

**ADVANCE: An investigation of the representation of female  
faculty candidates at Michigan Technological University**

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In the fall of 2008 Michigan Technological University was awarded a multi-year National Science Foundation ADVANCE grant entitled “Changing the Face of Michigan Tech”. This research was supported by NSF grant No. 0820083. At the start of this project, the faculty complement at Michigan Tech was over 80% in Science, Technology, Engineering and Mathematics (STEM) in terms of disciplines, and prior to the ADVANCE initiatives only 12% of the full professors and faculty serving in leadership positions were female. One of the focus areas of this grant is to investigate the minority status of women faculty in the STEM fields by researching and implementing strategic ways to improve the recruitment of a diverse applicant pool, focusing on qualified female faculty candidates. As the ADVANCE project got underway, Michigan Tech also began recruiting for faculty positions hired in clusters by various topical areas in order to promote collaborative research endeavors across disciplines. This hiring agenda has been called the Strategic Faculty Hiring Initiative (SFHI). The driving research questions behind our project are: How can we increase the representation of women and minorities at Michigan Tech? Second, are women and minorities more strongly attracted to opportunities for collaborative, interdisciplinary scholarship (cluster-based) than to traditional departmental (replacement hire) positions?

In order to assess the gendered faculty climate at Michigan Tech and to determine areas for recruitment improvement, the “Applicant Survey” was developed (Appendix). This survey was designed and distributed in conjunction with the University Affirmative Programs Office and sent to all faculty applicants prior to initial screening and before interviewing. The survey was approved by Michigan Tech’s Institutional Review Board (M0334). The Applicant Survey was voluntary and consisted of 20 questions meant to highlight various individual gender and race distinctions as well as the applicants’ understanding of the position for which they applied, along with their desires for and impressions of the university’s initial hiring processes. In this paper we will report on our findings and the impact of cluster-based strategic faculty hiring on our ability to increase the number of females in our applicant pool. The results of our analysis will lead to practical implications for improving the diversity of University faculty composition in STEM areas.

More than 1,700 applicant survey responses were collected over three academic years, i.e., 2008–09, 2009-10, and 2010-11. For purposes of this study, replacement hire respondents from non-STEM units were not considered, i.e., from the departments of Humanities, Visual and Performing Arts, Business, and Cognitive and Learning Sciences. Responses are provided only for applicants who indicated both gender and type of position (SFHI or replacement hire) for which the application was made. As shown in Table 1, the information from over 1,400 applicant survey responses was evaluated. It is important to note that the data for the 2008-09 academic year represents the full complement of SFHI applicants but only three of the replacement searches (from two academic units) due to being administered relatively late in the year. As the department replacement hire data contains far fewer responses, detailed comparisons between the SFHI and replacement hire responses were not conducted for this first year. Some of the questions for the 2009-10 survey were also slightly modified based on the responses to the first survey. Departmental replacement hires were aggregated, grouping all STEM searches performed across campus in the given year (Figures 1 and 2).

Table 1. 2008-2011 Total Numbers of STEM Respondents (SFHI and Replacement Hires) to Applicant Survey.

	2008-2009	2009-2010	2010-2011
<b>Total STEM Applicants</b>	<b>301</b>	<b>612</b>	<b>500</b>
Female	53	102	111
Male	223	510	389
(Gender Not Indicated)	(8)	(56)	(51)
<b>Total SFHI</b>	<b>153</b>	<b>297</b>	<b>209</b>
Female	24	36	39
Male	129	261	170
(Gender Not Indicated)	(0)	(2)	(1)
<b>Replacement Hire</b>	<b>123</b>	<b>315</b>	<b>291</b>
Female	29	66	72
Male	94	249	219
(Gender Not Indicated)	(25)	(129)	(117)
<b>SFHI By Topic</b>			
Computational Discovery-Female	24		
Computational Discovery-Male	129		
Health-Female		19	25
Energy- Female		17	14
Health-Male		128	79
Energy-Male		133	91
<b>Open Rank Questions (Strongly Agree or Agree)</b>			
<b>Opportunities for Collaboration</b>			
Female Replacement	26	51	58
Female SFHI	21	30	32
Male Replacement	72	218	146
Male SFHI	119	228	146
<b>Spousal/Partner Accommodations</b>			
Female Replacement	9	13	12
Female SFHI	9	13	17
Male Replacement	15	63	55
Male SFHI	27	92	65
<b>Diverse Workplace</b>			
Female Replacement	13	39	43
Female SFHI	16	27	30
Male Replacement	39	173	121
Male SFHI	84	191	139

