

Developing and Supporting a Culture of Undergraduate Research on Campus

Presented to:

Vice-President for Research (VPR) Office
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1. Executive Summary

Providing resources and encouraging a culture of undergraduate research by increasing access to undergraduate research opportunities and deliberately integrating them into the curriculum strengthens our academic mission and aligns with Michigan Tech's Strategic Plan.

Undergraduate (UG) research experiences are recognized as stronger examples of high-impact experiential learning, allowing students to gain skills applicable to both research and non-research careers. Moreover, undergraduate research has been shown to be particularly effective at increasing retention and opening career pathways for minority and underrepresented populations. However, students often are not aware of research opportunities and/or feel they are not capable of pursuing them. Faculty often don't have sufficient incentives to dedicate the necessary time and resources to supporting UG research.

As a Vice-President for Research (VPR) faculty fellow for 2022-2023, I was tasked to examine the landscape for undergraduate research (UG) at Michigan Tech, provide an overview of current UG research opportunities, and provide recommendations to the university administration to address the challenges to developing and supporting a culture of undergraduate research on campus. For this work, we defined undergraduate research as "a learning experience including conducting a literature review, learning essential experimental techniques, designing experiments, carrying out experiments (collecting and analyzing data), interpreting data, and communicating results (poster, presentation, formal paper)."

The project goals were to identify: (1) the barriers resulting in low participation of undergraduates in research; (2) best practices for increasing participation in research; (3) how to increase awareness among faculty and students about the benefits of UG research; and (4) a list of needed resources.

The recommendations to remove barriers are classified into two main categories: 1) to increase dissemination, research training, networking, assessment, and partnership opportunities: create a UG research office and a UG research website; 2) to increase participation: provide incentives for faculty, such as UG funding, cost-share, staff support, and recognition, and provide incentives for students, such as outreach, support, and recognition.

2. Alignment with Michigan Tech Strategic Planning

It is part of Michigan Tech’s strategic plan to integrate instruction, research, and innovation to achieve students’ competence-based education in support of students’ preparation for a wide range of careers in industry and academia. We want to outpace our peers by offering more opportunities for students to go beyond mastering basic skills. One of the efforts of Michigan Tech’s Reimagining Education for the 21st Century Tech Forward Initiative is the development of a new General Education (GenEd) program – Essential Education. The proposed Essential Education’s four learning goals and twelve performance criteria are shown in Fig. 1 and Fig. 2. The learning goals are Think Critically, Communicate, Adapt, and Transform. These learning goals and assessment performance criteria can be achieved and evaluated through experiential learning, such as UG research. The proposed GenEd framework includes an Essential Educational Experience, which is an immersive project-based or experiential learning course that leverages, integrates, or expands upon coursework in the pathway.

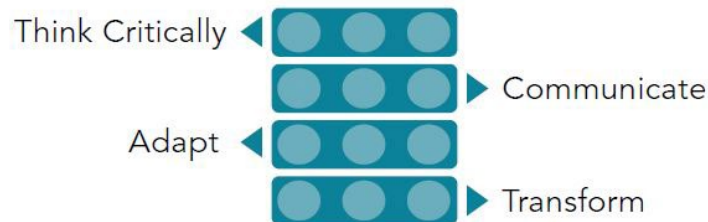


Fig. 1 – Proposed Essential Education four learning goals [14].

