<thead>
<tr>
<th>Variable</th>
<th>β</th>
<th>R²</th>
<th>R</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of Institution</td>
<td>-.001</td>
<td>.0144</td>
<td>.1200</td>
<td>.2121</td>
</tr>
<tr>
<td>US News Ranking</td>
<td>.002</td>
<td>.0332</td>
<td>.1800</td>
<td>.0567*</td>
</tr>
<tr>
<td>Students per Faculty</td>
<td>-.025</td>
<td>.0412</td>
<td>.2030</td>
<td>.0335**</td>
</tr>
<tr>
<td>Graduation Rate</td>
<td>-.006</td>
<td>.0251</td>
<td>.1584</td>
<td>.0983*</td>
</tr>
<tr>
<td>Acceptance Rate</td>
<td>.002</td>
<td>.0076</td>
<td>.0871</td>
<td>.3655</td>
</tr>
<tr>
<td>Retention Rate</td>
<td>-.013</td>
<td>.0334</td>
<td>.1828</td>
<td>.0561*</td>
</tr>
<tr>
<td>Average Graduate Salary</td>
<td>.000</td>
<td>.0001</td>
<td>.0100</td>
<td>.9340</td>
</tr>
</tbody>
</table>

*results significant with 90% confidence  
**results significant with 95% confidence

As a note for the interpretation of the above beta values, remember that a higher number for URA rankings corresponded to a worse rank overall. For instance, the US News rankings were, on average, better for schools with better URA rankings, but this is not intuitive from the beta value.

In attempting to explain variance in the URA Rankings using multiple regression, one model was able to explain 20% of the variance in URA Rankings (p < .0001). The model included the research designation (R1 or R2), the age of the institution, and the number of students per faculty:
Figure 7: Multiple regression printout for URA rankings of R1 and R2 institutions

![Multiple regression printout for URA rankings of R1 and R2 institutions](image)

URA Ranking = -0.41(Research Designation) - 0.002(Institution's Age) - 0.026(Students per Faculty)

In a separate multiple regression model, 88% of the variance ($R^2 = .88$) of retention rates was explained by three variables: US News ranking, students per faculty, and acceptance rate:

Figure 8: Multiple regression printout for retention rates among R1 and R2 institutions

![Multiple regression printout for retention rates among R1 and R2 institutions](image)

Retention Rate = -0.10(US News Ranking) + 0.26(Students per Faculty) + -0.06(Acceptance Rate)
Discussion

The results of these correlational studies are somewhat underwhelming. It is clear that there are some variables that correlate strongly with an institutions undergraduate research activity ranking. Two of high importance include US News Ranking (which got better as URA rankings got better) and retention rate, with which a corresponding decrease of ranking by 1 led to an increase in retention of 1%. Theoretically, if an institution were to improve their URA ranking from a 3 to a 1, the corresponding increase in overall retention would be around 2%. Using WMU’s tuition for a typical lower division student for 2017-18 (WMU Admissions, 2018) and the retention numbers from the WMU Office of Institutional Research (2017), a change from WMU's 2.2 URA ranking to a 1.2 ranking would have 30 more students carry over into their sophomore year, with a projected tuition income of $360,000 for that academic year from those students. That said, there are so many different factors in play that contribute. There are probably hundreds of variables that contribute on some level to an institution’s URA and retention, many of which were not recorded in this study or are confounding variables for URA or retention. Retention is not explained this closely by URA alone.

Further, it is clear from the validation of the URA rankings (Figure 5) that R1 schools are better at providing opportunities and research experience for undergraduates than R2 schools are. Since R1 institutions are schools that award more PhDs, there is likely an increased amount of grant money at these schools, since PhDs are often funded through grants. These grants are usually given for research projects taken on by faculty members. Stealing an economic term, this is something that could be called “trickle-down research.” More opportunities at the top of the educational hierarchy seems to lead to more opportunities at the bottom.