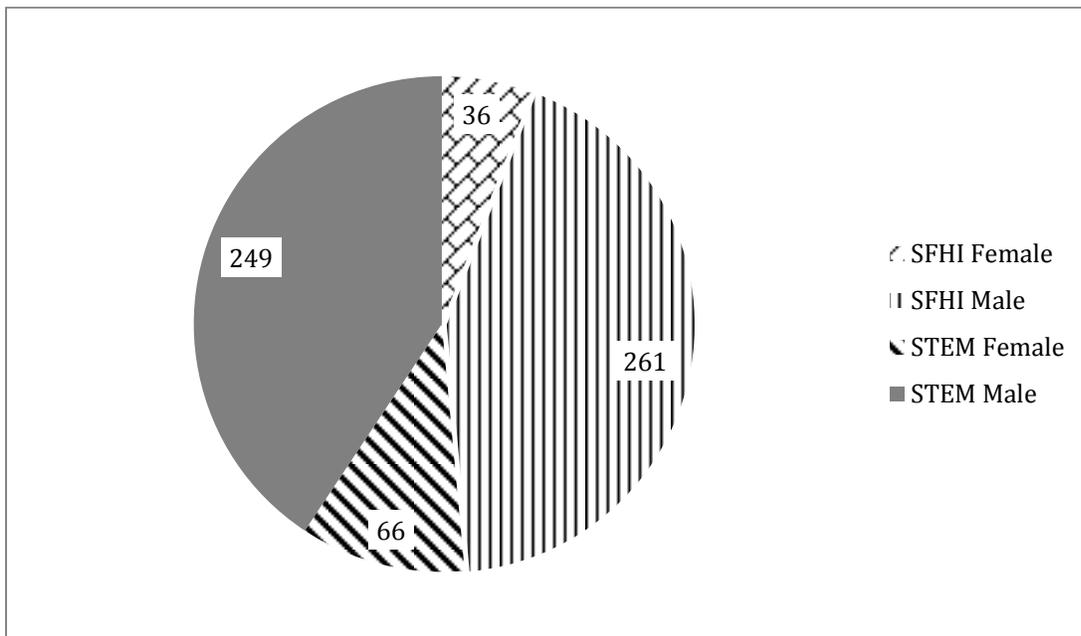


Figure 1. 2009-2010 SFHI vs. STEM Replacement Hire Applicant Survey Responses (n = 612)

