A Proposal to Change the Application Deadline for Full Support Doctoral Finishing Fellowships

Background

The Graduate School has been offering Doctoral Finishing Fellowships since the fall of 2007. Funding ranges from $2000 to full support (stipend + tuition) for a semester. To qualify for the fellowships, students must be PhD students who expect to finish their dissertations the following semester and must have submitted a petition to enter Full-Time Research Only Mode. See <http://www.gradschool.mtu.edu/financial/ff.html>

The deadline of August 13th for applications for the 2008 fall term came too late to allow adequate planning in departments such as Humanities where most supported graduate students teach undergraduate courses. Administrators in the department attempted to find ways to cover the classes of a recipient of a fellowship a week before classes were to begin. This was an impossible situation that was alleviated only by having the student defer the fellowship a term.

Dean Huntoon, at the request of Elizabeth Flynn, surveyed her e-mail list of graduate school deans to determine what the deadlines were at other institutions that had similar fellowships. Four institutions, the University of New Hampshire, Rutgers University, the University of Georgia, and Miami University of Ohio reported that they have full-year fellowships. Decisions are made about who will receive these fellowships the previous spring at the latest. Texas A&M University—Commerce has a Summer Dissertation/Thesis Award that is announced in the spring.

The Council of Graduate Schools has this to say about fellowship deadlines: “Deadlines for fellowships are as different as the number of fellowships. Usually, however, they occur early each calendar year, so the application process is in full swing by late summer or early fall.” <http://www.cgsnet.org/Default.aspx?tabid=163>

The *Rhetoric and Technical Communication Handbook* describes the deadline for finishing fellowships within the department as follows: “Thus, students interested in applying for these fellowships should discuss them with the Director of Graduate Programs, if possible before teaching assignments are completed in the Spring of the preceding year. (The actual application may be completed later as progress is made.)” <http://www.hu.mtu.edu/hu_dept/pdfs/handbook/CHAPTER_5.pdf>

Proposal
To facilitate adequate planning, the deadline for applications for full support students should be no later than midway through the previous term (excluding summer term), and departments should be notified that a student (or students) has received a fellowship shortly thereafter.
Michigan Tech - Graduate Student Council

RESOLUTION: 2008-3a
DATE: September 22, 2008
INTRODUCED BY: GSC Executive Board Jill Witt, Heather Jordan, Carrie Andrew, Warren Powers, Ashley Shackelford, Oystein Thorsen, Jaspreet Nayyar, David Fritz, Susan Balint, and Randy Harrison

A RESOLUTION TO:

Recommend to the Michigan Tech Board of Control and to the Administration that the newly implemented Experience Tech Fee be an optional fee for graduate students.

WHEREAS:

• Graduate Student Council passed a resolution on April 14, 2008 in opposition to the Experience Tech Fee and that resolution was presented to the Michigan Tech Board of Control on May 2, 2008.
• Fifty-two percent of graduate students voted against the fee in the campus-wide student vote.

WHEREAS:

• Graduate student needs should be considered independently of undergraduate students.
  • Many graduate students depend on research or teaching stipends for their support and are living very near to the poverty level. For example, a master’s student paid at the current minimum rate would have a net take home pay of just over $1000 every month, a Ph.D. student only marginally more. (http://aspe.hhs.gov/poverty/08Poverty.shtml). The Experience Tech Fee represents 1.3% of the minimum master’s-level stipend each semester. When combined with all other existing student voted fees, the total amount paid by each student each semester is on the order of $190, which is approximately 4% of the minimum master’s-level stipend.
  • Other students are self-supported and are stretching their limited personal resources in order to pursue their graduate degree at Michigan Tech. Student-voted fees are a hardship for these students because they do not directly contribute to the improvement of the students’ education.
  • Graduate students frequently spend long hours in their laboratories or office pursuing their research and do not typically have free time available that could be spent pursuing recreational activities covered by the Experience Tech Fee.
  • The Experience Tech Fee does not provide benefits to partners/spouses/families making it useless to graduate students who are heads of households or members of families who are unwilling to exclude from their recreation time.

WHEREAS:

• Allowing graduate students to opt out of the Experience Tech Fee would constitute only a minimal decrease in revenue generated by the Fee. Only approximately $63,000 of the $449,000 that is generated per semester is from graduate students. Should ALL graduate students choose to opt out of the Fee. (This estimate is based on graduate student enrollment constituting approximately one-seventh of the Michigan Tech student population.)

BE IT RESOLVED:

The Graduate Student Council respectfully requests that the Michigan Tech Board of Control make the Experience Tech Fee optional for graduate students.
Experience Tech initiative opens opportunities to all students

For more information on this story contact:

Email: Marcia Goodrich
Phone: 906/487-2343

JULY 25, 2008--The Experience Tech initiative, passed June 19 by Michigan Technological University’s Board of Control, will give students free access to Mont Ripley Ski Hill, the Portage Lake Golf Course, the Gates Tennis Center, Department of Visual and Performing Arts events, hockey games, and intramural sports. The plan will be subsidized through a student-wide $64-per-semester tuition-added fee.

Nate Kroodsma says the initiative will provide some exciting new opportunities’ for Tech students. Kroodsma and fellow student Nik Chaphalkar both members of Student Commission, the Undergraduate Student Government subgroup responsible for the Experience Tech project did much of the legwork in researching and planning the new initiative.

“Hopefully, it will get a lot more students involved in these activities,” Kroodsma says.

The plan, which goes into effect during the 2008 fall semester, received support from current students including graduate students, who will be included in the initiative when it was voted on in April. More than 3,000 students completed the online survey to cast their votes, with about 80 percent supporting the fee.

The fee approval is cause for celebration among more than just students; Michigan Tech staff has been overwhelmingly supportive, with the Student Affairs department providing assistance to the Student Commission throughout the development of the project.

Vice President for Student Affairs Les Cook calls the student-driven plan “a great accomplishment.”

“The Experience Tech initiative will provide opportunities for students to experience the many things that make Michigan Tech so special,” Cook says. “As far as I know, Michigan Tech is the only school in the nation where students can ski or snowboard without buying a lift ticket."

Among the most enthusiastic about the new initiative are incoming students. Talk on Rendezvous, Michigan Tech’s social networking website for accepted students, has been enormously enthusiastic, with future students looking forward to the new opportunities the plan will provide.

“This will save me a lot of money on fees for intramural sports, hockey games and the Gates Tennis Center,” says 18-year-old Austin Burke, who will begin his first year at Tech this fall. “But I’m also going to try new things, like snowboarding and golfing, because it won’t cost me anything.”

Anna Miller, 18, another incoming first-year student, is also eager to take advantage of the plan. “The Experience Tech fee is a great value,” Miller says. “It opens up a lot of recreational and entertainment opportunities to students. I’ll get a lot of use out of this--it makes me even more excited to come to Michigan Tech.”

