# **CASE STUDY: Revising and Resubmitting Rejected Proposals**

# NSF Program: Science, Technology, Engineering and Mathematics Talent Expansion Program (STEP) Proposal Title: Creating Undergraduate Honors Courses in Mechanics through the Incorporation of Numerical Computation

# Panel Summary #1 Panel Summary

**Intellectual Merit:** This proposal does not fit the STEP competition parameters well. It is better suited (with considerable modification) to the CCLI or other curriculum-development competitions. The purpose of the STEP program is to increase enrollments and graduates from STEM areas. This proposal will only reach a small number of students through an Honors program. The panel did not feel a case was made that an Honor program would succeed in increasing enrollments or graduation rates. In fact, the proposal did not include information about graduation rates which is required in the RFP.

The panel was positive about the concept of adding visualization components to the engineering courses and we liked the idea of training TAs because this will help improve overall instruction. We also compliment the PIs on adding real-world problems to the engineering curriculum. Finally, we believe the sequencing of courses in Mechanics is wise; however, we also believe this is a relatively small area of study.

We had many negative comments and you can see that our ratings reflect this. The panel suggests the following as constructive criticism (listed as criticism and then possible solution):

1. too few students impacted - Because the STEP program is intended to increase the number of students and graduates from STEM areas, we suggest that you consider developing stronger classes throughout the curriculum rather than focusing on an Honors program.

2. little focus on under represented groups and diversity - Many programs have extensive outreach to attract minorities, females, etc. We encourage you to develop a stronger recruitment program. The Milwaukee area has a significant underserved population base and you should reach out to encourage more students from this demographic.

3. stipends could send the wrong message - We applaud your plan to provide stipends to students with financial need; however, you only provide the stipends upon success in courses. Therefore, the stipends are not needs-based and are instead a reward for accomplishment. The panel thought the stipends would help recruit more students if they were needs-based.

4. TA training is overfunded - the panel believed that additional TA training will improve instruction and is a good choice. But, we also felt that too much emphasis and funding was placed on this program component. It seemed that program funds were directed toward building university salary and infrastructure rather than helping students directly. This could be addressed by creating a more balanced budget plan that is more student centered.

**Broader Impacts:** With only 80 students affected by this proposal, there are few broad impacts. Please see the comments above on potential ways to improve in this area.

**Panel Summary:** Obviously, the panel did not review this proposal positively. The fact that we were unanimous in our opinion that the proposal was not suited for the STEP competition leads us to suggest you reconsider the proposal for other programs. We believe there are good ideas included in your proposal and that with considerable effort it could be developed into a stronger idea. If you want to resubmit to STEP, please review the RFP closely and address the specific details for this program. The panel wishes to leave the PIs with the idea that despite the negative reviews, the ideas have merit and might be better directed to other programs.

# Review #1 Rating: Poor What is the intellectual merit of the proposed activity?

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1. How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? Limited.

2. How well-qualified is the proposer (individual or team) to conduct the project? PI has one previous CSEMS grant. Relatively inexperienced in grant administration.

3. To what extent does the proposed activity suggest and explore creative and original concepts? Limited.

4. How well-conceived and organized is the proposed activity?

The need is identified, however not well justified. Activity is organized.

5. Is there sufficient access to the necessary resources? Yes.

# What are the broader impacts of the proposed activity?

1. How well does the activity advance discovery and understanding while promoting teaching, training, and learning? Not applicable.

2. How well does the proposed activity broaden the participation of underrepresented groups (such as gender, ethnicity, disability, geography)? No significant focus or justification.

3. To what extent will it enhance the infrastructure for research and education, such as facilities,

instrumentation, networks, and partnerships? Not applicable.

4. Will the results be disseminated broadly to enhance scientific and technological understanding? Yes. Through normal means.

5. What may be the benefits of the proposed activity to society? Improved quality of mechanics courses.

## **Summary Statement**

From the RFP, Type 1 proposals are to be aimed at implementing strategies that will lead to an increase in the number of students obtaining STEM degrees. The potential for this project to do so is limited at best. Also from the RFP, the outcomes expected of funded Type 1 STEP projects include an evaluation, using the benchmarks defined in the proposal, that informs the institution and others of the progress and findings of the grant project. This proposal identifies benchmarks, but not reasonable targets. Does not convincingly demonstrate informing of the institution.

This evaluator is not convinced this program will attract 80 additional students as predicted. Even if this were true, \$1.3 million to increase STEM graduates by only 80 students is wasteful. The improvement of mechanics courses through modeling, simulation, and visualization is an excellent idea and is needed. Having honors mechanics courses is admirable. This is not a convincing argument however which would lead this evaluator to believe significant STEM enrollment increases will result.

## **Review #2 Rating: Fair**

## What is the intellectual merit of the proposed activity?

This project has three principal objectives: to create an Honors sequence in the undergraduate mechanics courses of Statics, Dynamics, and Strength of Materials; to develop enhanced content of the honors Statics, Dynamics, and Strength of Materials through the development of new course materials and activities that introduce the use of computational modeling, numerical simulation, and visualization, using modern engineering software, as a problem solving technique; to specially prepare mechanics teaching assistants by involving them in the development of the new course materials and by training them to effectively interact with students and to field student questions. The PI's are quite technically qualified to achieve stated objectives.

# What are the broader impacts of the proposed activity?

By strategically incorporating the use of computational modeling, numerical simulation, and visualization into the courses of Statics, Dynamics, and Strength of Materials, students will be able to solve a host of problems that are prohibitive under the current paradigm of restricting problems to idealized cases that are amenable to hand calculation. With the use of computing, students will be able to approach basic design problems that give a realistic flavor of true engineering practice. At last, students will be able to answer their questions of "why are we doing this?", and "what's the practical application?" The enthusiasm and excitement generated by engaging in realistic engineering problems at an early stage of the curriculum has the potential to stem losses of retention

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that occur due to lack of interest. The materials and methods that they create here are easily transferable to other institutions, and thus have the potential to positively impact national goals to increase retention and graduation of engineers in this small focused area.