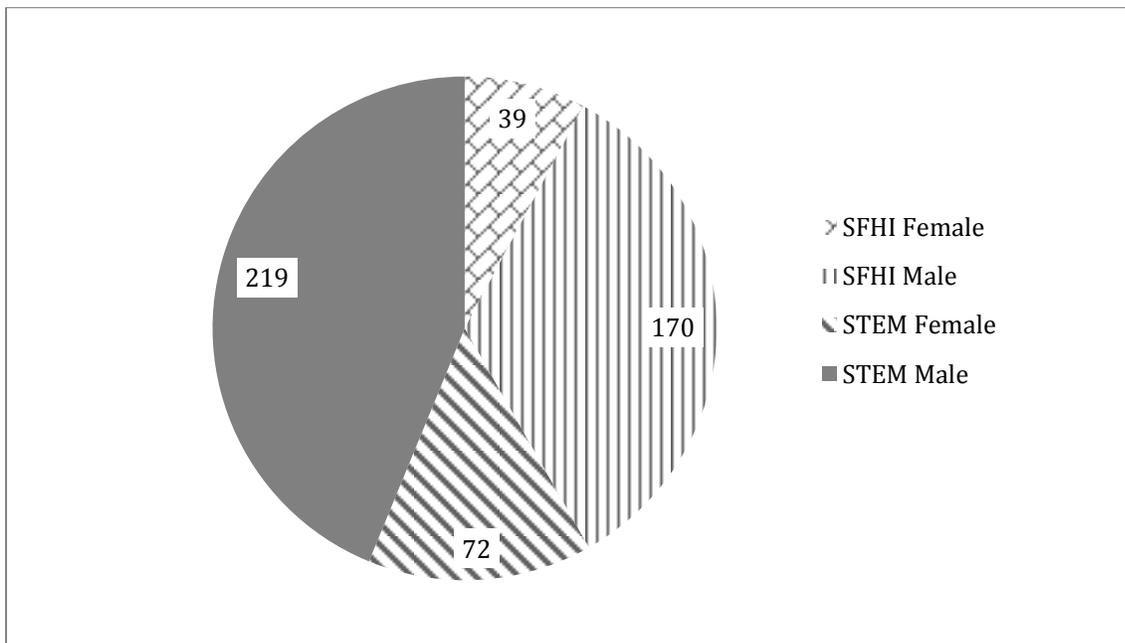


Figure 2. 2010-2011 SFHI vs. STEM Replacement Hire Applicant Survey Responses (n=500).

The SFHI results are most informative if the specific interdisciplinary focus of the hiring initiative is considered in combination with the applicant data. The SFHI for 2008-09 focused on Computational Discovery (Figure 3). The percentage of female applicants was roughly 15%, not

surprising given the low representation of females in computing fields nationally, particularly in higher education fields.<sup>1-5</sup> The model often used to identify this negative trend is that of a “leaking pipeline”<sup>3,7</sup>. The pipeline model illustrates the gradual, but continuous, phenomenon of women exiting the STEM fields at key decision points or specific stages of career progression.<sup>3</sup> In most instances, it is presumed that these decisions are voluntary, and are the outcome of a wide range of factors<sup>5</sup>. The SFHI initiatives for the two subsequent years were divided between disciplines related to Energy and Health. It was anticipated that more females would apply to the Health SFHI since the initiative includes a number of disciplines considered more traditionally occupied by females<sup>6</sup>. However, the percentage of female applicants was only slightly higher than for the Energy-related fields (Figure 3).

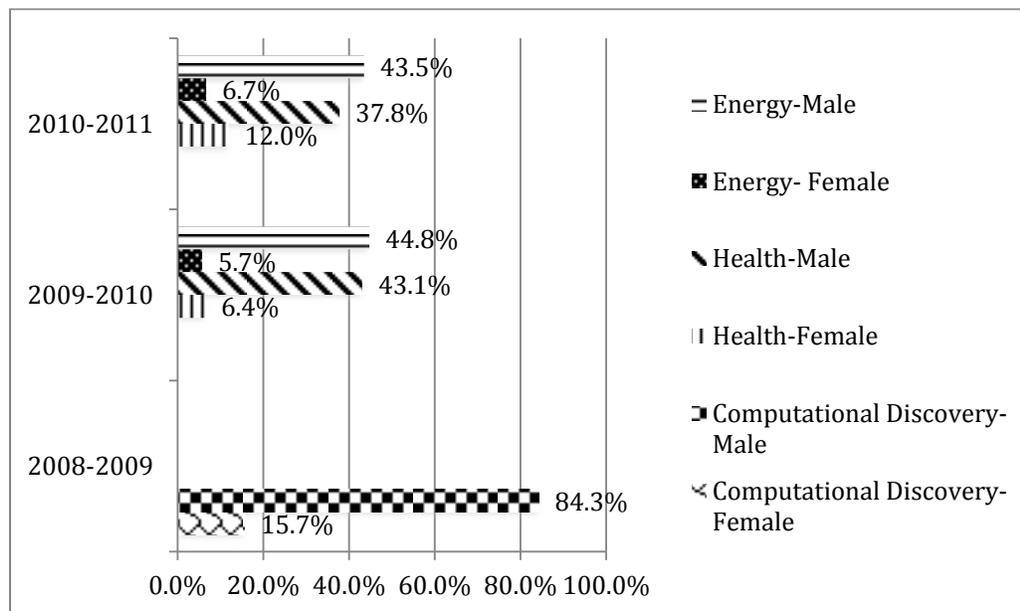


Figure 3. Applicant Respondents for SFHI Positions by Gender. (Percentages based on total number of applicants who responded to survey and identified as applying for a Strategic Faculty Hiring Initiative position, see Table 1.)