To learn more about the Experience Tech plan, visit www.usg.mtu.edu/techexp or contact Student Activities at 906-487-1963.
Graduate School Orientation – Fall 2008

Summary of this year

- Each student received a binder with important information and printouts of all presentations.
- Thursday’s optional event was attended by 141 students. It introduced students to the Graduate School and campus resources with approximately 1 hour of lecture and 17 round table discussions.
- Friday’s required event was attended by 205 students. It introduced the basics of mentor-mentee relationships, academic integrity and responsible conduct for research in a lecture and discussion based format. Thirty-one faculty, staff and students served as facilitators for small group discussion.
- Feedback was positive for both events from students and faculty/staff.

Challenges from this year

- Two afternoons proved more challenging to administer, and created duplicate work for staff (two sets of nametags, two registration processes, two days of staff time, etc.).
- The required session on Friday followed a full week of orientation activities, which is not the most effective time for RCR training.
- Although most students attended both events, some did not. All students would benefit from (at a minimum) being introduced to the Graduate School staff, Library staff, and campus services.
- Friday afternoon will often fall before the Labor Day weekend, which creates challenges for finding volunteers for the event and GSC picnic.
- In a one-day format, we could incorporate lunch for students and volunteers, creating more opportunities for new students to interact with their cohort and the volunteers.

We propose the following one-day schedule for orientation:

- 9-noon: Setting expectations and resolving conflict (mentor-mentee relationships, academic integrity, RCR)
- Noon – 1: Lunch with students and all volunteers
- 1 – 2: Short introductions to services for all graduate students (Graduate School, Library, intellectual property)
- 2 – 4: Round table discussions; students free to leave whenever they have visited tables of interest

Constraints for orientation

- Our orientation is during the same week as undergraduate orientation. The ballroom is the only room large enough to host our event. The ballroom is available Wednesday, Thursday or Friday.
- GTA orientation is planned for Monday, Thursday and Friday morning. They are open to considering changing the Thursday orientation to Wednesday morning.
- Many programs plan orientation activities on Wednesday based on last year’s survey.

Option #1: Schedule Graduate School orientation on Wednesday. Programs with programming on Wednesday would need to reschedule their activities.

Option #2: Schedule Graduate School orientation on Thursday. GTA orientation would move from Thursday to Wednesday morning. Programs with activities on Wednesday morning would need to reschedule their activities.
Proposal for a
Ph.D. Program in
Applied Cognitive Science and Human Factors

Summary

This is a formal proposal to establish a Doctor of Philosophy degree in Applied Cognitive Science & Human Factors in the Department of Cognitive and Learning Sciences at Michigan Technological University. The proposed program will help meet strong demand for Human Factors professionals, will build on Michigan Tech’s existing strengths in science and technology, and will enable MTU to develop a nationally recognized program in an emerging discipline critical to technology. This document provides the rationale for, and details about the program.

Applied Cognitive Science - Human Factors

Applied cognitive science addresses a diverse array of contemporary human phenomena, resulting in practical solutions for many real world problems. Through the application of cognitive psychology’s principles, applied cognitive scientists investigate diverse topics such as effective modes for the delivery of instruction, eyewitness memory, artificial intelligence, and human factors considerations in the design of systems.

Human Factors (HF) is the multi-disciplinary science within the purview of cognitive science that focuses on the needs of the human in the design of products, work processes, and technology systems in an effort to optimize human well-being and overall system performance. HF is concerned with the design and evaluation of technological systems from the perspectives of human needs, abilities, and limitations. HF professionals may examine human-machine interactions from cognitive, social, biological, physical, or other perspectives.

From an Applied Cognitive Science perspective, Human Factors is involved in conducting research regarding human cognitive abilities and limitations with respect to the design, operation, or use of products or systems. It is a subfield of applied cognitive science that focuses upon human-machine interactions. Overall goals include optimizing human performance, health, safety, and/or habitability. Thus, the proposed program in Applied Cognitive Science and Human Factors will integrate the knowledge of human experts (psychology and cognitive science) and built systems experts (for example, technology and engineering).

Human Factors is a critical area of research because of (a) human safety concerns, (b) market forces, and (c) environmental sustainability. Human operators are often critical contributors to lapses in overall system safety. Human errors, for example, have been attributed as the cause of up to 98,000 preventable patient deaths a year in US medical practice. Despite our desire for automated, faultless systems, our current technological knowledge is not capable of foolproof technological fixes to problems of human error. Substantial funding has been allocated to research on machine intelligence, pattern-recognition technologies, and expert systems, but there
is only one alternative for many complex systems: human operators. Although they have limitations, humans are excellent pattern recognizers and, unlike current automated systems, are immensely flexible. HF is concerned with understanding human abilities and limitations, information critical to the prevention of human-related errors and the preservation of human life and well-being.

Critical to understanding market forces, HF researchers are motivated to assess customer needs and desires in order to increase customer satisfaction by improving the usability of products. User-centered design is a widespread paradigm in information technology and consumer products. The success of a human factors perspective in improving customer satisfaction in these industries suggests wider application.

Human Factors is not only important for human safety, well-being, and the economy, but it is also a critical component in forming a sustainable society. Many environmental disasters, such as the Exxon Valdez incident, are due to poor HF design, task design, and working conditions. Good HF design not only prevents human casualties, it also prevents environmental catastrophes. In addition, HF leads to better consumer products. Customers will discard poorly-designed products as they seek products they can actually use. Throwing away products because of poor user design is not a sustainable practice. Therefore, HF design is sustainable design.

There is increasing need for personnel trained in Human Factors in industry, government, and academia. According to the US Dept. of Labor Occupational Outlook handbook (2008-09 edition), employment for all psychologists (including all specialty areas) is expected to grow 15 percent from 2006 to 2016, faster than the average for all occupations. Further, they state “Job prospects should be the best for people who have a doctoral degree from a leading university in an applied specialty…Psychologists with extensive training in quantitative research methods and computer science may have a competitive edge…” A survey of three doctoral programs in Human Factors revealed that 90-95% of their graduates have secured positions prior to graduation, and 99% obtained employment after graduation, typically in the exact sub-discipline they desired. Clearly, Human Factors is a growth field with immense potential that offers great career opportunities. Moreover, salaries for human factors specialists are the highest among all subfields within psychology and cognitive science. According to a 2005 salary survey conducted by the Human Factors and Ergonomics Society, the mean annual base salary is approximately $92K for a master’s level profession and $105K for persons holding a doctorate. Doctoral-level consultants are reported as earning an average of $175K annually.