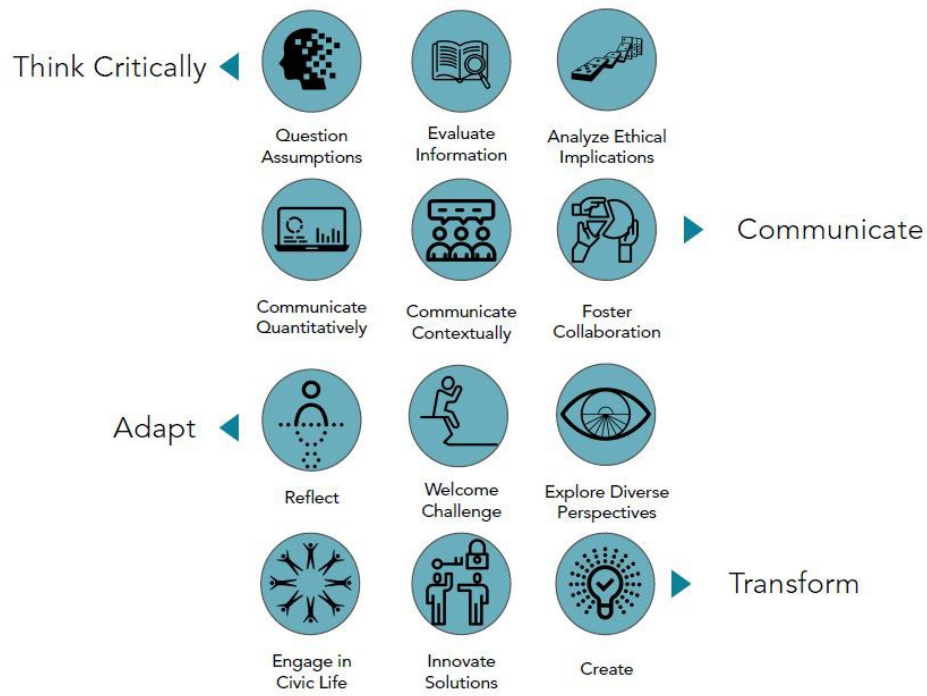


Fig. 2 – Proposed Essential Education 12 performance criteria [14].

3. Benefits of Undergraduate Research

Research experience is one of the most effective avenues for attracting students to and retaining them in science and engineering and for preparing them for careers in these fields [1]. Mentored research, in which students and faculty work together to discover new knowledge, apply it to their discipline, and share it locally, nationally, and globally, is instrumental in helping individuals develop an array of skills [2]. Undergraduate research simultaneously strengthens undergraduate education; provides additional outlets for faculty to teach, research, and serve; and fosters the creation of a community of scholars that is essential to the intellectual health of the university [2]. Undergraduate research (UG) experiences are recognized as stronger examples of high-impact experiential learning, allowing students to gain skills applicable to both research and non-research careers.

Studies show that students who engage in research are more likely to graduate, are more likely to attend graduate school, and have more successful careers after graduation. Students who participate in research experience many benefits, including increased persistence and confidence; increased interest in graduate school; and higher gains in research skills, including gathering and analyzing data, critical thinking, and improved communication skills [1]– [6]. Moreover, undergraduate research has been shown to be particularly effective at increasing retention and opening career pathways for minority and underrepresented populations [6]. However, students often are not aware of research opportunities and/or feel they are not capable of pursuing them.

To examine the landscape for undergraduate research (UG) at Michigan Tech, a set of questions were developed to guide discussions with main stakeholders (faculty, administrators, students). Interviews were held with campus-wide stakeholders who are directly or indirectly involved with UG research to identify the current landscape, barriers, and needed resources to develop and support a culture of undergraduate research. Additionally, data was collected via benchmarking peer institutions' UG research programs. In Spring 2023, a panel session was organized during the campus-wide Faculty Research Day at MTU to discuss UG research experiences. The data collected enabled a better understanding of the available opportunities and required resources. Please refer to the set of interview questions in Appendix 2.

Based on campus discussions with stakeholders, the following are the main cited benefits of UG research to Michigan Tech's students and faculty.

3.1 Benefits of UG Research to Students:

- Engages and empowers students in hands-on learning;
- Enhances students' learning experience through mentoring relationships with faculty;
- Contributes to recruitment, retention in STEM disciplines and other fields;
- Develops critical thinking, creativity, problem solving, self-confidence, and intellectual independence;

- Leads to discovering how research contributes to the advancement of human knowledge;
- Provides effective career preparation and promotes interest in graduate education;
- Can lead to interest in higher education careers;
- Leads to the application of knowledge learned in the classroom (retention);
- Contributes to more successful careers in either industry or academia;
- Contributes to industry employment: employers want students with more hands-on experience. UG research adds value to students' resumes by indicating the next level of thinking and development of new skill sets desired by the job market;
- Leads to an appreciation of what it takes to do research. It complements course education, gives the opportunity for additional literature reviews, and fosters a better understanding of the overall discipline;
- Contributes to students' income, if funded research;
- Improves work ethics. Students learn how to sustain commitment to work, not the number of hours;
- Contributes toward improving students' letters of recommendation;
- Improves leadership and time management skills as well as professional ethics and responsibility;
- Improves students' abilities to write competitive proposals to fellowship programs (e.g., SURF, DoE SMART, NSF GRFP).