WMU, in comparison to other research institutions, has room for improvement on undergraduate research. WMU just joined the Student Opportunity Center, which advertises
opportunities all across the nation for undergraduates. However, there is no structured internal program. This is something that WMU could implement, but not without some challenges in budgeting and allocating personnel (Hoke et al., 2014).

As shown in Figure 4, the one variable among the URA rankings that was not significantly different between R1 and R2 institutions was student compensation. The reason that this variable was included in the overall ranking was because compensation of students is an increasingly important factor in students’ ability to partake in experiential learning. A 2010 article by Laura Perna shows that the average college student of the 2000s is working more hours than the average college student in the 1970s. One graph she included in her article is shown in Figure 9 below:

*Figure 9: Undergraduate student employment trends from 1970 to 2005*

As shown in the triangle-designated line, the percentage of students employed has increased from 35% to nearly 50% from 1970 to 2005. Specifically, students working more than 35 hours per
week has nearly doubled since 1970, rising from 5% to 10%. The 10% of students that were working 20-34 hours in 1970 has increased to over 20% of students in 2005. Perna claims that most administrators would recommend that students work 10 to 15 hours per week, because of research that sees positive academic outcomes associated with moderate part-time work. That said, in 2005, nearly one in three students were working more than the recommended amount. If schools were able to provide more part-time, on-campus positions in the form of undergraduate research or experiential learning, then students would be able to hone their skills in their field with relevant experience with less worry in mind about bills and expenses.

**Limitations**

In collecting the data from the schools, there was abundant opportunity for bias or human error to cause mistakes in the collection. For instance, a person might be more likely to subconsciously give a research institution like Harvard a better score for a given variable due to their powerful prestige and brand.

Additionally, many variables only had partial data available. Specifically, with regard to the US News Rankings, many institutions that were not ranked at all were unable to be designated a ranking, and therefore did little to contribute to the regression models presented, despite these schools being ranked “worse” than the schools that were given ranks.

Another area that was wanting was the repository of variables available. One direction that would have been interesting to see correlations with would have been total grant funding for the institutions. One could hypothesize that the amount of external grant money to fund students would be a highly significant factor in having opportunities that undergraduates could partake in. Unfortunately, there was no single repository that was able to list each school's grant funding,
Lastly, due to all of the above factors, the significance of the results from this phase of the study were not as strong as one might hope. That said, there were still some very important findings that show the benefits and value of involving undergraduates in research.
Phase 2: WMU Faculty Perspective on Undergraduate Research Activity

Introduction and Methodology

As part of this thesis, it was imperative to see what kind of barriers WMU faculty felt about involving undergraduates in their research projects. Some previous research supports the idea that faculty might experience increased career satisfaction as relationships with students become stronger (August & Waltman, 2004; Buddie & Collins, 2011). In fact, the study by August and Waltman found that the variable of “student relations” – which included things like feeling valued as a mentor, having the opportunity to mentor students, being able to attract students to work with them, and, being intellectually stimulated by students – was the strongest predictor of career satisfaction for female faculty.

In order to collect the opinions and thoughts of WMU faculty, a paper survey was developed. The survey asked questions about the nature of research in that faculty member’s department, including their own opinions on undergraduates’ involvement in research. Faculty members were given the survey in person, and asked questions by the interviewer. They would be probed for further information in the style of an in-depth interview, so that both quantitative and qualitative data could be gathered. Faculty were asked to provide more names of other faculty that they thought would be willing to interview in order to broaden the sample (snowball sampling). In all, 19 faculty members participated, with representation from every college at WMU except for the College of Aviation. Thematic analysis and other quantitative measures were performed to analyze the results.
Results

Faculty members were asked how students generally found out about research opportunities. Half of the respondents claimed that students generally found opportunities in the department by actively reaching out to department faculty and simply asking. A couple of these respondents also said that having a student show initiative in their search for a research position boded favorably for the student’s likelihood of success in their mission. In addition to having students seek out opportunities, 6 faculty members also stated that their department put advertisements out in the form of flyers and Handshake position listings. Lastly, 3 faculty members said that there indeed is a “trickle down” effect that happens from graduate students to undergraduates. Graduate students are often in the throes of their own research and need help with data collection or other tasks that undergraduates are well-suited for.