Opportunities exist and are expanding in all major employer groups: government, not-for-profit institutions, consulting firms, private industry, and academic institutions. Work settings range from classroom, to laboratory, to the industrial design team. Applied Experimental and Engineering Psychology is increasingly employed in litigation involving product and workplace safety. Salaries are competitive with those of engineers and other professionals who work in similar settings. In industry, there has been explosive growth in the HF job market with the development of increasingly complicated consumer products, network-centric business (electronic commerce), and more stringent product liability laws. With new technology, businesses are increasingly capable of customizing products for individual users. Jobs in this area of industry are often titled cognitive engineer, customer experience specialist, ergonomist,
human factors engineer, knowledge engineer, usability specialist, usability engineer, user experience specialist, and/or user interface designer. There has also been a surge of employment in the government sector for personnel trained in HF. For example, employment opportunities exist in the Department of Defense, Department of Homeland Security, Federal Aviation Administration, National Aeronautic and Space Agency, transportation, and intelligence services. The military, for example, has a number of career tracks for Ph.D.-level HF specialists, including the US Navy’s aviation experimental psychologist, surface research psychologist, and subsurface research psychologist, the US Army’s research psychologist, and the US Air Force’s aerospace research physiologist. In terms of government support, the Department of Defense’s broad agency announcements consistently identify HF research as one of the most critical areas of research. HF careers are also available in academia, in particular in psychology, which is currently the second largest undergraduate major in the United States, and in interdisciplinary programs housed in colleges of engineering, science, and medicine.

Rationale

This graduate program focuses on the application of cognitive science to understanding human use of and interaction with technology. The Human Factors interdisciplinary field builds upon psychology, engineering, and computer science/information technology. Emphasis is on using the methods and theories of cognitive science to create interventions designed to enhance safety and performance. Implementation of a graduate program in Human Factors is a key component in the development of a technological university. This facet, currently underdeveloped at Michigan Tech, builds upon existing strengths in the Department of Cognitive and Learning Sciences and in other academic units of the university, integrates behavioral science research with expertise in engineering and natural sciences, and is consistent with Michigan Tech’s current strategic plan to “offer programs in new and emerging areas, particularly interdisciplinary areas.” More specifically, the proposed program addresses the following areas of MTU’s strategic plan:

- **Goal 2: Deliver a distinctive and rigorous discovery-based learning experience grounded in science, engineering, technology, sustainability, and the business of innovation.**
  
  2.2 Develop undergraduate and graduate programs in new and emerging areas.

- **Goal 3: Establish world-class research, scholarship and innovation in science, engineering, and technology that promotes sustainable economic development in Michigan and the nation.**
  
  3.1 Increase interdisciplinary initiatives to expand knowledge and address societal needs.
  
  …develop and support superior graduate programs.

This program will contribute significantly to the goals of 500 enrolled Ph.D. students at the university by 2012, and the conferring of 60 Ph.D. degrees annually.

Michigan Tech faculty members possess considerable expertise in cognitive science and applied cognitive psychology and in science and engineering fields which study the interaction of human and technological systems. Current expertise in the Department of Cognitive and Learning
Sciences is in the areas of human memory, perception, attention, and cognition. Current research projects include work in human-robot interaction, interface design, multi-modal display design, data visualization, cognitive-perceptual performance assessment, transportation systems, computer automated systems, covert communication strategies, detection of deception (polygraph), human performance modeling, and STEM education. Affiliated faculty in the departments of Computer Science, Civil and Environmental Engineering, Electrical and Computer Engineering, Exercise Science, Health, and Physical Education, Mechanical Engineering-Engineering Mechanics, and Biomedical Engineering have expertise in human-computer interaction, simulations, robotics, biomechanics, and work physiology.

By integrating cognitive and HF psychologists and STEM education researchers with science and engineering faculty, this program merges cognitive science research with applications in a wide range of STEM fields. By combining faculty expertise in human subjects research with scientific and engineering expertise, the program will enhance interdisciplinary research at Michigan Tech and strengthen the university’s competitiveness on complex projects at the interface of human and technical systems.

This program responds to the national need to better understand how technological systems are limited by human operators. The modern world is increasingly being integrated with advanced, although very complicated, communication equipment. While this speeds up the pace of transactions, it also introduces new risks for designers who may make products unsuitable for the intended users. The business world is shifting to fast, lean, agile, just-in-time production methods. There will increasingly need to be a tight integration between usability-consumer research and manufacturing. Transportation systems are becoming more complex. Without seriously considering human operators and their limitations, modern society is setting itself up for catastrophic loses. Many disasters can be attributed to poor human-machine interaction or systemic design errors. Our graduates will be well prepared to rectify this situation, and the skills the program will provide are in very high demand by industry and government.

1. Program Description

The proposed program will be offered by the Department of Cognitive and Learning Sciences. Affiliated faculty in other academic units will also be directly involved as adjunct faculty in the program. The program provides a strong scientific basis in human subjects research and in the core areas of cognitive science necessary to skillfully undertake research on the interface of human behavior and technological systems. The program is a research-intensive curriculum, which includes a core in psychology and research methods. Students will select an area of specialization in which to focus their elective coursework and their dissertation research.

Course Requirements
The doctoral program in Applied Cognitive Science and Human Factors (ACSHF) will require a minimum of 72 credit hours. This consists of 32 hours from the core courses and required research, 30 hours of electives, and 10 dissertation research hours. Although most MTU Ph.D. programs require only 60 credits, nationally, most Human Factors and related programs require
between 80 and 90 credits. A sampling of such programs yielded an average of 83 credits required. Likewise, many MTU programs have limited course requirements; however, Applied Cognitive Science and Human Factors is a field in which students rarely have much undergraduate preparation, so considerable work in basic subject matter is necessary to prepare students to conduct appropriate research. Below is a list of required and potential elective courses; a list of which faculty may teach each course is listed in Appendix A.

**Core Courses and Required Research (32 credits)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSY 5100</td>
<td>Applied Cognitive Science</td>
<td>3 hrs</td>
</tr>
<tr>
<td>PSY 5850</td>
<td>Human Factors I</td>
<td>3 hrs</td>
</tr>
<tr>
<td>PSY 5XXX</td>
<td>Human Factors II</td>
<td>3 hrs</td>
</tr>
<tr>
<td>PSY 5XXX</td>
<td>Advanced Statistical Analysis and Design I</td>
<td>4 hrs</td>
</tr>
<tr>
<td>PSY 5XXX</td>
<td>Advanced Statistical Analysis and Design II</td>
<td>4 hrs</td>
</tr>
<tr>
<td>PSY 5010</td>
<td>Cognitive Psychology</td>
<td>3 hrs</td>
</tr>
<tr>
<td>PSY 5160</td>
<td>Sensation and Perception</td>
<td>3 hrs</td>
</tr>
<tr>
<td>PSY 5060</td>
<td>Behavioral Neuroscience</td>
<td>3 hrs</td>
</tr>
<tr>
<td>PSY 5XXX</td>
<td>Graduate Research Project</td>
<td>6 hrs</td>
</tr>
</tbody>
</table>

*Depending upon background of individual students, some of these courses may be waived.