3.2 Faculty Benefits of UG Research:

- Increases access to grant funding. Funding agencies (NSF, DoE) have RFPs specifically requesting UG researchers' project participation;
- Promotes advancements, discovery, and participation since many students are willing participants in UG research.
- Can lead to high risk investigations. Research projects have to be properly sized for UG students. However, faculty can take more risks with UG students because the pressure to generate publication is less than that for Ph.D. students. Thus, faculty can give a project to UG students with an uncertain outcome;
- Promotes greater engagement with students, colleagues, and the community;
- Invigorates intellect and increases enthusiasm;
- Enhances teaching effectiveness;
- Contributes toward molding scientific thinking and behavior since UG researchers are still a blank canvas – faculty benefit from the long-term relationship if the UG researchers become graduate students;
- Contributes to relatively low-cost personnel since hourly paid UG researchers are relatively low-cost;
- Contributes to the educational mission since students get experience and develop new skills that can be used in either academia or industry.

3.3 Institutional Benefits of UG Research¹⁷:

- Enhances intellectual vitality of the institution;
- Brings new equipment and facilities through external funding;
- Attracts engaged students and community interest;
- Encourages innovative and collaborative curricula;
- Promotes engagement with national trends in higher education and new research directions;
- Attracts talented faculty and builds research programs.

4. Barriers and Concerns

- Awareness of existing research opportunities;
- Awareness of the benefits of research experiences;
- Difficulty to match UG research availability, resources, and students. Students often don't know how to find an advisor/mentor;
- Perceived barriers to interactions with faculty;
- Financial barriers (funding/cost share);
- Lack of incentive and recognition for faculty. It is not easy for tenure-track faculty to carve out time for students, as UG research demands more mentoring with little research output;
- Need to better align students' path/curriculum with research;
- Lack of role models;
- Lack of UG research information dissemination for both faculty and students.
- Need for additional staff support to increase research commitment, such as more support for already existing programs such as SURF, URIP, and MiCUP.
- Need for more faculty members participating in recruiting events, which would help with recruitment, facilitate student/faculty interaction, and increase students' familiarity with faculty research.
- Need for an "intentional" curriculum. Part of our mission is to develop scholars, but there are concerns we are failing on that; some believe we have an ad hoc instead of an "intentional" curriculum.
- Need for faculty to do a better job introducing students to their research; for instance, talking more about their research in their classrooms and participating in recruitment events on and off campus, such as the Leading Scholars Fellowship program.

5. Solutions

5.1 Benchmarking: Higher Education/Peer Universities⁷

Most of our peer institutions have well-established undergraduate research programs as well as undergraduate research offices. A UG research office serves as a clearinghouse for research training, networking, and partnership opportunities. The following is a list of typical basic functions associated with a UG research office [15], [16]:

- Provides opportunities for students to engage in an undergraduate research experience.

- Provides opportunities for students to learn about the benefits of UG research or scholarly experience.
- Provides opportunities for students to disseminate the results of their research.
- Helps students find research mentors.
- Cultivates and promotes external research opportunities for students.
- Identifies and leads new grant efforts to support undergraduate research.
- Coordinates all undergraduate research efforts across campus.
- Centralizes assessment and evaluation of all undergraduate research programs.
- Increases the visibility of undergraduate research and recruits future participants.
- Promotes recognition of student research accomplishments.
- Provides financial support for students to present at professional meetings and undergraduate research conferences.
- Helps faculty develop the skills required to become effective research mentors through development and dissemination of best practices.
- Works with the University Career Center and the Graduate School to help prepare students for their post-graduation careers.

Below is a list of undergraduate research resources provided by some of our peer institutions [7].

1. **Colorado School of Mines** has an Office of Undergraduate Research: The Office of Undergraduate Research Scholars provides students with a wide array of opportunities to conduct cutting-edge research led by Mines faculty mentors. Research opportunities include fellowships, research assistantships, and a curriculum path with credits for research. Programs such as the First-Year Innovation & Research Scholar Training (FIRST) and Mines Undergraduate Research Fellowship (MURF) can help incoming students get a head start in their field of interest [8].
2. **Missouri Science & Technology** has a website on experiential learning [9]. Experiential Learning (EL) at Missouri S&T refers to learning stimulated by a variety of structured activities that differ significantly from the traditional lecture format. Experiential learning activities are designed to require students to go beyond mastering basic skills and knowledge to problem-solving challenges. The experiential learning activities at Missouri S&T include undergraduate research, service learning, study abroad, and opportunities for undergraduate research experiences (OURE) Fellows. The purpose of the OURE Fellows Program is to increase the quality of experiential learning for Missouri S&T students, and funding has been made available to support interdisciplinary research projects for undergraduates. The university also offers experiential learning and service learning awards. The Experiential Learning Award recognizes faculty and staff who require undergraduate students to go beyond mastering basic skills and knowledge in the application of that material to problem-solving challenges. The Service Learning Award recognizes faculty and staff who involve or influence undergraduate students in academic service learning or community service activities outside the classroom.