Figure 10: Ways that undergraduates find out about research opportunities

<table>
<thead>
<tr>
<th>Theme</th>
<th># of Respondents</th>
<th>% of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word of mouth/direct contact with faculty</td>
<td>10</td>
<td>53%</td>
</tr>
<tr>
<td>Marketing efforts/job postings</td>
<td>6</td>
<td>32%</td>
</tr>
<tr>
<td>“Trickle down” effect with graduate students</td>
<td>3</td>
<td>16%</td>
</tr>
</tbody>
</table>

One professor offered an intriguing opinion: students that are most at-risk of attrition (not staying enrolled at the university) are the ones that are most unfamiliar with the process of doing research and discovering research opportunities. As a first-generation college student themselves, they said that they had no idea what doing research was, what it meant, or how to get started. No other faculty member corroborated this opinion, however.

Additionally, respondents were asked what kind of qualifications or trainings, if any, were required for undergraduates before they could partake in experiential learning in their department. There were many different takes, and no clear consensus.
Figure 11: Qualifications, trainings, or requirements for undergraduate involvement in research

<table>
<thead>
<tr>
<th>Theme</th>
<th># of Respondents</th>
<th>% of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSIRB/CITI/Ethics training</td>
<td>5</td>
<td>26%</td>
</tr>
<tr>
<td>Methodological/statistical training</td>
<td>4</td>
<td>21%</td>
</tr>
<tr>
<td>Intangible qualities (work ethic, curiosity, etc.)</td>
<td>4</td>
<td>21%</td>
</tr>
<tr>
<td>Good grades</td>
<td>2</td>
<td>11%</td>
</tr>
<tr>
<td>Safety training</td>
<td>2</td>
<td>11%</td>
</tr>
<tr>
<td>Protocol required for internship (# of hours, rules, etc.)</td>
<td>2</td>
<td>11%</td>
</tr>
</tbody>
</table>

As shown, the most listed requirement of all related to ethics while conducting research. After that, faculty wanted students to be familiar with the relevant methodologies in the field. This was largely so that students could take on the time-consuming but necessary task of collecting data.

During the interview, faculty members were asked how beneficial undergraduate involvement in research was to them on a scale of 1 to 5, with 1 being not at all beneficial and 5 being extremely beneficial. Here are the results of this question:

Figure 12: Faculty opinion on how beneficial undergraduate involvement in research is to faculty
The vast majority of faculty members claimed that undergraduate involvement in research was “extremely beneficial” to them. Of those who did, some explanations were offered as to how undergraduates are beneficial to faculty:

*Figure 13: How undergraduates are beneficial to faculty members in research activity*

<table>
<thead>
<tr>
<th>Theme</th>
<th># of Respondents</th>
<th>% of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helpful with time-consuming work</td>
<td>2</td>
<td>11%</td>
</tr>
<tr>
<td>Student could become an expert/colleague</td>
<td>2</td>
<td>11%</td>
</tr>
<tr>
<td>More flexible schedule than graduate students</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>Increase retention to own master’s program</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>Cross-pollination from other disciplines</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>Physical capability/youth</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>Ability to take more risk</td>
<td>1</td>
<td>5%</td>
</tr>
</tbody>
</table>

These themes are insightful and even surprising. The faculty member that spoke on the retention into the master’s program seemed to view undergraduate research as a recruitment tool for both the student and the department; the student could see if their research interests were able to be fulfilled by the department, and the department could evaluate the student as a candidate as well. One faculty member spoke about the physical capability required for certain disciplines, saying that once a faculty member reaches a certain age, it is harder for them to partake in the more physical aspects of research. This manifests in areas such as fine arts, with dance or theater, but also in the sciences, where biologists might conduct lengthy fieldwork missions or geoscientists might go spelunking for data.

