Transdisciplinary Strategic Priority

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Introduction to Transdisciplinary Priority
Transdisciplinary research and education integrates the methods, theories, techniques, and perspectives of multiple disciplines to develop new approaches to solve complex, real-world challenges.

Importance of Transdisciplinary Priority
Based on New Mexico Tech’s history of interdisciplinary research and development and the increased national focus on research involving multiple disciplines, NMT is moving into the challenging arena of transdisciplinary programs. According to McGregor (2011) “the world is facing a polycrisis, a situation where there is no one single big problem - only a series of overlapping, interconnected problems. These interconnected, complex problems cannot be solved by disciplines working along within the academy using independent, fragmented, disciplinary-focused knowledge.” We must embrace transdisciplinarity as a stimulus to creativity and productivity while still maintaining the rigor and strength of our disciplinary efforts. We will craft a transdisciplinary approach in order to better prepare our students to be leaders in multi-disciplinary problem solving and research. Such broad and cross-cutting efforts will contribute positively to the economies of our state, nation, and world.

Current Situation: Topical Analysis
Based on discussion of the challenges and issues related to developing transdisciplinary education and research programs, the task force recognized the following areas for exploration, data collection, and development. Each of these has been explored and is briefly outlined below.
Program Requirements Analysis

Data and analysis
From Johns Hopkins’ B.S. in Biomedical Engineering, we have adapted the following requirements for transdisciplinary education programs. By completion, students will demonstrate the ability to:

1. apply knowledge of mathematics, science, and engineering.
2. design and conduct experiments, as well as to analyze and interpret data.
3. design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. function on multidisciplinary teams.
5. identify, formulate, and solve science and/or engineering problems.
6. display an understanding of professional and ethical responsibility.
7. communicate effectively.
8. acquire the broad education necessary to understand the impact of science and engineering solutions in a global, economic, environmental, and societal context.
9. recognize the need for, and an ability to engage in life-long learning.
10. exhibit a knowledge of contemporary issues.
11. use the techniques, skills and modern science and engineering tools necessary for professional practice.

Grant Funding
Many funding opportunities that can support transdisciplinary research and education are available under headings or keywords including interdisciplinary, multidisciplinary, cross-cutting, collaborative, integrative, and synthesis.

Funding opportunities for interdisciplinary research has been growing. The National Science Foundation (NSF) has added numerous opportunities for interdisciplinary research including funding for CAREER awards and Major Research Instrumentation. Indeed, NSF has added Interdisciplinary Research as a high priority with a number of specific solicitations. The National Science Foundation has integrated this support even inside of disciplines. For example, the Division of Physics has a program called “Education and Interdisciplinary Research” and the Social, Behavioral, and Economic Sciences has a program called “Interdisciplinary Research in Hazards and Disasters”. In addition, in 2012 NSF added a crosscutting, NSF-wide program called “Integrated NSF Support Promoting Interdisciplinary Research and Education (INSPIRE)”, but it is not clear whether this is being funded in 2014. Finally, NSF’s site on Interdisciplinary Research lists the following mechanisms for funding: solicited interdisciplinary programs, areas of national importance, center competitions, unsolicited interdisciplinary proposals, education and training, and workshops/ conferences/ symposiums. The NSF’s self proclaimed flagship interdisciplinary training program is the “Integrative Graduate Education and Research Traineeship”
In addition to the many interdisciplinary opportunities, NSF also has many pages of listings that include transdisciplinary in the description, e.g., in the Division of Chemistry the “EPS/NSF Networks for Characterizing Chemical Life Cycle”. Finally, NSF lists one explicitly transdisciplinary funding opportunity in the Division of Integrative Organismal Systems.

The Department of Education also has funding opportunities for transdisciplinary education including the “Predoctoral Interdisciplinary Research Training Program in the Education Science”; indeed our experience with Department of Education has been across multiple disciplines.

The Grants.gov site currently lists 1,984 open funding opportunities with “interdisciplinary” as a keyword from agencies including Bureau of Reclamation, Bureau of Land Management, Fish and Wildlife Service, International Narcotics and Law Enforcement Affair, National Institutes of Health, National Institute of Standards and Technology, Department of the Army - Corps of Engineers on just the first page of opportunities. When we add the restriction to include “graduate” as well, we still have 114 open opportunities. Under “multidisciplinary” we find another 182 opportunities including National Institute of Health, Department of the Army, National Science Foundation, National Park Service. The number that are explicitly “transdisciplinary” is much smaller (9), but there are opportunities from the National Institutes of Health and from the National Institute of Food and Agriculture.

Some private foundations focus on cross-cutting themes. For example, the Morris Family Foundation focuses on innovation in interdisciplinary education, and the James S. McDonnell Foundation supports interdisciplinary science approaches to a select list of topics.

### Grant Support

Some institutions provide grant proposal development support, e.g., Michigan Tech’s Sponsored Program Office advertises that they will assist with proposal development to create competitive proposals.

A few practices with specific support that should be considered for advancing the development of grant funding are:

- San Jose State University provides “programs and resources designed to assist them(faculty) in honing their research interests, in finding collaborators and in crafting proposals”.
- The University of Iowa’s Grant and Research Services Center assists with identifying funding sources, provides workshops on grant-related topics, and provides support services for the development, implementation, and utilization of grants.
- The University of Arizona Cancer Center’s Research Grant Support and Resources provides support for grant applications, assists with assessment and reporting, assists with setting up customized funding reports, and coordinates best practices for grants.


### Academic Program Models

Data and analysis
There are many academic programs that are either interdisciplinary or transdisciplinary, both in the US and internationally. There are three general approaches for such programs.

- Transdisciplinary (or Interdisciplinary) degrees - in these programs the title does not reflect any disciplinary or research area; it is generic, e.g., the Transdisciplinary Program at Claremont Graduate University [http://www.cgu.edu/transdisciplinary](http://www.cgu.edu/transdisciplinary). The advantage for this type of program is that NMT would create one program and it could be used to do any transdisciplinary academic program at the same level. The task force is concerned that such degrees are difficult to evaluate for acceptance. Given that we specifically want our degrees to generate outstanding opportunities for students, the task force decided this approach should not be pursued currently.

- Transdisciplinary (or Interdisciplinary) Topical degrees - in these programs the title of the degree is specific to a particular topic or research problem; it is specific, e.g., Transdisciplinary Graduate Education in Media Arts and Science Ph.D. at Arizona State University [http://ame.asu.edu/education/degrees/masphd.php](http://ame.asu.edu/education/degrees/masphd.php). In this case, each topic or research area proposes, creates, and supports a particular transdisciplinary degree with an appropriate name. The advantage here is that the name can provide some disciplinary or topical specificity that may assist with acceptance of the degree. However, it appears that NMT does not have the necessary size and resources to generate a significant number of such degree programs.

- Add on Transdisciplinary Certificate - in these programs the student earns a certificate in transdisciplinary research or a transdisciplinary topic, typically while earning a specific discipline degree, e.g., the Graduate Certificate in Engineering Technology (Transdisciplinary Engineering) at University of Southern Queensland [http://www.usq.edu.au/study/degrees/graduate-certificate-in-engineering-technology/transdisciplinary-engineering](http://www.usq.edu.au/study/degrees/graduate-certificate-in-engineering-technology/transdisciplinary-engineering). This has the advantage that we initiate one certificate program and use that to specifically develop and acknowledge the transdisciplinary capabilities of students across all disciplines. This is the approach that the task force thinks fits NMT best.