**Electives (30 credits)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSY 5XXX</td>
<td>Human Performance</td>
<td>3 hrs</td>
</tr>
<tr>
<td>CS 5760</td>
<td>Human-Computer Interaction and Usability Testing</td>
<td>3 hrs</td>
</tr>
<tr>
<td>PSY 5XXX</td>
<td>Ergonomics and Biomechanics</td>
<td>3 hrs</td>
</tr>
<tr>
<td>ED 5510</td>
<td>Educational Technology</td>
<td>3 hrs</td>
</tr>
<tr>
<td>PSY 5XXX</td>
<td>Supervised Teaching Practicum</td>
<td>3 hrs</td>
</tr>
<tr>
<td>PSY 5XXX</td>
<td>Automation</td>
<td>3 hrs</td>
</tr>
<tr>
<td>PSY 5XXX</td>
<td>Displays and Alarms</td>
<td>3 hrs</td>
</tr>
<tr>
<td>PSY 5XXX</td>
<td>Independent Research</td>
<td>3 hrs</td>
</tr>
<tr>
<td>PSY 5XXX</td>
<td>Current Issues in Human Factors</td>
<td>1-3 hrs</td>
</tr>
<tr>
<td>PSY 5XXX</td>
<td>Special Topics in Cognitive Science</td>
<td>3 hrs</td>
</tr>
<tr>
<td>PSY 5XXX</td>
<td>Special Topics in Human Factors</td>
<td>3 hrs</td>
</tr>
</tbody>
</table>

**At least 9 credits must be from coursework; students will select courses in consultation with the advisor.

Additional courses not listed here may be accepted as electives (see Section 7, Other Courses). Up to 21 credits of independent research may be applied towards the 30 required elective hours. A minimum of 9 elective hours must come from coursework, which comprises a student’s area of specialization within ACSHF.

**Dissertation (10 credit hours)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSY 6999</td>
<td>Dissertation Research</td>
<td>10 hrs</td>
</tr>
</tbody>
</table>

72 Credit Hours Total
Students who wish to terminate their studies after two years may acquire a M. S. degree by completing the core courses and six credits of required research for a 32-credit master’s degree. It is not our intention to admit students to a terminal master’s degree program, however utilizing standard practice in graduate programs at Michigan Tech, students who are unable to complete the Ph.D. may be allowed to earn a M. S. degree upon completion of the core courses and required research.

2. Rationale

See pp. 2-4, above.

3. Related Programs at MTU and Elsewhere

The proposed Doctorate of Philosophy in Applied Cognitive Science and Human Factors will complement other programs at Michigan Tech and will be interdisciplinary in nature. There are no related programs at the university, although faculty in the Department of Cognitive and Learning Sciences has established a collaborative network for research in Human Factors with researchers in numerous science, engineering, and related departments. The Department of Cognitive and Learning Sciences offers a B.S. degree in Psychology.

There are no doctoral programs in Human Factors in Michigan. Central Michigan University offers a Ph.D. in applied experimental psychology, which potentially overlaps with Cognitive Science and Human Factors when applied to technological systems. Several Michigan universities offer graduate programs in Industrial Engineering or Industrial Design, somewhat related yet distinct disciplines that typically offer a single course pertaining to Human Factors. Michigan State University offers an interdisciplinary specialization in Cognitive Science, but not a degree.

In the upper Midwest, only the University of Minnesota-Twin Cities has a comparable degree program. They offer a graduate minor in Cognitive Science or in Human Factors for Ph.D. or M.A./M.S. programs. Additionally, they offer a Human Factors emphasis as part of their Kinesiology Ph.D. program.

The Human Factors and Ergonomics Society lists 120 graduate programs related to human factors in the Directory of Human Factors/Ergonomics Graduate Programs in the United States and Canada. Forty-three percent are doctoral programs, most of which are housed either in Industrial Engineering (41%) or Psychology (39%) departments. The remaining doctoral programs reside in departments such as Cognitive Science, Environmental Medicine, Design and Environmental Analysis, or Kinesiology; other programs are of an interdisciplinary nature and are housed in the graduate school. Of the Industrial Engineering programs, the majority (61%) offer concentrations through optional coursework rather than specific degrees in human factors or cognitive science.
Only two of MTU’s benchmark universities offer doctoral programs in Cognitive Science or Human Factors: Rensselaer (Cognitive Science) and Georgia Tech (Human Factors). Georgia Tech offers a Human Factors concentration at the bachelor degree level. None of our benchmark universities offers an interdisciplinary program combining both fields.

4. Projected Enrollment

We anticipate that two students will enter the program by Fall, 2009. Thereafter, we expect 3 new students per year. Within 6-7 years the program will have between 12 and 15 students and an average of 3 new Ph.D. students will complete the program annually.

<table>
<thead>
<tr>
<th>HF Ph.D. Enrollment</th>
<th>2008-09</th>
<th>2009-10 (Year 1)</th>
<th>2010-11 (Year 2)</th>
<th>2011-12 (Year 3)</th>
<th>2012-13 (Year 4)</th>
<th>2013-14 (Year 5)</th>
<th>2014-15 (Year 6)</th>
<th>2015-16 (Year 7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attrition = 25% &gt;yr.3 Planning &amp; Recruiting</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>New Students</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Returning Students</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>10</td>
<td>11</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Total Enrollment</td>
<td>2</td>
<td>4</td>
<td>7</td>
<td>9</td>
<td>11</td>
<td>14</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Ph.D.s Awarded</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td></td>
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</tr>
</tbody>
</table>

Three students will be supported as GTAs; ten students will be supported by external research funds; the remainder will be self-supported. External funding is anticipated to come primarily from US Department of Defense (see page 2), but also the National Science Foundation and National Institutes of Health. The result will be approximately two Ph.D. students per full-time graduate faculty member.

5. Scheduling Plans

The program will be a regular on-campus offering, with inception planned for Fall, 2009. The 2008-2009 academic year will be used for student recruiting. All core courses will be offered regularly (either annually or biennially), beginning Fall, 2009.

6. Curriculum Design

The core courses in the program (see Program Description, above) are designed to provide students, particularly from engineering and computer science, with fundamental understanding of human behavior, expertise in conducting research with human subjects, and an overview of the concepts, tools, and applications of Human Factors psychology. These eight core courses will be taken during the first 3 semesters in the program and will be taught by Cognitive and Learning Sciences faculty.
Areas of Specialization
Upon completion of the core courses, students will identify an area of specialization, from which they will select at least 18 credits to ensure sufficient depth and expertise to conduct dissertation research. Potential areas of specialization include the following:

- Human Performance
- Human-Computer Interaction
- Adaptive Automation/Biosensors
- Educational Technology
- Environmental Design
- Transportation/Geospatial Systems
- Manufacturing Systems
- Construction

Comprehensive Exam
To obtain doctoral candidacy status, students must pass a comprehensive written examination. The comprehensive exam is taken after all required courses and course-based electives are completed. It must be passed within five years of starting the ACSHF program and at least two semesters prior to the dissertation defense. The exam will consist of four sections with questions covering the following topics: 1) applied cognitive science/cognitive psychology, 2) human factors/human performance, 3) research methodology/statistics, and 4) a specialty topic within ACSHF. Each section may contain multiple questions evaluating whether the student is capable of concept integration and application at the doctoral level. Questions for the first three sections will be provided by ACSHF faculty. A committee comprised of three faculty members of the student’s choosing will supply questions for the specialty area. The student’s answers will be graded by a minimum of two faculty members. Passage is required on all four sections to be considered a doctoral candidate. If a student fails one section, a remediation project to compensate for an area deficiency will be developed by relevant faculty in coordination with the student’s advisor. If a student fails two or more sections, the exam is considered failed en toto. The student must retake and pass the entire exam at the next scheduled administration. If a student fails to pass all sections of the exam upon retaking it, he/she will be expelled from the program.