All applicant groups reported high interests in teaching and interacting with undergraduate/graduate students (data not presented) and in opportunities for collaboration (Figure 4). However, the SFHI applicants, in general, were also more interested in the applied research focus of the positions compared to the replacement hire applicants (data not presented). The female SFHI candidates also indicated that they were more likely to consider working in a culturally diverse environment (Figure 5) with partner/spousal accommodation as compared to the female replacement hire respondents (Figure 6). (“Valued” for each of these concerns was determined by the respondents who selected “strongly agree” and “agree” from a 6 point Likert scale.) The data presented in Figures 4 – 6 represents the percentage of applicants who valued collaboration, diversity or partner accommodation; the original data are presented in Table 1. This trend also appears to some extent for the male SFHI vs. replacement hire respondents.

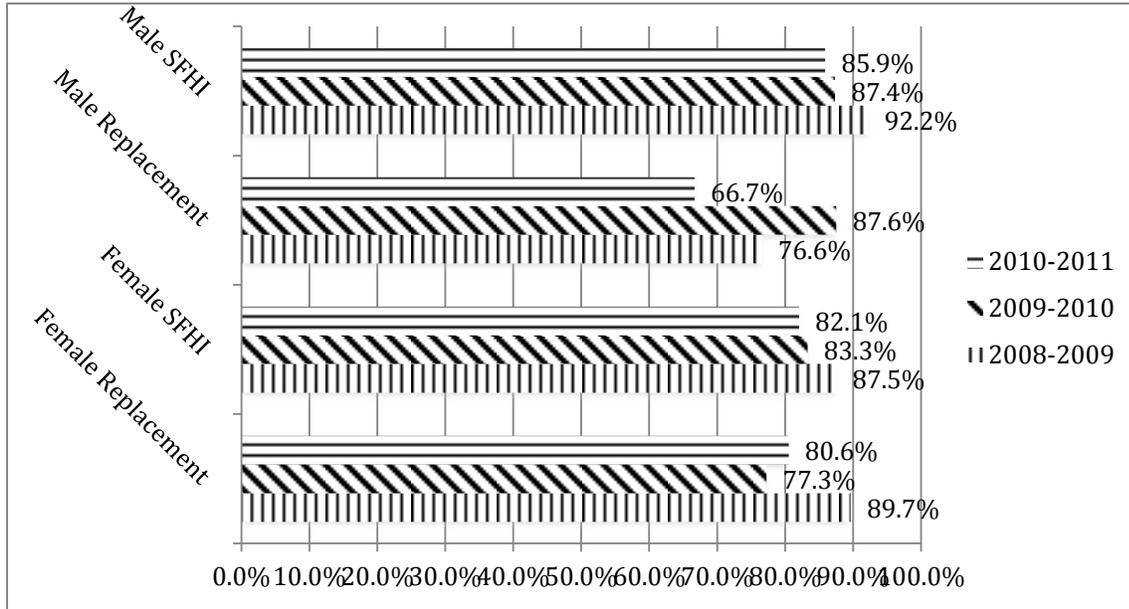


Figure 4. Applicants who valued opportunities for collaboration.  
 (Percentages for total respondents by gender; see Table 1 for corresponding number.  
 “Valued” = Response of Strongly Agree or Agree.)