Missouri S&T emphasizes the participation of undergraduates in research through a number of means, including an annual undergraduate research conference. This event provides an opportunity for Missouri S&T undergraduates to showcase their research efforts to the campus community and to the public.

3. **New Jersey Institute of Technology** has a well-established Undergraduate Research and Innovation (URI) Program [10], with a well-designed website and office. URI programs give students a chance to learn how to do research, but also to pick projects that will improve a societal problem and enhance the quality of life for a community. These programs are designed to help students develop the vision to contend with global challenges. URI programs focus on interdisciplinary work by inviting students from all majors, such as design, engineering, business, humanities, or science. NJIT holds an annual Undergraduate Summer Research and Innovation Symposium. In addition, the URI program has an External Advisory Board, which judges the Symposium presentations. NJIT offers several undergraduate research, innovation and design programs including McNair Research Fellowships, Provost Undergraduate Summer Research Fellowships, URI Student Seed Grant Program, and New Jersey Innovation Acceleration. A summary of NJIT UG programs is displayed in Fig. 3 below.

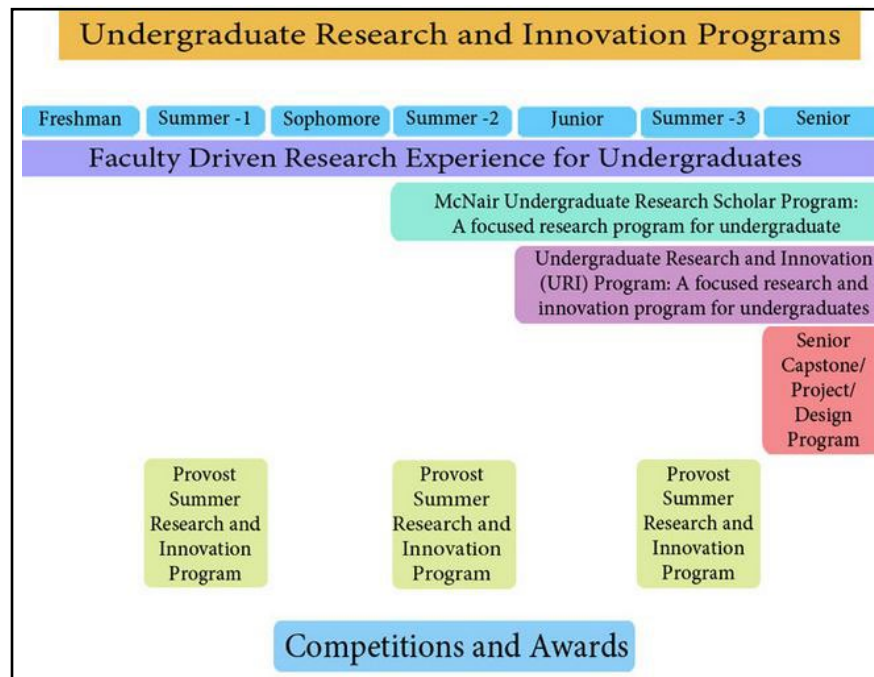


Fig. 3: New Jersey Institute of Technology UG Research Programs [10].

4. **Northeastern University** has an Office of Undergraduate Research and Fellowships. Students can explore research opportunities beginning in their first year, with research centers and institutes focused on interdisciplinary and translational research that meets societal needs in a variety of subject areas, including: Business, Computer and Information Science, Engineering and Technology, Health Sciences, Humanities and Arts,

Law, Physical and Life Sciences, and Social Sciences [11]. The office has a comprehensive Portal where students can explore research opportunities, find fellowships and scholarships, connect with faculty mentors, and see students' profiles. Faculty can post a research opportunity and have access to resources such as mentoring resources, add faculty profile, request a classroom visit, resources on how to hire a student, and awards info, among others. The advisors and staff in Undergraduate Research and Fellowships guide and encourage students to fully engage in research and creative endeavors. The office has one director, two associate directors, and one administrative assistant as well as advisors. The Office of Undergraduate Research and Fellowships, in keeping with the mission and policies of Northeastern University and the goals of Northeastern 2025, is committed to building and sustaining a diverse, equitable, and inclusive community of learners that welcomes and respects all persons, regardless of race, color, religion, religious creed, genetic information, sex, age, ethnicity, national origin, ancestry, sexual orientation, gender identity or expression, family structure, socioeconomic status, ability status, immigration status, or veteran status [11].