During the interviews, sometimes discussions would trail from the script and some miscellaneous, but relevant, topics came up:
Almost half of the respondents said that their research was interdisciplinary in nature, meaning that undergraduates from outside of their department would be appropriate candidates to assist with their research. Many faculty also said that first and second year students would technically be able and allowed to participate in research, but they are look upon as too fresh or unready to take on serious academic tasks. Lastly, some faculty voiced concern about not having enough time for undergraduates between teaching, service, and closely advising graduate students.

There were other survey questions that were asked, however these questions were also asked to undergraduates. The results will be compared in the Phase 3 section.

**Discussion**

The good news of this phase of the study is that WMU does offer opportunities for undergraduates to get involved in research and experiential learning. The bad news is that these opportunities aren’t serving toward the overarching goal of improving retention rates. There is a stigma among faculty toward first and second year students that creates a barrier for undergraduate students that would like to get involved early. The first step to solving this problem would be to revamp the way undergraduate researchers are found. These opportunities need to be broadcasted to the target demographic of first and second year students. Now, faculty did say that they prefer students to take initiative for a reason – those students that seek out opportunities are usually driven, intelligent, and capable. However, plenty of students that are driven and capable are likely still unable to find opportunities in the first place, so a middle ground

<table>
<thead>
<tr>
<th>Theme</th>
<th># of Respondents</th>
<th>% of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Their research was interdisciplinary in nature</td>
<td>8</td>
<td>42%</td>
</tr>
<tr>
<td>1st/2nd year students are able, but not as welcome</td>
<td>6</td>
<td>32%</td>
</tr>
<tr>
<td>Faculty concern about workload being too heavy</td>
<td>4</td>
<td>21%</td>
</tr>
</tbody>
</table>
must be found. Perhaps faculty could mention in their large 1000-level or 2000-level classes that if students are interested in becoming research assistants, then they should stop by office hours. That way, opportunities are advertised without removing the element of student initiative.

Another self-selection bias that is happening that artificially disallows first and second year students from partaking in research are the qualifications listed by faculty. Many faculty members mentioned that having methodological or statistical training would be a requirement for an undergraduate to partake in research. While this is not inherently an issue, WMU doesn't offer any one-time methodological trainings in statistical programming like SPSS, SAS, or R (all free for students to use). Instead, each department offers their own specialized version of a methods class (some have two!) that is usually a late 2000 or 3000 level class. This self selects for sophomores and juniors, leaving first-years out to dry. In fact, research suggests that most academics believe that a research mentor's primary responsibility is to teach students these technical skills (Shanahan, Ackley-Holbrook, Hall, Stewart, & Walkington, 2015). A solution to this issue could be to have a third party (perhaps the Office of the Vice President for Research) offer one-time training sessions in things like SPSS, SAS, R, Qualtrics, Minitab, etc.

Another theme that causes problems for undergraduates is the one that says that faculty are concerned about the time that it takes to mentor more students. Due to the lack of external resources for undergraduate researchers, faculty are often tasked with a large amount of the training, mentoring, and guidance that unseasoned undergraduates need to succeed as research assistants. Interestingly, one study found that faculty that had not supervised undergraduates in research believed more strongly than faculty that had supervised undergraduates that students were underprepared to be involved in research (Buddie & Collins, 2011). This goes to show that some faculty perception about undergraduates' inability may be unfounded, since faculty opinion of undergraduates improves after supervision of undergraduates. Nevertheless, offering other resources, like an assigned research peer mentor that has previously been a research assistant in
the student’s field, would go a long way in mitigating this issue. The goal would be to have faculty not see students as a time burden, but instead as a time-saver – as an asset that can accurately perform the tasks that they need for their own research to be successful. That said, faculty can get credit toward tenure or teaching load by mentoring undergraduates (Hoke, Pantano, Zarrouk, & Zeleke, 2014), so it is possible that this reasoning is a smokescreen for ulterior motives.