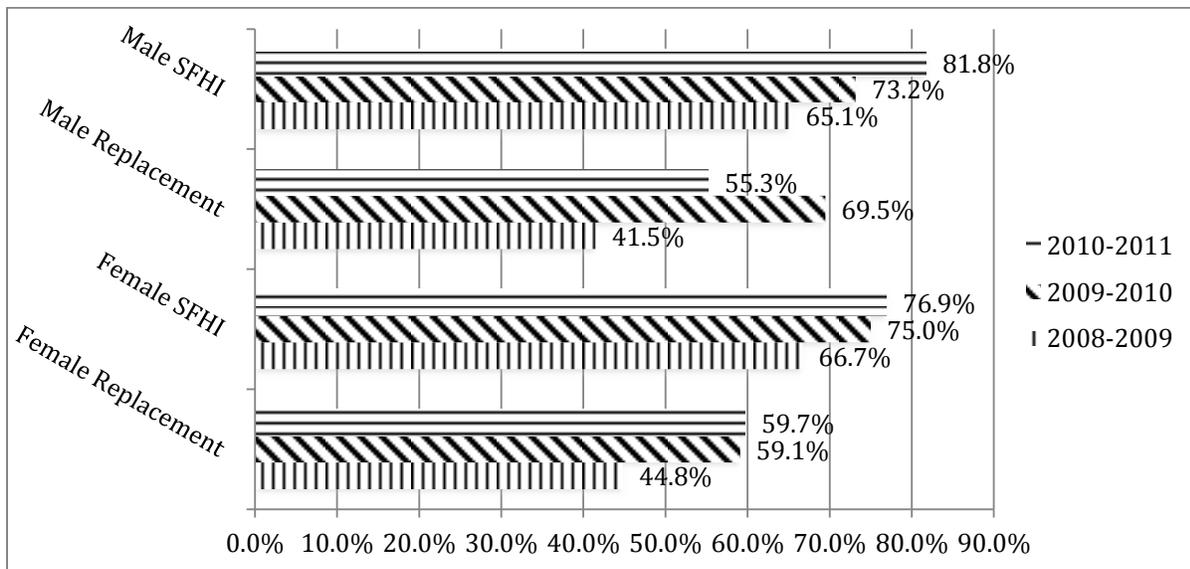


Figure 5. Applicants who valued diversity in the workplace.  
 (Percentages for total respondents by gender; see Table 1 for corresponding number.  
 “Valued” = Response of Strongly Agree or Agree.)

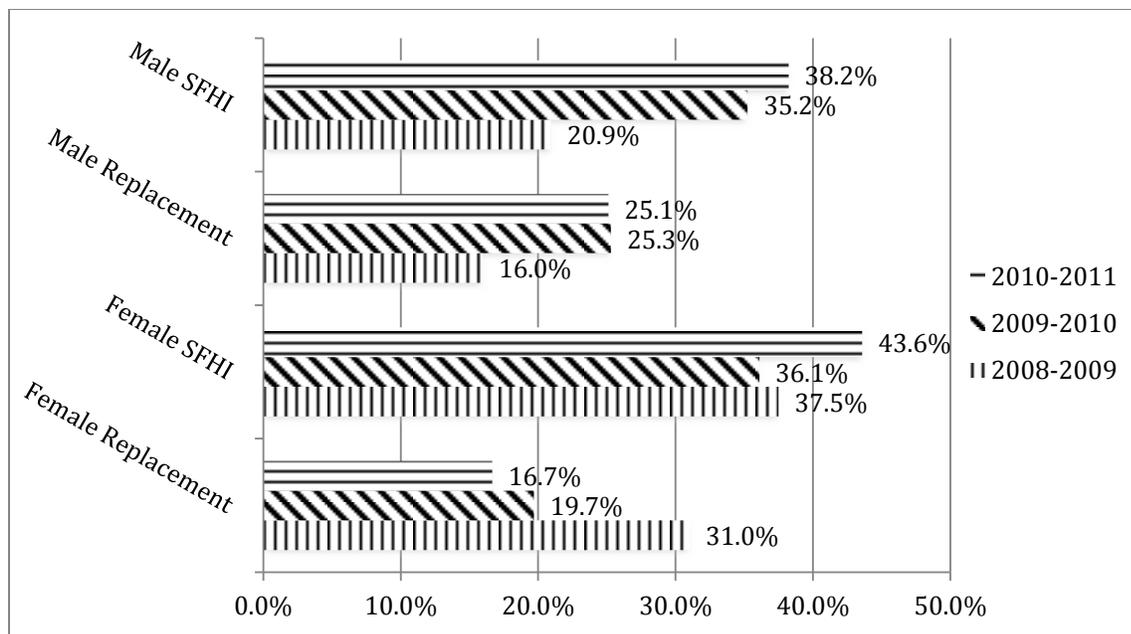


Figure 6. Applicants who valued partner accommodation.  
 (Percentages for total respondents by gender; see Table 1 for corresponding number.  
 “Valued” = Response of Strongly Agree or Agree.)