5.2 UG Research Programs and Approaches at Michigan Tech

Pavlis Honors College:

- **Summer Undergraduate Research Fellowship (SURF):** SURFs are open to all Tech undergraduates who have at least one semester remaining after the summer. Summer fellowship recipients conduct research projects under the guidance of a Michigan Tech faculty mentor during the summer semester. Students receive \$4,000 stipends.
- **Undergraduate Research Internship Program (URIP):** URIPs are open to all Tech undergraduates who are interested in engaging in a research experience in a faculty member's laboratory. Awards of up to \$1,920 are available to fund student researchers and are paid at an hourly rate. The Pavlis Honors College provides \$960 of this award with the expectation that the faculty mentor will match this amount. Award recipients conduct a research project under the guidance of a Michigan Tech faculty mentor during the regular academic year (September-March).

Center for Diversity and Inclusion (CDI):

- **MiCUP Scholars Program:** The Michigan College/University Partnership (MiCUP) Scholars Program is a collaborative effort between three Michigan community colleges and Michigan Tech, which brings students to Michigan Tech's campus for 7 weeks in the summer to participate in a research or project experience with a staff, faculty, or graduate student mentor. Participant students are enrolled in an honors research course, complete community services, and end the program with a research poster presentation.
- **McNair Scholars Program:** The McNair Scholars Program provides eligible undergraduates with critical research experiences as well as assistance with the graduate school application process. The McNair Program supports Scholars by focusing on three areas: academic research, graduate school preparation, and personal and

professional development. The McNair Summer Research internship provides a stipend for undergraduate research during 8 weeks at MTU as well as a stipend for approved research with a professor during the academic year.

Other Units:

- **College of Forest Resources and Environmental Science (CFRES):** Earn-and-Learn Assistantship: All incoming first-year and transfer students enrolled in the College of Forest Resources and Environmental Science—including master's students in the professional degree category—can apply for the \$1,100 assistantship award to work with a faculty member and explore their strengths, interests, and passions without waiting.
- **Health Research Institute (HRI) Summer UG Fellowship:** \$4,000 for 10-12 weeks of summer experience working on a research project and poster presentation. This fellowship is open to Michigan Tech and external students.
- **Social Sciences: Undergraduate Program for Exploration and Research in Social Sciences (UPERSS)** - The UPERSS program provides opportunities for undergraduate Social Sciences students to work closely with faculty (or an advanced graduate student) to do research, creative work, or a community-based project. Students enroll in SS 3090 Exploring Undergrad Research in Social Sciences for 1-3 credits. Students earn 1 unit of academic credit for every 3 hours worked per week (limited to a total of 3 credits per semester).
- **Great Lakes Research Center Student Research Grant:** The GLRC Student Research Grant provides support for graduate and undergraduate research. This opportunity allows students to gain experience in writing competitive grants and to perform research they wouldn't otherwise be able to attempt due to funding limitations.

6. Recommendations

The typical basic functions associated with a UG research office listed in section 5.1 are critical for a research focus institution. In addition, we would aspire to additional goals to align with our mission and strategic plan, such as:

- Advocating for and teaching how to do research-based instruction in the classroom.
- Using undergraduate research to reinforce our core values of an engaged and integrated learner by reinforcing the critical thinking skillset required to address complex problems.
- Creating large-scale and interdisciplinary thematic research teams to address important societal problems (i.e., sustainability, cybersecurity, pollution, hunger).
- Updating our faculty review structure to explicitly reward undergraduate research.

Approximately 10% of post-secondary institutions are classified as doctoral universities. The Carnegie Classification model identifies doctoral universities as either research or professional/doctoral universities. Research universities are further classified as R1, considered the most organizationally complex and prestigious, with very high research activity; or R2, next-tier research universities with high research activity [12]. Successful completion of these more

ambitious goals will have a dramatic impact on student learning, will make Michigan Tech a national leader in using undergraduate research as a means to reinforce our core teaching mission, and would contribute to our Carnegie Classification from R2 to R1.