Doctoral Dissertation

Dissertation Committee and Proposal Process
Once a student has doctoral candidacy status, he/she may officially form a dissertation committee. Students must submit a form signed by all committee members declaring the make-up of the committee. Any changes to committee membership must be made in writing. The committee should have four members, two of whom must be faculty within the Department of Cognitive and Learning Sciences and one faculty member from outside the ACSHF Program. One committee member must be designated as the committee chair. Once the chair is satisfied with the student’s dissertation proposal, a proposal defense may be scheduled. The defense consists of an oral presentation before the committee. All committee members must sign-off on the proposal indicating their approval before the student may begin any data collection.
Oral Dissertation Defense
When the research is complete and the committee chair is satisfied with the manuscript, the student should send the dissertation to all other committee members to prepare for the defense. The dissertation defense is public, in that any member of the university committee may attend. The defense must be advertised a minimum of two weeks in advance of the scheduled defense date. All committee members must be present at the defense. After the defense presentation and a period of questioning from committee members, the committee will hold a private vote on two items. The first is whether the defense was passed (yea or nay). The second item is the status of the dissertation manuscript (accepted without revisions, accepted with minor revisions, or not accepted/needs extensive revisions).

7. New Course Descriptions

PSY 5XXX Human Factors II (3) – An overview of the tools and techniques used by human factors researchers and practitioners. Topics include task analysis, link analysis, human error in systems, workload analysis, and physiological assessment techniques.

PSY 5XXX Advanced Statistical Analysis and Research Design I (4) – An overview of research ethics, experimental design, proposal writing, and univariate statistics such as t-tests and ANOVA.

PSY 5XXX Advanced Statistical Analysis and Research Design II (4) – A continuation of PSY 5XXX covering multivariate and nonparametric statistics such as MANOVA, ANCOVA, Multiple Regression, factor analysis, and Chi Square.

PSY 5XXX Human Performance (3) – An overview of factors contributing to human performance in human-machine systems. Topics include cognitive workload, attention, fatigue, aging, stress, and perceptual limitations.

PSY 5XXX Ergonomics and Biomechanics (3) – An overview of the physical aspects of user-centered design. Specific topics include anthropometry, repetitive strain injuries, and physical workload evaluation.

PSY 5XXX Automation (3) – An overview of the changing role of human users in automated systems. Topics include levels of automation, automation trust issues, automation uses and misuses, and the role of automation in human performance.

PSY 5XXX Displays and Alarms (3) – An overview of display and alarm display design principles for human-machine systems. Topics include visual, auditory, and tactile display design, masking and alarm detection, and the cry wolf effect and alarms.

PSY 5XXX Independent Research (3) – TBD.
PSY 5XXX Current Issues in Human Factors (1) – An overview of the state of the field of human factors, trends, ethics for human factors practitioners, and career development.

PSY 5XXX Special Topics in Human Factors (3) – Study of special topics in human factors as designed by section title.

PSY 5XXX Special Topics in Cognitive Science (3) – Study of special topics in cognitive science as designed by section title.

PSY 5998 Research Project I (3) – Proposal and data collection phases of an independent research project.

PSY 5999 Research Project II (3) – A continuation of PSY 5998, analysis and public presentation of research results.

PSY 6999 Dissertation Research (10) – Fundamental and applied research in cognitive science and human factors psychology. Taken by doctoral students in partial fulfillment of the PhD research requirement.

Other Courses (catalog descriptions are in Appendix B)

PSY 5010 Cognitive Psychology
PSY 5100 Applied Cognitive Science
PSY 5060 Behavioral Neuroscience
PSY 5160 Sensation and Perception
PSY 5850 Human Factors I
BE 5110 Neuroengineering
BE 5700 Biosensors
BL 4470 Analysis of Biological Data
CE5404 Transportation Planning
CE 5410 Intelligent Transportation Systems
CS 4760 Human-Computer Interactions
CS 4811 Artificial Intelligence
CS 5811 Advanced Artificial Intelligence
ED 5510 Special Studies in Educational Technology
EE 4250 Communication Theory
EE 4257 Digital Image Processing
EE 5530 Wireless Digital Communication
EH 4400 Motor Control
EH 4420 Motor Learning and Development
EH 4500 Biomechanics of Human Movement
EH 5350 Special Topics in Kinesiology
FW 4130 Biometrics
MA 4720 Design and Analysis of Experiments
MEEM 4660 Data Based Modeling & Control
MEEM 4705 Introduction to Robotics and Mechatronics
MEEM 5602 Process and Product Design and Improvement
8. Library and Other Learning Resources

Access to scholarly materials is absolutely essential at a research institution such as Michigan Tech, particularly for faculty mentoring doctoral students through high-quality, funded research. The Van Pelt library currently subscribes to 23 journals that are core to the Applied Cognitive Science and Human Factors program. In addition, the library has supporting journal holdings in engineering, computer science, exercise science, general psychology, and teacher education.

Enhancing our electronic database search engine PsychFirst is required. MTU currently offers database search access to psychology publications from only the preceding three years. Access to a more complete database and subscriptions to additional journals beyond our current holdings will be essential for both faculty and graduate students. This will require the availability of PsycINFO and PsycARTICLES.

Subscriptions to nine additional journals is essential to the program (see Appendix C). New library costs include (costs were estimated in consultation with Ellen Seidel):

- $3000.00 one-time allotment for the library to purchase core monographs in the area of cognitive and human factors psychology, allowing the purchase of approximately 90 hard and soft-cover items.
- $5782.00 for nine additional journals.
- $7200.00 (annual cost) provides full database search capability of the psychology literature (through PsycINFO in journal, book, and book chapter, and dissertation records, 1887–present, and PsycARTICLES records, 1988–present, to all faculty and students. Additional Interlibrary loan costs will be generated for the library.