### **Summary Statement**

This proposal will serve the fundamental goal to increase the number of students who advance to majors in, and ultimately graduate from, the College of Engineering and Applied Science (CEAS) at the University of Wisconsin-Milwaukee (UWM). This is an extremely narrowly focused curriculum development project intended for the most dedicated students pursuing a degree in (I assume) mechanical engineering. The expectation is by enhancing sophomore-level static, dynamics, and strength of materials course, a broader population of engineering students will benefit. A stretch since students not interested in mechanics who take these course do so reluctantly because they are required for their major.

## Strengths:

The quest to create honor sequence in mechanics is commendable for those interested in this narrow engineering track. Well defined development and implementation plans. Looks like a good deal of thought and planning has gone into this.

## **Concerns:**

Potentially very small number of students impacted.

Degree to which underrepresented minorities and women participate and are impacted.

Aside from providing money to students, training of teaching assistants in the newly developed courses and tracks is mostly better quality labor for the few instructors.

Does not seem appropriate for STEP; more suitable for curriculum development funded by specific engineering discipline.

### **Review #3 Rating: Poor**

#### What is the intellectual merit of the proposed activity?

The PIs propose to develop an Honors program in engineering and populate the classes with better technology and specially trained teaching assistants. OK, fine - that is real nice to do. But, where is the evidence that an Honors program will recruit or retain more students? The PIs present no such evidence, therefore I do not feel this proposal speaks to the STEP guidelines well (it seems more like a curriculum development proposal more suited for the CCLI program). From experience and some literature review, it appears to me that many students leave engineering programs because the courses are difficult - not too easy. Thus, creating an Honors program is likely to only succeed with the best students who are likely to remain engineering majors anyway. I do not see where this program will recruit and retain more students.

## What are the broader impacts of the proposed activity?

The Honors courses proposed might become good models for other schools to utilize. Other than this, the student population base in engineering served by this proposal would be small and not have much of a broader impact at all.

#### **Summary Statement**

I do not believe this proposal should move forward for funding consideration. I think the PIs missed the point of the STEP program entirely.

## **Review #4 Rating: Fair**

# What is the intellectual merit of the proposed activity?

They hope to create an Honors sequence in undergraduate mechanics courses. Part of this will entail developing new course materials and activities, incorporating numerical simulation, computational modeling, and

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visualization, using software. They hope to develop a plan to prepare mechanics teaching assistants. Smaller class sizes provide an opportunity for high quality teaching.

# What are the broader impacts of the proposed activity?

This proposal offers students a reason for why they study mechanics, as well as providing practical applications, to prepare them for solving problems. There is a potential to demonstrate that incorporating computational modeling at an early stage lead to increased student interest, increasing retention and graduation rates. An outcome of the project will be to provide substance for new textbooks.

## **Summary Statement**

I think too much emphasis is being placed on training teaching assistants. The TAs might become responsible for getting the message across. Just because class sizes would be limited to 20, that would require more TAs, but why not hire more PhDs? The proposal makes me think that other schools are limited by the "current paradigm" that most problems are restricted to hand calculation. What are the math courses doing? They did not address the current graduation rate. Many programs incorporate technology now; what makes their proposal unique?

# **Review #5 Rating: Poor**

# What is the intellectual merit of the proposed activity?

Having an honors sequence will not entice students to go into STEM fields who otherwise wouldn't. Honors students typically choose major first, then are "into it" so they don't need "incentive" to do honors work, other than the challenge, recognition and intellectual endeavor. Honors work can encourage students to pursue graduate study. Allowing students to take courses out of sequence only to increase diversity sets up underrepresented students for failure. Statistics given are sometimes not comparing the same profile of student, so not really relevant comparisons. Good that sequence engages students in their sophomore year, when interest often lags.

## What are the broader impacts of the proposed activity?

It promotes quality teaching and learning. However, the number of students impacted directly is small, but the TA teaching skills could impact future students. Doesn't seem to address increasing diversity in a directly tangible way.

**Summary Statement:** Very small impact for the cost. Some basic good ideas interwoven with very limited impact ideas.

# **Review #6 Rating: Fair**

## What is the intellectual merit of the proposed activity?

The **strengths** of this proposal begin with an innovative project designed to create a mechanical engineering curriculum for honors students that incorporates more open-ended, real-world case studies. This model for including the very activity that excites STEM professionals about their work, solving open-ended problems, has the potential for being a highly-effective motivational tool for helping students preserver through their coursework challenges, and retain their declaration as STEM majors. Program activities include often overlooked details such as special training for the teaching assistants involved in these courses.

**Weaknesses** of this program include the potential of these activities for increasing STEM majors. If a student self-selects to participate in an honors program, this student is very likely to successfully complete a major in a STEM discipline independent of the proposed activities. The STEP program is designed to increase the overall number of STEM majors, and by focusing program efforts on the high-achieving students only, there is a low probability that this will increase the overall number of STEM majors. Providing stipends to offset financial hardships is not a sustainable post-award activity, and because the award amount is conditional, the stipend may encourage academic dishonestly. A stronger proposal would be prepared by finding alternative methods to offset the cost of education.

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# What are the broader impacts of the proposed activity?

Few efforts to increase STEM majors are focused on high-achieving students. If successful, the wide dissemination of the results of this project has the potential to impact numerous campuses around the nation.