To stay competitive, we also need to learn the needs and wants of prospective students and parents. Thus, I attended Michigan Tech admissions events and talked to the director of admissions. I learned that one of the commonly asked questions from parents and prospective students is what experiential learning opportunities are available. In addition, enrollment survey data shows that students rank academic reputation, research opportunities, faculty mentors, and quality programs as highly important (See Fig. 4). Hence, the key discovery is that co-curricular activities are as critical as the programs we offer.

Increasing access to research and deliberate integration of research into the curriculum strengthens our academic mission and aligns with Michigan Tech’s Strategic Plan. Hence, an office of UG research would be an extremely valuable resource to improve academic reputation, research opportunities, quality programs, and student/faculty mentorship. It would serve as a clearinghouse for research training, networking, assessment, and partnership opportunities. It is a resource where students could explore research opportunities beginning in their first year.

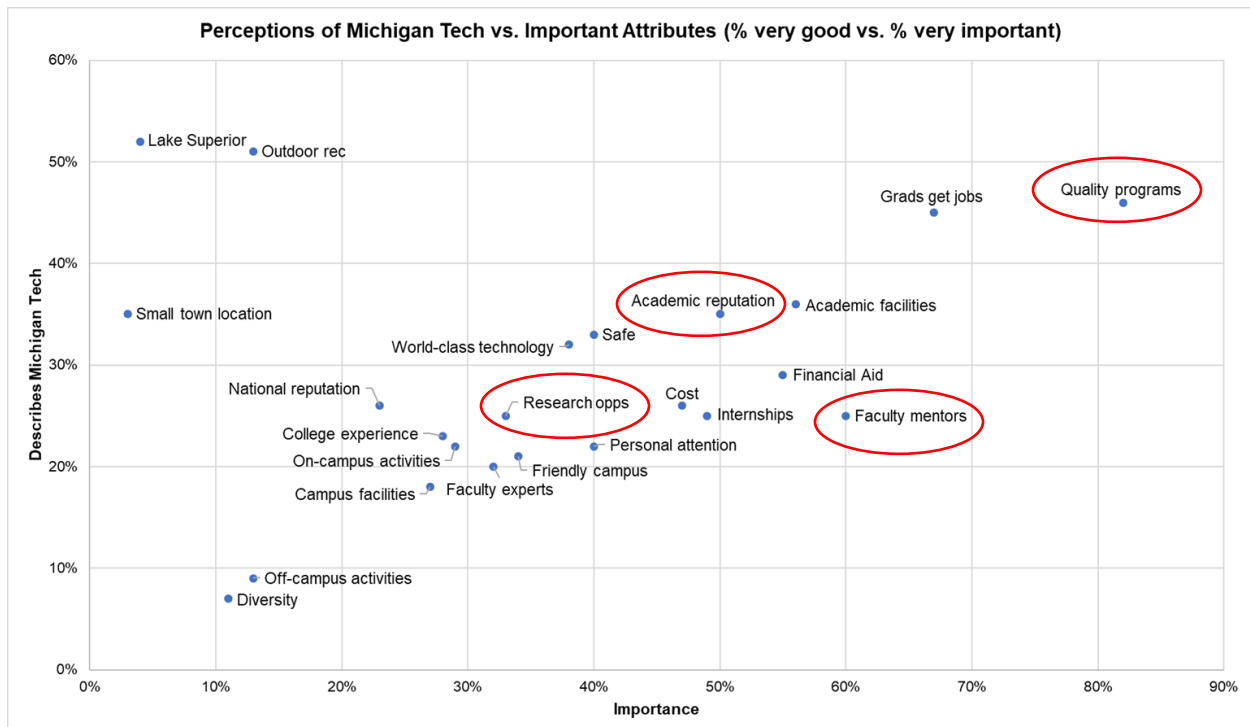


Fig. 4 – 2021 Incoming Class – Undergraduate Prospects [13].

During interviews, faculty and students stressed the need for a UG research website to support research participation and to help students navigate the application process for research

groups and laboratories campus-wide. In fact, a student told me he didn't start UG research earlier because he was not even aware of it. He didn't know how to sign up or where to look for information.