Limitations

For this phase of the study, the sample size was small. There was much reliance on the qualitative responses to the survey rather than the quantitative. This is not inherently bad, but it did inhibit the ability to make quantitative conclusions based on some of the answers given by faculty members. In addition to the small sample size, the sample itself was potentially biased. Using snowball sampling, faculty themselves were asked to recommend other faculty members that would be willing to participate in the study. It is probable that many of these faculty members thought of their colleagues that tended to work with undergraduate students and would therefore give answers that reflected undergraduates more favorably. In addition, this bias was likely amplified by social desirability bias. The interviewer was an undergraduate student, so faculty respondents might have cushioned their answers more to seem more satisfactory to the student in the room.
Phase 3: WMU Student Perspective on Undergraduate Research Activity

Introduction and Methodology

For this portion of the study, student opinions on partaking in research were gathered. Students were asked about their personal involvement in undergraduate research, the barriers to entry, their level of satisfaction with the current state of undergraduate research and a gamut of other relevant questions. Some questions that were asked to faculty members were also asked to the undergraduate students for comparison.

The methodology of this phase had two parts. The first part was an electronic survey designed in Qualtrics. The survey was distributed to students using convenience sampling. Departments, faculty, and colleges were asked to pass it on to their undergraduate students, email lists were contacted, and friends were asked to partake as well. In all, 416 students responded to the survey, with representation from every college at WMU. The survey consisted of both qualitative and quantitative responses, so both were analyzed. At the end of the survey, students were given the opportunity to do two things. The first was to submit their name into a drawing to receive a $50 gift card to the WMU bookstore (this was done through Google Forms and was not associated with the respondents' answers). The second option was to submit their name to be part of a focus group. Several students did submit their names and were invited to participate in the focus group. However, only two came to the session, and a third and fourth were invited spur of the moment to have a focus group size of 4. The colleges represented in the focus group were the College of Arts and Sciences, the College of Health and Human Services, and the Haworth College of Business. The session lasted around an hour. The interview was recorded and later transcribed, allowing for an in-depth thematic analysis similar to the one conducted in phase 2 of this thesis. Despite the small sample size, the group provided incredible insight into many different topics.
Results

Focus Group

As a result of the focus group, five major themes emerged. These themes were collected from the transcription of the focus group, and follow in no particular order:

Theme 1: Students lacked volition in the selection of a research topic.

Students said that they largely did not have much say in the topic of their research. As research assistants, often a given faculty member will have a project that they need help with, and the undergraduate will slot in to help. That said, the students agreed that they felt fulfilled with the work they were doing regardless. One student said, “I still have really enjoyed [my project], even though I didn’t have that initial self-direction.”

Another factor to consider that one student brought up was related to prioritization of jobs. The student had the opportunity to work on one of two projects, the first project was one that they were highly interested in learning about, but would be done on a volunteer basis, maybe for academic credit. The second project was not as interesting to them but was a paid opportunity. Their decision: “I did choose getting paid over the more interesting subject.” This shows that students have many competing priorities that must be weighed when deciding how they spend their time.

Theme 2: Supervisors tended to be laissez-faire in their dealings with undergraduates

Going hand in hand with the faculty’s theme of being worried about time consuming mentorship, it seemed that students experienced a mostly hands-off approach in their research experiences. Faculty generally let students work independently, which had mixed results. One student said their mentor was “very hands off, but not when I needed the support.” Another student, however, said that they “would like more hands-on support just because [they]’d be more motivated” to complete tasks. Interestingly, the person that had a positive reaction to the hands-
off approach was an upperclassman, and the person that had a more negative reaction to the hands-off approach was an underclassman.

**Theme 3: Some ideal qualities of a supervisor**

The students spent a good chunk of time talking about the qualities that their ideal supervisor would have. Some of these included:

- “Confidence in your ability”
- “Acceptance of failure”
- “Getting really excited”

The first two bullets sort of served as a yin and yang. Students wanted their supervisors to be confident, but also understand that they might not get it right every time, and that that is okay. One student told a story about how they created a survey to distribute, and had their supervisor look over it. The supervisor, upon seeing the survey, knew that it would fail, but decided to let the student find it out for themselves. The student said that the failure was a stronger learning experience than if they had simply told them it would fail.