### Discussion

The preliminary results of this study support our original propositions regarding increasing diversity across the Michigan Tech faculty. As our results show, more females were attracted to hiring initiatives that included inter-disciplinary and multi-disciplinary opportunities than to traditional departmental replacement postings. In other words, the applicant pools for SFHI positions contained more females than the aggregated results of departmental faculty replacements. Female applicants from both pools indicated that collaboration with peers and teaching opportunities were of great interest. Of greater significance in this study, female SFHI applicants were also most interested in workplace diversity. Therefore, opportunities to enter a new organization or position as part of a cohort might be an attractive factor to consider for institutions attempting to increase the diversity of their faculty. Placement advertisements for SFHI-type postings should clearly communicate this unique opportunity.

The other characteristic that proved valuable to female SFHI applicants was partner/spousal accommodations. This result might be linked to the specific location of Michigan Tech. Realistically, there are few major employers in the surrounding geographical area, and employment is depressed throughout the region. The focus of applicants seeking assistance for their partners is becoming a critical consideration that must be addressed by the institution in order to attract and retain a diverse faculty.

## Appendix: Applicant Survey (2010-2011) ADVANCE: Changing the Face of Michigan Tech

**ADVANCE (2010-2011): Changing the Face of Michigan Tech**

Michigan Tech Tenure-Track Faculty  
Equal Employment Opportunity Self Disclosure Form and Applicant Survey

**CONSENT TO PARTICIPATE IN RESEARCH**

**ADVANCE: Changing the Face of Michigan Tech**

You are asked to participate in a research study conducted by Dr. Margaret Gale, through the Provost's Office at Michigan Technological University. This work is funded by the National Science Foundation. Your participation in this study is entirely voluntary. Please read the information below in its entirety before deciding whether or not to participate. This survey also contains information necessary for us to meet our federal Affirmative Action reporting requirements.

**PURPOSE OF THE STUDY**

This on-line survey of applicants for tenure-track faculty positions is being used to collect information that will aid us in attracting a more diverse applicant pool. We will also obtain the information necessary for us to meet our federal Affirmative Action reporting requirements.

**PROCEDURES**

If you volunteer to participate in this study, you will be asked to do the following things:

Respond to the questions in this survey to the best of your ability. Submit the survey once you have completed the questions you wish to answer.

**POTENTIAL RISKS AND DISCOMFORTS**

There are no anticipated direct or indirect risks or discomforts associated with participating in this study.

In the event of physical and/or mental injury resulting from participation in this research project, Michigan Technological University does not provide any medical, hospitalization or other insurance for participants in this research study, nor will Michigan Technological University provide any medical treatment or compensation for any injury sustained as a result of participation in this research study, except as required by law.

**POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY**

There are no anticipated direct benefits to the participants in this study as a result of their participation.

It is anticipated that the results of this study will be used to attract a more diverse pool of candidates to tenure-track faculty positions at Michigan Tech. The results may also be disseminated to other institutions and therefore should broaden the representation of faculty from under-represented groups across the academy.

**CONFIDENTIALITY**

The information obtained from this survey will be collected by the Affirmative Action Office. Any information that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Information for those conducting this NSF-funded study will not be released until after the application process has been completed. Names and e-mail/IP addresses will not be connected to specific responses; all data will be pooled and used only in aggregate form.

Individuals from NSF and the Institutional Review Board may inspect these records. Should the data be published, no individual information will be disclosed.

## **ADVANCE (2010-2011): Changing the Face of Michigan Tech**

### **PARTICIPATION AND WITHDRAWAL**

You can choose whether or not to be in this study. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind or loss of benefits to which you are otherwise entitled. You may also refuse to answer any questions you do not want to answer. There is no penalty if you withdraw from the study and you will not lose any benefits to which you are otherwise entitled.

### **IDENTIFICATION OF INVESTIGATORS**

If you have any questions or concerns about this research, please contact Ms. Chris Anderson, 104 Alumni House, 906-487-2474, or email [csander@mtu.edu](mailto:csander@mtu.edu), Dr. Peg Gale, 121 Nobel Hall, 906-487-2352, or email [mrgale@mtu.edu](mailto:mrgale@mtu.edu), Dr. Susan Bagley, 531 Dow Bldg, 906-487-2385, [sbagley@mtu.edu](mailto:sbagley@mtu.edu), Dr. Bill Predebon, 808 ME-EM Bldg, 906-487-2551, or email [wpredeb@mtu.edu](mailto:wpredeb@mtu.edu), or Lisa Watrous at [lwatrou@mtu.edu](mailto:lwatrou@mtu.edu).