The findings of this study indicate that Michigan Tech would benefit from culturally embracing the importance of UG research at all levels, including making it part of the faculty performance review process. By providing supporting resources for undergraduate research, we are providing opportunities to build strong programs, which will differentiate Michigan Tech, attract more high-caliber students, and further our goals of providing a technologically-rich education grounded in a residential and experiential learning environment.

6. Recommendations to Remove Barriers:

To increase dissemination, research training, networking, assessment, and partnership opportunities:

- Create an office of undergraduate research to coordinate campus-wide efforts.
- Create a website to centralize UG research opportunities information and resources, and in this way be able to coordinate efforts. A dedicated website would be helpful to match UG research availability, resources, and students. This website could also provide resources for students to apply for graduate school as well as to guide students through the process of applying for and winning nationally competitive fellowships such as Goldwater, NSF GRFP, DoD SMART, and NDSEG.

Incentives to increase participation:

Incentives for faculty

- Funding for research and cost-share: create seed funding to include opportunities for UG research. This should be a shared effort by departments, colleges, and centers. A similar existing program is the URIP housed at Pavlis Honors College, but it has relatively low faculty participation.
- Central coordination and staff support to reduce the logistics burden.
- Teaching release: consider a 3-credit course release for a given number of UG research students mentored.
- There is a widespread perception that mentoring undergraduate researchers carries little or no weight in the faculty TPR review process. It is critical for colleges and departments to explicitly include undergraduate research within their TPR review processes. Create a question of digital measure to address UG research participation.
- Create a yearly faculty award at each rank level (assistant, associate, full) for faculty who have given institution-wide contributions to UG research.
- Faculty should be encouraged by departments to talk more about applications and research opportunities in class as well as convey more enthusiasm to students.
- Create more department and college level programs.

Incentives for students:

- Create a mechanism to better disseminate information;
- Create a more “intentional” curriculum by aligning students’ paths (time for research, course credits) with UG research opportunities;
- Provide course credit for UG research;
- Provide funding for UG research;
- Provide peer and mentor support;
- Foster a sense of belonging;
- Create a yearly student award in different categories for students involved with UG research;
- Create more department and college level programs.

Office of UG Research: There are many administrative models for undergraduate research offices, but all include a few basic elements such as staffing, programs, and agenda [16]. Based on the nature of this proposal and models from peer institutions, an option would be for the office to be staffed by the following:

- Director
- Associate and/or Assistant Director
- Administrative Assistant and Webmaster
- Faculty Fellows (partial support for faculty members)
- Undergraduate Research Advisory Board

It is outside of the scope of this study to make a cost analysis and propose a budget for this office. Findings by benchmarking peer institutions indicate a common model is the sharing of costs by several units on campus, including Departments, Colleges, Pavlis Honors College, Graduate School, Provost Office, and Vice-President of Research Office. The UG research office is essentially an investment in research and could be funded by, for instance, IRAD funds, general funds, philanthropy, and proposal submissions to funding agencies. The UG research office could be housed at the Van Pelt and Opie Library, Administration Building, or other location on campus.

7. Acknowledgements:

I would like to thank the Vice-President of Research Office for the opportunity to work on this project and to serve as a faculty fellow. In particular, I would like to express my immense gratitude to Kathy Halvorsen for her time and mentoring throughout this process. I also thank all faculty, staff, and students interviewed for this study, whose names are listed in Appendix 1.

8. References:

[1] NSF, Research Experiences for Undergraduates (REU), program solicitation, NSD 22-601.

[2] S. Russell, M. Hancock, J. McCullough, “Benefits of Undergraduate Research Experiences,” *Science*, 316, 548-9.

- [4] J. Moody, "Why undergraduate Research Matters in College," U.S.News, Sept. 20, 2019.
- [5] <https://www.usnews.com/education/best-colleges/articles/2019-09-20/why-undergraduate-research-matters-in-college>
- [6] Nagda, B., Gregerman, S., Jonides, J., von Hippel, W., & Lerner, JS. (1998). Undergraduate Student-Faculty Research Partnerships Affect Student Retention. *Review of Higher Education*, 22, 55-72.
- [7] <https://www.mtu.edu/institutional-research/peers/>
- [8] <https://www.mines.edu/undergraduate-research/>
- [9] <https://experientiallearning.mst.edu/>
- [10] <https://centers.njit.edu/uri/index.php>
- [11] <https://undergraduate.northeastern.edu/research/>
- [12] K. Seecharan, "Exploring the Umpetus of R2 Universities that Attain R1 Status," Univ. of Pennsylvania 2020 Dissertation, <https://repository.upenn.edu/dissertations/AAI28025587/>
- [13] Michigan Tech Non-Enrollment Data for 2021 Incoming Class, provided by the Office of Admissions.
- [14] Essential Education Vision Presentation to MTU Senate on 02/01/2023.
- [15] D. Livesay, "Building upon our success," UNC Report, Feb.11, 2016.
- [16] J. Kinkead and K. Blockus, "Undergraduate Research Offices & Programs: Models & Practices," Washington DC, Council of Undergraduate Research, 2012.
- [17] <https://www.cur.org/>