The third bullet was a quality that massively resonated with the participants. Students want to interact and learn from faculty that show immense passion and excitement in their field. One student said, “when they’re excited, you get excited and it makes you want to keep going.” The curiosity and wonder that comes from new discovery is highly influential in keeping students excited and engaged.

**Theme 4: Lack of awareness of research opportunities**

Again in line with the faculty responses, students noted that they were largely unaware of opportunities in their desired field. One student said, “it took me two years before I figured out there was an opportunity for research in my field.” Eventually, that student was able to find research opportunities as an upperclassman. One underclassman participant, however, stated that “knowing where to start is the hardest part.”
Theme 5: Various experienced barriers/difficulties in research

Students faced challenges in the research process, both in finding an opportunity to conduct research and in carrying out that research once a position was obtained. Relating to barriers to entry, one student said that there was a certain “stigma on research,” and that other students looked down on the ones that pursued research opportunities. The same student said that they did not realize how essential research was to their field, because faculty did not call it “research” in lectures. Instead, they called it “evidence-based practices.” Another student said that research opportunities simply aren’t advertised enough to students. Another chimed in by saying that it is “easier to find opportunities...at the higher levels of classes.” As underclassmen, these two students struggled to find opportunities, and only one of them was successful.

Once actually participating as a research assistant, there were other difficulties. One student found that loneliness was a big problem for them. “I feel it a lot in research,” they said. Sometimes, the student would go to the lab during late nights or during the weekend and would be all alone conducting experiments and analysis. This led to feelings of burnout and isolation throughout the process. Others also found that, since the research they were assisting with was ground-breaking, it was hard to get guidance on their topics, even from their supervisors. One student's task involved some coding, but the student had to largely teach themselves how to do it to satisfy the project’s needs. The lack of structured support network for the undergraduate researchers was apparent in their complaints.

Survey for Undergraduate Students

As mentioned before, 416 students responded to the survey. However, due to the way the survey was set up, not every student completed every question. That said here are the demographics of the survey respondents:
Representation from the class standings was good, with the lowest segment being fifth-year+ students at 12%. While every college was represented, the College of Arts and Sciences had a larger representation than all of the other colleges.

The survey asked students about three kinds of applied learning: research, creative scholarship, and experiential learning. Students were asked how happy they would for receiving received certain forms of compensation.

Figure 16: Student happiness with receiving “only volunteer hours” for applied learning
As shown in Figure 16, students are reluctant to be happy about receiving no compensation (volunteer hours) for their work. However, students are ecstatic to be paid, as seen in Figure 17. The survey also asked students if they had ever held a position in one of the three areas and asked how they were compensated. For those students that were compensated monetarily, a follow-up question was asked: “What was your hourly wage?” The average (median) hourly wage for undergraduate student positions in applied learning was $12.49/hr. The median was used because there were some outliers near the $30/hr. range that drove up the mean.

Figure 9 showed that employment rates for undergraduate students have been creeping upward along with the hours that those employed undergraduates work. Since this thesis seeks to know specifically about WMU’s student population, students were asked how many hours they worked for a wage every week, on average. These numbers can be roughly compared with the rates from Figure 9.
As shown in Figure 18, a large number of undergraduates either do not work, or work very little. About a quarter work a modest amount, and another quarter work more than recommended (20+ hours per week). That said, the majority of students are working for some type of wage, either on campus or off campus. Here is a testimonial from one student in the survey, exemplifying the many competing priorities that current undergraduate students face:

“I am also conducting research as part of an honors thesis. It is a lot of hard work and is very time consuming. I also have an unpaid internship, which I love, but because it is unpaid I have to work two other part time jobs, making my life very stressful.”

