

FACULTY DEVELOPMENT PLAN



Assistant Professor of Manufacturing Engineering

August 2022

This document outlines my faculty development plan for 2022, including a self-assessment of my strengths and needed improvements, and goals for each of the three categories: citizenship, scholarship, and teaching. These assessments and goals will help shape my efforts as I prepare for my Continuing Faculty Status review. These goals will strengthen myself as a faculty member and benefit my students and the Manufacturing Engineering Department as a whole.

SCHOLARSHIP SELF-ASSESSMENT

Research interests

My research interests are in tribology and surface texturing, biomaterials, and joint replacement technology. These interests are chosen based on my prior experience and the needs of the Manufacturing Engineering Department. My research focuses on manufacturing processes to improve the lubrication of biomaterials and enhance the longevity of joint replacement implants. My research methodology employs numerical simulations of lubricated textured bearing surfaces and friction and wear testing of bearing surfaces before and after manufacturing processes. My active projects include precision machining methods for advanced bio-compatible ceramic materials, and different heat treatments of cobalt-chromium-molybdenum alloys for enhanced wear resistance.

Scholarship strengths

I was a successful graduate student, publishing 1 paper as a master's student and 4 papers as a PhD student. These publications were in high-quality journals and represented a significant amount of work on my part, both in physical experiments and numerical simulations. My main strengths in scholarship come from my attention to detail, systematic approach to research, strong desire to communicate findings clearly through journal articles, and my experiences with a wide range of different research techniques. I have worked hard to become a good writer, and I also feel that I am good at proofreading and giving feedback on student work. I enjoy mentoring students and have employed several fantastic student research assistants.

Scholarship areas of improvement

As a new faculty member, I have no experience submitting proposals to funding agencies. This is the biggest area I need to improve. Securing funding is vital for my success as an engineering professor, as it determines how many students I can employ and what projects I can work on. To be more successful in proposal writing, I will identify key contributors to work with and help me write a joint proposal. I also would benefit from better ideas for broader impacts of my work.

Progress to date

I have hired several student research assistants and meet with each student weekly. I have ordered a 6-station pin-on-disk tribometer for conducting long-duration friction and wear tests of

different biomaterials in a short amount of time. I have formed partnerships and begun writing joint proposals with several more experienced faculty in the Manufacturing and Mechanical Engineering Departments. I should have several proposals submitted by the end of the year.

TEACHING SELF-ASSESSMENT

Teaching philosophy

My teaching philosophy is based on three principles: giving students an experience with the subject matter, sharing applications and real-world problems to engage and encourage curiosity in the students, and creating a safe and respectful culture where the students can ask questions and find answers. The lessons that stay with students are the hands-on experiences. As I teach, I strive to find ways to get the students involved. Hands-on lab activities, final projects, and daily engaging questions are all important for effective experiential learning. Introducing applications of the core knowledge is also important, because if the students see the significance of what they are learning, they will be more willing to put in the work needed to master the material. Learning is a dynamic and individual experience. It is of paramount importance to establish from the beginning an atmosphere where the students can ask questions and make comments without being made fun of or dismissed. I am also not afraid to tell my class if I do not know the answer to a question that is posed, because I am still learning too, and I think that going and finding answers to questions models the lifelong learning that I want the students to strive for.

Teaching strengths

My greatest strength in teaching is simply the fact that I enjoy teaching and learning. Another strength as a new faculty member is that I remember what it is like to be a student. As a student, it always bothered me when a teacher brushed over the surface of something or did not explain it clearly. I never like to teach something that I do not completely understand myself. I put a lot of effort into preparing lectures, labs, and assignments, and I think the students appreciate that. I also try to encourage student involvement in my lectures and hands-on experiences during lab exercises. My wife is a high school teacher, and she has given me some very good suggestions on how to improve my teaching, including having lots of example problems in class and following the “I do, we do, you do” approach, where I first show how to solve a problem, then solve one with the students, and finally have the students solve a problem on their own.

Teaching areas of improvement

I am new to teaching and still figuring out the best ways to be effective. I spend a lot of time creating my lectures and lab assignments and will need to work faster to have more time for my other responsibilities. Also, I am not always sure of the best homework assignments to give students lots of practice with the material without being busy work. It is hard to find the right balance of writing test questions that challenge the students to think critically, but are fair representations of what we discussed in class. Finally, I need to increase my efforts to bring in real-world examples to my lectures and labs, because I want students to remember and use what we talk about in class.