Appendix 1:

I would like to thank all the faculty, staff, and students across Michigan Tech consulted during this study. I thank all of them for the time, helpful discussions, and their insights.

Michigan Tech Faculty/Staff (listed alphabetically by last name):

- 1) Jim Baker
Associate VP for Research Administration
- 2) Michael Blanco
Director of Diversity and Inclusion Operations
- 3) Mari Buche
Professor and Associate Dean – College of Business
- 4) Will Cattrell
Professor and Dean of Graduate School
- 5) Molly Cavaleri
Professor, College of Forest Resources and Environmental Sciences
- 6) Gabriel Escobedo
Director, McNair Scholars Program and Center for Diversity and Inclusion
- 7) Beth Fitzpatrick
Director of Admissions
- 8) Wayne Gersie
VP for Diversity and Inclusion
- 9) Robert Handler
Sr Research Engineer, Chemical Engineering
SURF and URIP Program Coordinator, Pavlis Honors College
- 10) Kathy Halvorsen
Associate VP for Research Development
- 11) Cody Kangas
Director Career Services
- 12) Kelly Kamm
Assistant Professor, Department of Kinesiology and Integrative Physiology
- 13) Elizabeth Karstrand
Prospective Student, Leading Scholar Finalist
- 14) Matt Kouba
Senior Student, Computer Engineering
- 15) Dennis Livesay
Dave House Dean of Computing, College of Computing

- 16) Katie Lucca
Federal Work Study Program Coordinator, Financial Aid Manager
- 17) Pushpa Murthy
Emeritus Professor and Dean of Graduate School
- 18) Soner Onder
Professor, Computer Sciences
- 19) Luke Pietluck
Prospective Student, Leading Scholar Finalist
- 20) Kellie Raffaelli
Associate Dean for Student Engagement
- 21) Smitha Rao
Assistant Professor, Biomedical Engineering
- 22) Christopher Sanders
Assistant Director, Center for Diversity and Inclusion
- 23) Jacque Smith
Director of Graduate Enrollment Services, Graduate School
- 24) Alexsay Smirnov
Professor and Chair, Geological and Mining Engineering And Sciences
- 25) Andrew Storer
Interim Provost
- 26) Keller Swiatlowski
Prospective Student, Leading Scholar Finalist
- 27) Ashutosh Tiwari
Associate Professor, Chemistry
- 28) Richelle Winkler
Professor, Social Sciences
- 29) Ezra Bar Ziv
Professor, Mechanical Engineering – Engineering Mechanics

Appendix 2:

In order to guide our discussions with faculty and staff, we developed a set of questions listed below. We then, group the answers based on main themes.

- 1) What are the benefits (to faculty and to students) associated with undergraduates being involved in their own or faculty research projects during their years at Tech?
- 2) Do you think about the right number of undergraduates are involved in their own or a faculty member's research while at Tech? If no, should it increase or decrease? Why?
- 3) If the answer is increase to Q2, What resources do we need to increase UG research on campus?
- 4) What are the main challenges/barriers you see for UG research on campus?
- 5) What strategies have you seen be effective in getting undergraduate students interested in research?"
- 6) How can we connect UG research with the curriculum? Research credits? Technical Electives? Senior Design?

Do you think if students could more easily count UG research towards degree requirements, they would be more willing to consider UG research?

- 8) In order to improve the quality of UG research experiences, what are the most effective mentoring practices for UG students? Did you have a graduate student to mentor your UG research student? Did you mentor? Or a mix of both?
- 9) How can we leverage UG research to encourage students to apply for graduate school?
- 10) What path did you follow to go to graduate school? Ask faculty if they participate in UG research.
- 11) How does your unit encourage faculty to work with UG students in research?