9. Computing Access Fee

Graduate students in the program will pay the standard Computing Access Fee to utilize the current undergraduate computing lab for Psychology majors.
10. Faculty Curriculum Vitae (vitae attached at end of document)

Cognitive & Learning Sciences Faculty:

Susan L. Amato-Henderson, Ph.D.
Associate Professor of Psychology
PhD, University of North Dakota
Psychology and law (eyewitness memory, credibility assessment, field sobriety testing); career and educational interests and decision making; self efficacy (your belief in your ability to do well in a given situation or setting); service learning as a teaching tool; outcome assessments; experimental design and statistical analysis

J. Christopher Brill, Ph.D.
Assistant Professor of Psychology, Cognitive & Learning Sciences
PhD, University of Central Florida
Tactile communication, mental workload, cognitive resource theory, multi-modal display and alarm design, spatial audio, human performance assessment, motion and simulator sickness, Sopite Syndrome (motion-induced drowsiness)

William S. Helton, Ph.D.
Assistant Professor, Department of Cognitive & Learning Sciences
PhD, University of Cincinnati
Engineering (human factors) psychology, environmental psychology, neurophysiological measures of cognition, psychometrics (stress and workload), skill acquisition in humans and working dogs

Kedmon N. Hungwe, Ph.D.
Assistant Professor, Cognitive & Learning Sciences
PhD, Michigan State University
Learning and development; educational policy & practice; educational media/technology

Rosalie P. Kern, Ph.D.
Associate Professor of Psychology, Department of Cognitive & Learning Sciences
PhD, Central Michigan University
Emotion, attention, and memory; decision making; perceptions of sexual harassment; psychology and law (trial consulting); experimental design and statistical analysis

Adjunct Faculty:

Jason Carter, Ph.D.
Chair & Assistant Professor of Exercise Science, Health and Physical Education
Adjunct Assistant Professor, Cognitive & Learning Sciences
Adjunct Assistant Professor, Biological Sciences
PhD, Michigan Technological University
Regulation of arterial blood pressure, the vestibulosympathetic reflex in humans, autonomic and cardiovascular adaptations to microgravity and exercise
Michele Miller, Ph.D.
Associate Professor of Mechanical Engineering
PhD, North Carolina State University
Precision engineering, microelectromechanical systems, engineering education

Amlan Mukherjee, Ph. D.
Assistant Professor of Civil Engineering
Member, Michigan Tech Transportation Institute
Engineering-Environmental (inter-disciplinary program)
PhD, University of Washington
Planning and decision making in construction management using situational simulations, information visualization, transportation infrastructure management, simulations of complex systems, system dynamics, expert novice cognition (especially among construction managers)

Michael Neumann, Ph.D.
Professor & Chair of Biomedical Engineering
Adjunct Professor of Electrical Engineering
PhD Case Institute of Technology, MD Case Western Reserve University
Biomedical instrumentation, biomedical sensors, microfabrication technology and perinatal medicine

Robert Pastel, Ph.D.
Assistant Professor, Computer Science
PhD, University of New Mexico
Human-computer interaction and human-robot interaction

Jindong Tan, Ph.D.
Assistant Professor of Electrical and Computer Engineering
PhD, Michigan State University
Computer engineering, mobile robotics

11. Available/Needed Equipment
Facilities

The department of Cognitive and Learning Sciences operates or has access to seven dedicated laboratories.

**Human-Robot Interaction Laboratory** in Advanced Technology Development Center equipped with unmanned aerial and ground robot vehicles, including 6 ground active-robots, 10 ground Romba robots (iRobot), and 2 remote-controlled helicopters, sensors (laser range finders, sonar systems, visual capture systems), computers, and a wide-scale sensor network for environmental sensing.
Virtual Reality Laboratory in Rehki equipped with a GeoWall 3-d projection system, World Viz virtual reality system, magnetic and optical tracking equipment, head-up displays, computers, and interface equipment (joysticks, steering wheels, data-gloves).

Human Fatigue and Vigilance Laboratory in Chemical Sciences equipped with MindWare Technologies Biomedical Signal Processing Systems, Respironics Actigraphy System, Companion III Transcranial Doppler Sonography Unit, Seeing Machines Eye-tracker, Arrington Eye-tracker, and computers programmed with Superlab software.

Multimodal Interface Laboratory in Chemical Sciences equipped with a 24 Channel Vibrotactile Laboratory Display System, a 8 Channel Vibrotactile Laboratory Display System, a 8 Channel Wireless Vibrotactile Display System, and computer programmed with SuperLab software.

Emotion and Memory Laboratory in Chemical Sciences equipped with computers programmed with SuperLab software and other specialized programs.

Detection of Deception Laboratory in Chemical Sciences equipped with video recording equipment, computers, and a polygraph unit.

Educational Technology Laboratory in Academic Office Building equipped with computers, Vernier Software and Technology, including sensors for use with our Vernier interfaces.

No additional equipment will be necessary to initiate the program. Additional space needs are addressed below in Section 13.

12. Program Costs

Additional recurring costs are associated with implementation of this program (Appendix A). Three new graduate assistant lines to support teaching of introductory psychology courses will be necessary during the first five years of the program. New human factors faculty will be necessary to support existing faculty with undergraduate teaching obligations and to teach the required core courses in the program. New faculty should have expertise in the following areas:

- Applied Cognitive Science - Cognitive Ergonomics or Human-Computer Interaction
- Human Factors Psychology - Visual Performance and Display
- Quantitative Psychology; I/O Psychology: Simulation and Training or Team Performance

Two new faculty members will be needed when the program is initiated (Fall, 2009). The third faculty member (in Quantitative Psychology) will be added in the third year of the program, as externally funded research funds result in greater demands on the time of existing faculty. Additional ongoing funds for library journals and online journal access will also be needed (see #8, above). The addition of these faculty members will enable the program to accommodate up to 15 students (approximately 2 Ph.D. students per full-time faculty member).
13. Space

Currently, each faculty member has an office and a 100 square foot room for research. The department also rents a 1000 square foot high bay facility for HF research. Other Human Factors programs typically provide approximately 1000 square feet of lab space per faculty member, with space increasing to nearly 2000 square fee for faculty with external funding. In addition, nearly all programs at other institutions have a dedicated teaching laboratory averaging 700 square feet (Appendix B).

We currently have 1438 square feet consisting of faculty offices, laboratories, a reception area, and a small conference room. This space is satisfactory for an undergraduate program with modest research activity, but additional space is essential if the program is to be successful. The Department of Cognitive and Learning Sciences has no excess space. New faculty will require office space and research facilities in order to carry out their research and scholarship obligations. Graduate students will also need office space. Without additional space, the Ph.D. program cannot be implemented. We are requesting approximately 10,000 square feet of space. A breakdown of this space request is provided in the table below:

<table>
<thead>
<tr>
<th>Allocated Use</th>
<th>Approximate Size (Sq Ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 Faculty Offices (144 sq ft each)</td>
<td>1008</td>
</tr>
<tr>
<td>7 Laboratory Suites (1000 sq ft each)</td>
<td>7000</td>
</tr>
<tr>
<td>2 GTA Offices (250 sq ft each; 2-3 students in each)</td>
<td>500</td>
</tr>
<tr>
<td>Reception/Common Area</td>
<td>400</td>
</tr>
<tr>
<td>Seminar/Conference Room</td>
<td>500</td>
</tr>
<tr>
<td>Graduate Teaching Laboratory</td>
<td>600</td>
</tr>
</tbody>
</table>

**Total:** 10,008

14. Policies, Regulations and Rules

No additional policies, regulations, or rules beyond those mandated by the Graduate School.