Progress to date

I coached a capstone team this year and learned how to be effective in helping guide the students through their assignments and design challenges. I taught my first class, Instrumentation, in the

Winter 2022 semester. This was a fun and challenging assignment, as this is the first time this class has been taught in the department and I needed to build all the resources myself. The class went well and was enjoyable for both me and the students. I also attended the Effective Teaching Workshop this summer and benefitted from the instruction from the CTL.

CITIZENSHIP SELF-ASSESSMENT

Citizenship strengths

I am a friendly person with a desire to help my coworkers. I am willing to participate in many different capacities. I have been assigned to two different committees: the ABET and external relations committees. Outside of my department at BYU, I serve as an ad-hoc reviewer for the Journal of Materials Science and Engineering A. I have also joined two professional organizations: the Orthopaedic Research Society (ORS) and the Society of Tribologists and Lubrication Engineers (STLE).

Citizenship areas of improvement

Being the newest faculty member in the Manufacturing Engineering department, I am somewhat limited in my knowledge of the department and our responsibilities as faculty. As I become more familiar with the department, I will be able to add more to the discussions in faculty meetings. I will also seek to be more involved with the external relations committee. Finally, I will endeavor to become more involved in various professional communities and organizations outside of BYU.

Progress to date

I helped to write the Manufacturing Engineering unit review document for the ABET committee. I am currently on the graduate committees of 5 graduate students in Manufacturing Engineering (not counting one student who recently graduated). I have engaged with other faculty across campus interested in biomedical engineering by attending and presenting at the Biomechanics Grand Rounds hosted by [REDACTED] and joining discussions for the new cross-disciplinary biomedical engineering minor and Intro to Biomedical Engineering class. I attended the STLE annual meeting in May to network with other tribologists. I attended the business meeting for the Materials Tribology group and will seek to increase my involvement with that organization. After attending this conference, I have also accepted invitations to serve as an ad-hoc reviewer for Tribology Transactions and Tribology International.

LONG-TERM GOALS

Scholarship

- Obtain Continuing Faculty Status
- Apply for an NSF CAREER award
- Achieve a sustainable amount of funding to support and maintain a productive research lab
- All graduate students publish at least one peer-reviewed journal article
- All undergraduate students involved in a paper or conference publication

Teaching

- Develop the Instrumentation and Quality courses to become thriving classes
- Develop graduate level class(es) in biomedical manufacturing and/or tribology
- Regularly achieve good teaching reviews
- Invite feedback from students and peers, and implement that feedback to improve
- Involve interactive tours of research labs into my classes

Citizenship

- Meaningful participation in all committee assignments
- Join a planning/editorial board of a worthwhile professional organization and/or journal

SHORT-TERM GOALS FOR 2022

Scholarship

- Submit at least 1 journal article this year
 - Review paper on CoCrMo heat treatments
 - Precision manufacturing ceramic materials
 - CoCrMo microstructures for wear and corrosion resistance
 - Lubrication/tribocorrosion simulations
- Submit at least 1 conference publication
- Submit at least 3 proposals to federal funding agencies
 - NIH NIAMS R01: CoCrMo microstructure design
 - NSF Advanced Manufacturing: Precision machining of ceramic materials
 - NSF Advanced Manufacturing ERI: Friction stir processing of CoCrMo for wear resistance
 - NSF Advanced Manufacturing: 3D printing metal textured surfaces for lubrication enhancement
 - NIH NIAMS R15: Durability of CoCrMo passive oxide film
- Volunteer to sit on an NSF review panel
- Find good collaborators
 - Life Sciences/Exercise Science (protein lubrication)
 - Mechanical Engineering (surface texturing, fluids modeling, microstructure design, machine learning, 3D printing)
 - Computer Science (lubrication simulations, machine learning)
 - Orthopedics industry (medical device design, simulator testing)
 - Industry (machining ceramics)
 - Manufacturing Engineering (friction stir processing, 3D printing)

Teaching

- Be prepared for every lecture and lab
- Return assignments to students quickly
- Keep good notes on how to improve for next year
- Invite Student Consultants on Teaching (SCOT) to sit in on my classes
- Send out midterm student feedback surveys

- Invite senior faculty members to observe my teaching
- Implement feedback from student and peer reviews
- Read the book “Effective Grading” and implement best practices for my assessments

Citizenship

- Actively contribute to all assigned committees
- Attend the STLE annual meeting to network
- Seek involvement in other professional organizations
- Build collegiality with other faculty members in the department and across campus
- Submit joint proposal applications with collaborators