Students vs. Faculty

As mentioned, some survey questions were asked to both students and faculty. Their answers are compared here. These results will give a better idea of how the opinions of students and faculty differ. The first question to compare was about the level of support for undergraduate involvement in research for the individual’s department.
Faculty members were more than two times as likely as undergraduates to say their departments were “extremely supportive” of undergraduate involvement. This shows that either the social desirability bias was present in questioning of faculty, or that there is a true discrepancy between faculty and students' perceived support for undergraduate involvement.

The next question asked about the “accessibility” of opportunities for undergraduates. “Accessibility” meant the availability of opportunities for undergraduates.

Figure 20: “How accessible are research/experiential learning opportunities for undergraduates in your program?”
Once again, the discrepancy between faculty and undergraduates is clear. Over 40% of faculty respondents claimed that opportunities were “extremely accessible” to students, while only around 15% of students said the same. If both sides were being honest and were well-informed, then, somewhere, communication is failing.

That said, there is one area where faculty and students agreed: the beneficiality of research/experiential learning:

*Figure 21: “How beneficial to undergraduates is involvement in research/experiential learning?”*

![Graph showing the beneficiality of research/experiential learning](image)

When adding together the columns, over 90% of faculty say that research/experiential learning is either “beneficial” or “extremely beneficial” to undergraduates. Meanwhile, just under 90% of undergraduates say the same thing. Both parties are aware of the benefits of undergraduates getting involved in applied learning, but faculty feel that the benefits are much stronger.

**Discussion**

Viewing these results with the context of the results of Phase 2 enlightens some of the weaknesses of WMU’s undergraduate research output. For undergraduates, there are many barriers, both within the university and outside of it, that keep them from partaking in these applied learning opportunities. For example, many departments at WMU offer internship or
research credit for students that can count toward a major or minor program. However, some students choose not to do this, because they see it more as a job than they do as an alternative learning setting. One student left a comment on the survey that said, “if research programs were offered for course credit, I would be hesitant to apply due to the cost of tuition...If tuition was paid in lieu of other monetary compensation, I would be more interested in applying.”

Another barrier is that communication of opportunities to first and second year students is poor. Upperclassmen are better able to network, have more skills under their belt, and are generally seen as better candidates for research assistantships. This, unfortunately, leaves early-career students, the ones that are most likely to discontinue their enrollment, in the dust: “In my attempts to find undergraduate research opportunities I have found that it is incredibly murky and difficult to access. There is no clear way to get involved, but we are constantly told how important it is. This causes highly increased stress levels.” Another student said that positions are rare unless you know someone: “It’s all about your connections.” Yet another student said, “I think there are opportunities, but you are expected to reach out for them without really knowing what is available. I am happy to reach out, but with how busy and difficult my program is, it would be nice to have a condensed list or way to view which opportunities are available.” Opportunities must be broadcasted more to these first and second year students, since they lack the connections to discover opportunities themselves. One student proposed a solution to this very issue: “I would argue that if a department were to more actively showcase the research it conducts to its students, then it could recruit more students to join that department and its research. Perhaps a research ‘meet-and-greet’ hosted by the departments’s faculty would be an option for doing this, where students could personally meet faculty members and learn what research they are conducting.” Before this can happen, a level of trust for these early-career students must be encouraged among faculty.
The lack of trust in young undergraduates among the faculty is both clear and understandable. Early-career undergraduates that seek out opportunities are scarcely able to secure them, however, as they meet more faculty and learn more concepts, only then is their ability to assist taken seriously, but this is not a guarantee by any means. In fact, even highly qualified students struggle to find opportunities: “I have a research internship at an external institution and have publications from my work. When I inquired about spots in WMU research labs, I was not offered any real lab work or financial compensation. I do not currently work in a WMU lab, but I do research externally. I considered transferring to a more prestigious university but did not, simply because I have some scholarship money here.” WMU faculty need to be assured that early-career undergraduates at the institution are highly capable. One solution would be to ask research-active faculty what skills, computer programs, and concepts are necessary for undergraduates to learn to do research with them, and then have a third party (OVPR) offer those trainings to students at the beginning of the year. This would displace some of the mentorship burden from the faculty.