15. Accreditation Requirements

Accreditation is not necessary for this program.
16. Internal Status of Proposal

Dept. of Cognitive & Learning Sciences, __________________, Date Approved _______
Dean, College of Sciences and Arts, ____________________, Date Approved _______
Provost, ____________________, Date Approved _______
Graduate Faculty Council ____________________, Date Approved _______
University Support Units, ____________________, Date Approved _______
University Senate, ____________________, Date Approved _______
Academic Affairs Officers, ____________________, Date Approved _______
Board of Control, ____________________, Date Approved _______

17. Planned Implementation Date

Fall, 2008, for planning, faculty recruiting, and student recruiting. First students begin Fall, 2009.
## APPENDIX A  Courses and Potential Faculty Assignments

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Amato</th>
<th>Brill</th>
<th>Helton</th>
<th>Hungwe</th>
<th>Kern</th>
<th>Adjunct Faculty</th>
<th>New Hires</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSY 5100</td>
<td>Applied Cognitive Science</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSY 5850</td>
<td>Human Factors I</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSY 5XXX</td>
<td>Human Factors II</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSY 5XXX</td>
<td>Advanced Statistical Analysis and Design I</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>PSY 5XXX</td>
<td>Advanced Statistical Analysis and Design II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSY 5010</td>
<td>Cognitive Psychology</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSY 5160</td>
<td>Sensation and Perception</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSY 5060</td>
<td>Behavioral Neuroscience</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSY 5XXX</td>
<td>Human Performance</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CS 5760</td>
<td>Human-Computer Interaction and Usability</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>PSY 5XXX</td>
<td>Ergonomics and Biomechanics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ED 5510</td>
<td>Educational Technology</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSY 5XXX</td>
<td>Automation</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>PSY 5XXX</td>
<td>Displays and Alarms</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSY 5XXX</td>
<td>Current Issues in Human Factors</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>PSY 5XXX</td>
<td>Special Topics in Human Factors</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>PSY 5XXX</td>
<td>Special Topics in Cognitive Science</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

Note: Required courses are listed in italics; elective courses are in plain text. An “x” indicates the person is qualified and may teach the course. Actual course assignments will be determined at the time of implementation.
APPENDIX B  Existing Courses with Catalog Descriptions

PSY 5010  Cognitive Psychology
A systematic survey of classical and contemporary research topics in human information processing and learning. Topics include models of cognition, perception/pattern recognition, attention, the nature of mental representation and processing; the architecture of memory, imagery, concepts, and prototypes; reasoning, decision making, problem solving, and cognitive development.

PSY 5100  Applied Cognitive Science
Survey of applied human information processing literature, detailed review of recent developments in applied cognitive science, and examination of the purposes, role and scope of cognitive engineering.

PSY 5060  Behavioral Neuroscience
Advanced topics in the field of behavioral neuroscience and neuroergonomics. Topics may include motor and sensory systems and complex motivated behaviors such as vigilance, attention, adaptive automation, and fatigue countermeasures.

PSY 5160  Sensation and Perception
Examination of basic sensory mechanisms and perceptual phenomena. Sensory mechanisms reviewed will include vision, audition, olfaction, gustation, vestibular system and touch.

PSY 5850  Human Factors I
Advanced concepts critical to the design of human-technological systems, such as capitalizing upon human capabilities and compensating for human limitations. Topics may include perceptual and motor abilities, human error and cognitive engineering.

BE 5110  Neuroengineering
Brief overview of neuroanatomy, neurophysiology, and neurobiology followed by introductions of more advanced topics including neural tissue engineering, neural/electrode interfaces, and functional electrical stimulation.

BE 5700  Biosensors
This course introduces the student to the fundamentals of biosensor development and applications. It provides an understanding of biological components, immobilization methods, transducers, and fabrication techniques.

BL 4470  Analysis of Biological Data
Methods and techniques of analyzing quantitative biological data and of designing biological experiments.

CE 5404  Transportation Planning
Introduction to urban transportation planning, travel characteristics, demand forecasting techniques, corridor studies, traffic impact studies, and public transit planning and operations.

CE 5410  Intelligent Transportation Systems
Introduction to ITS, concepts, technologies, activities, and deployment issues. Topics include advanced traffic management, traveler information systems, commercial vehicle operations, vehicle control systems, ITS applications in public transit, and rural ITS.
CS 4760  Human-Computer Interactions
Principles of design and implementation of user interface (UI). Topics include: UI design principles, evaluation, tools and theory. Students receive direct experience with designing, implementing, and evaluating UIs. Requires completion of a group project.

CS 4811  Artificial Intelligence
Fundamental ideas and techniques that are used in the construction of AI problem solvers. Topics include knowledge representation, problem solving, heuristics, search heuristics, inference mechanisms, expert systems, and language understanding.

CS 5760  HCI Evaluation and Usability Testing
Current issues in human-computer interaction (HCI), evaluation of user interface (UI) design, and usability testing of UI. Course requires documenting UI design evaluation, UI testing, and writing and presenting a HCI survey, concept or topic paper.

CS 5811  Advanced Artificial Intelligence
Course topics include current topics in artificial intelligence including agent-based systems, learning, planning, use of uncertainty in problem solving, reasoning, and belief systems.

ED 5510  Special Studies in Educational Technology
Individual or group studies of specially selected issues or problems in educational technology. Credit may be granted for scholarly work under the supervision of departmental-approved, authorized University faculty members that results in an acceptable scholarly product – research reports, curricula, computer program, or other.

EE 4250  Communication Theory
Introduces the mathematical theory of communication science. Topics include baseband and digital signaling, bandpass signaling, AM and FM systems, bandpass digital systems, and case studies of communication systems.

EE 4257  Digital Image Processing
Image formation, enhancement and reconstruction. Applications in medical imaging, computer vision, and pattern recognition.

EE 5525  Wireless Digital Communication
Principles of wireless communications systems. Projects may include cell phones, computer networks, paging systems, satellite communications, radio, television and telemetry.

EH 4400  Motor Control
Designed for upper level undergraduates or graduates with a basic neuroscience background. Students learn the basics of how the neural and muscular systems coordinate human movement. This will require an integration of biomechanics, molecular and cellular neurophysiology, cognitive neuroscience, and sensory motor skills.