### **RIGHTS OF RESEARCH SUBJECTS**

The Michigan Tech Institutional Review Board has reviewed this request to conduct this project. If you have any concerns about your rights in this study, please contact Joanne Polzien of the Michigan Tech IRB at 906-487-2902 or email [jpolzien@mtu.edu](mailto:jpolzien@mtu.edu).

Once you have entered the survey, enter your e-mail address and select the CONTINUE button to acknowledge that you understand the above statements and give your consent to participate in this study.

Thank you in advance for participating in this study.

Date of IRB Approval: 9-15-2010

IRB Number: 0334

Project Expiration Date: 9-14-2011

## ADVANCE (2010-2011): Changing the Face of Michigan Tech

### ADVANCE: Changing the Face of Michigan Tech

**\*1. Please enter your email address.**

**\*2. Please select "Continue" to acknowledge that you understand the above statements and give your consent to participate in this study.**

**Thank you in advance for participating in this study.**

CONTINUE

## ADVANCE (2010-2011): Changing the Face of Michigan Tech

### Part I. Affirmative Programs Office Data

Michigan Technological University is an equal opportunity employer. In order to meet this commitment, it is necessary to collect information concerning applicants (Part I) in accordance with our federal Affirmative Action reporting requirements. Additionally, Michigan Tech continually strives to improve its processes for attracting quality applicants. To help us with this process, we ask that you complete the following brief survey (Part I). Answers provided to these additional questions will be used as part of a NSF-funded ADVANCE study.

Your response to this request is voluntary and refusal to provide it will not subject you to any adverse treatment. This survey is being administered and reviewed independently of those who review your application. The responses you provide will not be connected to your application.

#### 3. Please enter your name (first, last).

#### 4. Gender

- Male  
 Female

#### 5. Date of Birth

Please enter your  
date of birth.

MM / DD / YYYY  
 /  /

#### 6. Position applying for:

#### 7. Department:

#### 8. Ethnicity (optional)

- Hispanic or Latino- A person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race
- Not of Hispanic or Latino origin
- None

#### 9. Race- Select one or more (optional)

- American Indian or Alaskan Native- A person having origins in any of the original peoples of North and South America (including Central America), and who maintains cultural identification through tribal affiliation or community recognition.
- Black or African American - A person having origins in any of the Black racial groups of Africa.
- Asian - A person having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, for example, China, Cambodia, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.
- Native American or Other Pacific Islander - A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.
- White - A person having origins in any of the original peoples of Europe, North Africa, or the Middle East.

**ADVANCE (2010-2011): Changing the Face of Michigan Tech**

**10. How did you learn about this position? (Please select from drop down menu below.)**

Other (please specify)

**11. If you learned about the position from an online or print journal or magazine advertisement please list the name of the source in the text box provided.**

## ADVANCE (2010-2011): Changing the Face of Michigan Tech

### Part II. Specific Data for Advance Project

#### A. Background Information

**12. U.S. citizen or permanent resident (green card)?**

- Yes  
 No

Other (please specify)

**13. Is your application in response to a specific department/school's hiring opportunity?**

- Yes (If yes, go to question 14)  
 No (If no, go directly to question 15)

**14. If you answered "Yes" to question 13 please indicate the specific department/schools to which you applied.**

**15. Is your application in response to a Strategic Faculty Hiring Initiative (SFHI) position?**

- Yes- Energy  
 Yes- Health  
 No

**16. For what type of position did you apply? (Please select position from drop down menu.)**

Other (please specify)

**17. What is your current academic rank/level? (Please select rank from drop down menu.)**

Other (please specify)