Limitations

The student survey, while ultimately informative, was a bit of an albatross. It asked many questions, some of which were confusingly worded. For instance, some students thought that “accessibility” referred to the Americans with Disabilities Act, which might have reduced the accuracy of that particular question. The length of the survey and the multitude of questions asked led to a lot of analysis paralysis – there is still so much information that could be uncovered from the results of the student survey after some data cleaning. In some of the questions, specifically the likert scale questions, the coding of the answers made them impossible to quickly analyze in programs like Excel or SPSS, so statistical significance was not able to be determined. Lastly, the diversity of the sample of students left something to be desired. Many came from the College of
Arts and Sciences, and a large majority were white students. The opinion of students of color would have been much more informative and pertinent to the overall theme of this thesis as it relates to retention, and would have helped replicate some of the previous literature. Unfortunately, the number of students of color that participated was too low for any meaningful discovery to take place.
Recommendations

Based on the results of this thesis, there is an optimal plan to create an undergraduate research program at Western Michigan University. The first step would be to collect a database of research projects by contacting faculty. Faculty would be asked to describe the project they are offering, and when. In addition, they would be asked if they would be willing to have freshmen/sophomores work with them, if they would be able to offer credit or pay for these undergraduates, and what qualifications, computer programs, and skills a student would need to be successful as an assistant for their project. This database would be updated yearly.

The prioritized targets of a program like this would be undergraduate students with the highest likelihood of attrition, although they wouldn’t be the only ones allowed to participate. These populations include students of color and first-generation college students that are in their first or second year of their undergraduate degree. This would help increase student retention rates among the more at-risk populations, and also better set up students for future success.

In order to remove some of the burden of teaching and mentorship from faculty, more specific training seminars and workshops would need to be offered. The topics would be selected based on the qualifications and computer programs that faculty require for their student researchers. The most in-demand skills sought by faculty would become the highest priority trainings for undergraduates. Faculty could require their students to attend these sessions in order to maintain their position. As for who would run these trainings, qualified faculty, graduate students, staff, or even junior/senior undergraduates could volunteer or be paid to facilitate sessions. Students need the opportunity earlier in their schooling to learn statistical programs, data collection methodologies, and other skills essential to conducting research. An alternative solution to this would be to lobby the university to have methods classes come much earlier in program curricula, so as to earlier prepare students for applied learning/research opportunities.
For compensation, students have shown that their time needs to be valued. Many departments offer elective credit for internships and research experience relevant to the major, so this practice could be encouraged more university-wide. Perhaps a model like the one for graduate research assistants could be explored, where students are reimbursed tuition for credits that are spent in research positions at the university. Alternatively, federal or other grants could be sought out by OVPR to test an undergraduate research program's effect on retention in an official way, and grant money could be used to sponsor students. Federal work study could also be used for eligible students, and would not add more cost to OVPR.

In order to remove even more burden from faculty, provide undergraduate students with peer research mentors that are assigned based on discipline. This would be similar to the Success @ WMU program, but ultimately a better representation of the "learner-centered" and "discovery-driven" pillars of the university's overall strategy. The peer research mentors would be available to students academically and personally, and would be older undergraduates with prior research experience. Perhaps these peer mentors could be facilitators of the aforementioned workshops.

Lastly, the most important goal of a program like this would be to make sure it is beneficial to both students and faculty. Some of the problems faced by students in research positions included loneliness and lack of guidance. Having more than 1 student (optimally 2 or 3) working on a project together would help combat both of these issues; having other students to bounce ideas off of and to consult would remove yet more burden from busy faculty. Faculty are largely concerned about workload considerations, so this program would need to help them in their research activity, not slow them down. Even if this means having undergraduates do menial tasks like cleaning data or transcribing interviews, the exposure to the process and the connections made with experts in the field are invaluable. With a program like this, WMU has a great opportunity to better its reputation and rankings, cultivate happier students, and improve ROI for both students and the university in the years to come.
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