EH 4420  Motor Learning and Development
Designed for upper level undergraduates or graduates with a basic neuroscience background. Students learn the basics of how humans learn to control muscles and coordinate movement (motor learning), and how motor behavior progressively changes throughout a life cycle (motor development).
EH4500  Biomechanics of Human Movement
An in-depth view of the biomechanical properties of the musculoskeletal system. The course provides
detailed analyses of the kinetics of human movement, material properties of the component tissues, and
dynamic processes of adaptation to stress and strain of the system.

EH 5350  Special Topics in Kinesiology
Selected additional topics in kinesiology for advanced students based on interests of faculty and students.
Interested students should contact the Exercise Science, Health and Physical Education department.

FW 4130  Biometrics
Application of statistical and mathematical methods to ecological issues. Subjects include exploratory
data analysis, monitoring programs and development of prediction equations.

MA 4720  Design and Analysis of Experiments
Covers construction and analysis of completely randomized, randomized block, incomplete block, Latin
squares, factorial, fractional factorial, nested and split-plot designs. Also examines fixed, random and
mixed effects models and multiple comparisons and contrasts. The SAS statistical package is an integral
part of the course.

MEEM 4660  Data Based Modeling & Control
System modeling from observed data for computer-aided design and manufacturing, providing
differential equation models. Analysis of manufacturing and dynamic systems, computer routines for
modeling, forecasting with accuracy assessment, and minimum mean-squared error control. Underlying
system analysis, including stability and feedback interpretation, periodic and exponential trends.
Illustrative applications to real-life data.

MEEM 4705  Introduction to Robotics and Mechatronics
Cross-discipline system integration of sensors, actuators, and microprocessors to achieve high-level
design requirements, including robotic systems. A variety of sensor and actuation types are introduced,
from both a practical and a mathematical perspective. Embedded microprocessor applications are
developed using the C programming language.

MEEM 5602  Process and Product Design and Improvement
System modeling and analysis from observed data for computer-aided design and manufacturing,
providing differential equation models. Computer routines for modeling, forecasting with accuracy
assessment and minimum mean-squared error control. Underlying system analysis, including stability and
feedback interpretation, periodic and exponential trends. Uses illustrative applications to real-life data,
including team projects.
APPENDIX C  Library Holdings and Needs

Journals in J. R. Van Pelt Library
Accident Analysis and Prevention
Applied Cognitive Psychology
Applied Ergonomics
Behavioral and Brain Sciences
Cognition
Cognitive Psychology
Cognitive Science
Emotion
Ergonomics
Journal of Environmental Psychology
Journal of Experimental Psychology: Applied
Journal of Experimental Psychology: General
Journal of Experimental Psychology: Human Perception and Performance
Journal of Experimental Psychology: Learning, Memory and Cognition
Journal of Mind and Behavior
Journal of Occupational and Environmental Hygiene
Medicine and Science in Sports and Exercise
Memory and Cognition
National Academies in Focus / National Academy of Sciences
Physiology and Behavior
Psychological Bulletin
Psychological Science
Research Quarterly for Exercise and Sport

Journals Needed: Essential
Aviation Space & Environmental Medicine $215
Cognition and Emotion $1395
Human Computer Interaction $619
Human Factors $457
International Journal of Human-Computer Interaction $940
Perception and Psychophysics $365
Total $3991

Journals Needed: Important
International Journal of Aviation Psychology $645
Mind, Culture and Activity $375
Theoretical Issues in Ergonomics Science $771
Total $1791

Other Needs: Essential
Online Search Database $7000
Total $7000
APPENDIX D  Costs and Revenue

Program Costs

One-time start-up costs:
- Marketing and Recruiting $10,000
- Library monographs $3,000
Total one-time costs $13,000

Continuing costs:
Beginning Year 1 (2009-10)
- New faculty (salary + fringes) $164,000
- New journals $5,782
- Library online search $7,000
- Graduate assistantships (2) $40,000
Beginning Year 2
- Graduate assistantship (1) $20,000
Beginning Year 3
- New faculty (salary & fringes) $82,000
Total annual costs, as of 2011-12 $319,000

Program Revenue

Continuing revenue:
Beginning Year 1 (2009-10)
- External research funding $75,000
By Year 5 (2013-14, with 8 CLS faculty) $300,000
- Indirect cost return $168,000
- Part-time instructional costs assumed by GTAs $27,000
Total annual revenue, as of 2013-14 $327,000

By year three, the investment in the new program of about $300K annually (3 faculty lines and 3 GTA-ships) will result in an increase of external research funding by approximately the same amount. Enrollment in the program will have increased by three PhD students per year. By year five (2013-14), the program is projected to become revenue neutral, if not profitable. By year seven, the program will produce three PhD graduates annually, while remaining profitable.
## Research Space Survey Summary

<table>
<thead>
<tr>
<th>Institution</th>
<th>Office Space per Faculty Member (Sq Ft)</th>
<th>Lab Rooms per Faculty Member</th>
<th>Lab Space per Faculty Member (Sq Ft)</th>
<th>Dedicated Teaching Lab (Sq Ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Univ. of Central Florida</td>
<td>144-180</td>
<td>1-3</td>
<td>420-700 (unfunded); increase to 1500-3500 for funded projects</td>
<td>2 labs, each with 45 computers (1972 sq ft total)</td>
</tr>
<tr>
<td>Old Dominion University</td>
<td>168-180</td>
<td>1-2</td>
<td>500-600 (unfunded); increase to 1500-2000 for funded projects</td>
<td>Info Not Available</td>
</tr>
<tr>
<td>Clemson Univ.</td>
<td>144-180</td>
<td>3-5</td>
<td>1000-2000 (regardless of funding)</td>
<td>Info Not Available</td>
</tr>
<tr>
<td>Univ. of Cincinnati</td>
<td>240-280</td>
<td>4-6</td>
<td>1000-2000 (regardless of funding)</td>
<td>1 lrg room 400 sq ft, plus 5-6 rooms 120 sq ft each (approx. 1000-1200 total)</td>
</tr>
<tr>
<td>Univ. of West Florida</td>
<td>144-180</td>
<td>1-3</td>
<td>400-600 (regardless of funding)</td>
<td>1200 sq ft</td>
</tr>
<tr>
<td>George Mason Univ.</td>
<td>300</td>
<td>1-3</td>
<td>200-400; plus shared lab spaces (e.g., simulation rooms, neuroergo testing)</td>
<td>500 sq ft</td>
</tr>
<tr>
<td>Virginia Tech</td>
<td>144</td>
<td>1-3</td>
<td>300-400 (regardless of funding), plus shared spaces</td>
<td>300 sq ft with 25 computers</td>
</tr>
<tr>
<td>Georgia Tech</td>
<td>360</td>
<td>3-6</td>
<td>1500-3000; plus shared spaces (regardless of funding)</td>
<td>800 sq ft with 30 computers</td>
</tr>
</tbody>
</table>

*Average for Institutions Surveyed: 226 Sq Ft 3 Rooms 1030 Sq Ft (unfunded); 1928 Sq Ft (with funding) 717 Sq Ft*