## ADVANCE (2010-2011): Changing the Face of Michigan Tech

### B. Interest/Motivation

**18. Evaluate the following elements that motivated you to apply for the position.**

**I am interested in...**

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
The high level of relevance and timeliness of this academic area/position	<input type="radio"/>					
The applied research focus associated with this academic area/position	<input type="radio"/>					
Opportunities for collaboration	<input type="radio"/>					
Working in a culturally diverse environment	<input type="radio"/>					
Spousal/partner accommodations & opportunities	<input type="radio"/>					
The opportunity for teaching undergraduate students	<input type="radio"/>					
Opportunities for working with graduate students	<input type="radio"/>					

**19. Please rank the following in order of importance to you in applying for this position, 1 being the least important and 6 being the most important.**

	1	2	3	4	5	6
Multidisciplinary Research Opportunities	<input type="radio"/>					
Opportunities for Collaboration	<input type="radio"/>					
Job Description Matches Research & Teaching Interests	<input type="radio"/>					
MTU Reputation	<input type="radio"/>					
Working in a Culturally Diverse Environment	<input type="radio"/>					
Location	<input type="radio"/>					

**20. Do you have any concerns/reservations about this position?**

## **ADVANCE (2010-2011): Changing the Face of Michigan Tech**

Thank you for your assistance in helping us enhance the quality of the application process at Michigan Technological University.

- <sup>1</sup>. Ahuja, M.K. (2002). Women in the information technology profession: A literature review, synthesis, and research agenda. *European Journal of Information Systems*, 11, pp. 20-34.
- <sup>2</sup>. Buche, M.W. (2006). Gender differences in defining "technology", in Eileen M. Trauth (Ed.) *Encyclopedia of Gender and Information Technology*, Hershey, PA: Idea Group Reference, pp. 528-534.
- <sup>3</sup>. Camp, T. (1997). The incredible shrinking pipeline, *Communications of the ACM*, 40(10), pp. 103-110.
- <sup>4</sup>. Denning, P.J., and McGettrick, A. (2005). Recentering Computer Science. *Communications of the ACM*, 48(11), pp. 15-19.
- <sup>5</sup>. Fouad, N.A., and Singh, R. (2011). Stemming the tide: Why women leave engineering. Retrieved online October 5, 2011 at [http://www.studyofwork.com/wp-content/uploads/2011/03/NSF\\_Women-Full-Report-0314.pdf](http://www.studyofwork.com/wp-content/uploads/2011/03/NSF_Women-Full-Report-0314.pdf).
- <sup>6</sup>. Moen, P. and Chermack, K. (2005). Gender disparities in health: Strategic selection, careers, and cycles of control. *Journal of Gerontology, Series B*, 60B, pp. 99-108.
- <sup>7</sup>. Woszczynski, A., Myers, M., and Beise, C. (2004) *Women in Information Technology, in Strategies for Managing IS/IT Personnel*, Eds. Magid Igbaria and Conrad Shayo, Hershey, PA: Idea Group Inc., pp. 165-193.

#### Biographical Information

LISA M. WATROUS, *PhD Candidate*, Michigan Technological University College of Arts & Sciences  
 Ms Watrous' PhD candidate in the Rhetoric and Technical Communication Program at Michigan Tech. Her areas of research interest attend to the intersection of language and oppression. She is also a research assistant on Michigan Tech's ADVANCE grant.

DR. MARI W. BUCHE, *Associate Professor*, Michigan Technological University School of Business and Economics

Dr. Buche's research is motivated by questions that investigate the radical impact of changes in technology and information systems on the professionals intimately involved in developing, implementing, and supporting those systems. She also considers the moderating effect of gender on theoretical outcomes.

DR. SUSAN T. BAGLEY, *Professor*, Michigan Technological University Biological Sciences

Dr. Bagley's research is focused on effecting systems-wide improvements in production of fuels and other materials using lignocellulosic biomass. She is a Co-PI on Michigan Tech's ADVANCE grant.

DR. JASON M. KEITH, *Professor, Director, and Earnest W. Deavenport Jr. Chair*, Mississippi State University  
 Dave C. Swalm School of Chemical Engineering

Dr. Keith's research uses mathematical modeling to improve air quality and energy efficiency through the applied fields of reactor design and alternative energy. He has also spent time studying, evaluating and implementing faculty development programs. Prior to joining Mississippi State University, Keith was a faculty member at Michigan Technological University, most recently as an associate professor.