Panel 3A
Intro to Capstone
Design Research

Facilitator: Beth DeBartolo – Rochester Institute of Technology

Panelists:
1. Kris Jaeger-Helton – Northeastern University
2. Susannah Howe – Smith College
3. Brian Novoselich – United States Military Academy (West Point)

Description: Research into capstone design is what brought us all here, but many attendees may be just starting their work on this topic. Learn from established researchers as they discuss best practices, ideas for developing research topics in this field, and potential funding sources to tap into.

Notes:
Kris: involved for about 10 years; desire to look at success models rather than just deficit models (what not to do) for students. Started collecting data around What are the patterns that lead to student and team success, and what are the patterns that lead to failures. Led to more collaborations, cross-institutional work, more questions.

Brian: Deliberate pathway that started in first tour at West Point, where his work in ME there led him to ASEE conferences and pubs, desire for improvement. Returned to army, and then offered a second tour at West Point, with an option for a PhD, and he choose EngEd for his degree, so came to VT. Focused on leadership models in design teams (echoed experiences in Afghanistan) - whole focus on shared leadership and different models.

Susannah: Accidental pathway - trained as a civil engineer in structural materials. Started teaching capstone at Smith and started by looking at all the other models of capstone out there. Started looking at what the models are, and came across the original BYU study of structural and pedagogical issues of capstone. Study was 10 years out of data, and they offered her the base survey and she took that and then expanded it, and did it in 2005, presented at CDC, joined the community. Did the survey again in 2015, with the next one planned in 2025. Continued to look more and more into capstone research - what pedagogies work, what students learn, how the transition to work goes, etc.

Where do you start?

Observe what's happening, read what's already out there - see what people already know and where the opportunities are, have a lot of conversations with mentors and others working in the area. Mentorship as key. Asking questions in this community. Model the study after someone who's already done something similar. Use other people's work as templates, looking at how other people have done things and how that can apply to what you are interested in.

Susannah: Continuing to learn new methods. Listening to the questions people are asking of the data also helps drive analysis - hearing what other people are interested in, getting feedback and conferences and hearing what new questions people bring.

No one currently on the panel is doing intervention/acton-based research. How to start in action/intervention research.

How do you differentiate course improvement from research?

Brian: Transferability/generalizability as a key separator between a localized culture of assessment and continuous improvement in one's own course to a larger audience for/value of the knowledge. Key questions are related to purpose as well as the rigor or robustness of the method.

Susannah: Also collaborations with people at other institutions - collaborate with more experienced researchers, as well as peers at other institutions that might be similar or might be different for systematic or explainable reasons.

Kris: It comes down to focus on audience - who needs to learn from this and why? Who will find the information valuable, and why? Who is your dissemination population, and what is relevant locally (to students, faculty, advisors, etc.) versus nationally to others in similar contexts.

How do you measure learning in capstone when all the students are on different projects.
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- Measures of process
- The challenge of evaluating performance when all the projects and all the structures are differently … what do we mean by success? The need for the researcher to define what they mean by success and then see if it's measurable.
- Is the outcome the project or the student's learning or something else?

How do you do research with people? What the issues and the considerations?

- Work with your IRB to learn about how to ethically engage with individuals
- Know how your going to manage your data, get those pieces together and clarified
- Know what data you need and what the issues are with those data types
- What are you going to disclose to students/participants about what you are trying to measure or study?

Funding Sources:

Your state NASA Space Grant can fund undergraduate researchers for an academic year (it doesn't have to be NASA research): https://www.nasa.gov/stem/spacegrant/about/index.html

Engineering Information Foundation (eifgrants.org)

NSF Solicitations for new researchers:
PFE: Research Initiation in Engineering Formation (PFE: RIEF) | Beta site for NSF - National Science Foundation

EHR Core Research: Building Capacity in STEM Education Research | Beta site for NSF - National Science Foundation

Journals & Conferences:
Capstone Design Conference
ASEE - especially DEED (esp Design Engineering Education Division)
Mudd Design Workshop (every 2 years)
IEEE Professional Communication Society Conference
Australasian Association for Engineering Education Conference
ASME IDETC/DTM
ICED (The Design Society)

Advances in Engineering Education (AEE)
International Journal of Engineering Education (IJEE)
Journal of Engineering Education

IEEE Transactions on Education
IEEE Transactions on Professional Communication
Studies in Engineering Education
Journal of The First-Year Experience & Students in Transition
Journal of Postsecondary Student Success
Interdisciplinary Journal of Problem-Based Learning
International Design Engineering
ASME Journal of Mechanical Design
Journal of Engineering Design
Design Studies
Journal of Civil Engineering Education
Chemical Engineering Education
Research in Engineering Design (Springer)

Lists of journals and conferences:
[Where to publish your Engineering Education Research? | UCL Centre for Engineering Education - UCL – University College London](#)

[EER JOURNALS | RESEARCH IN ENGINEERING EDUCATION NETWORK (reen.co)](#)

[engineeringeducationlist [licensed for non-commercial use only] / Engineering Education Community Resource (pbworks.com)](#)

Shifting from an engineering mindset to a engineering education mindset:
Qualitative - the massive amount of data that can result.
Qualitative and Quantitative - Just because you can measure with numbers doesn't mean you should

Advice:
Chris - know why you are doing it? What is your goal? Be ready for unscripted
Brian - find a mentor, no matter where you are in your research evolution. The more you have to talk about what you want to do, the more it will solidify your ideas.
Susannah - Don't be afraid to start small and let it grow from there..

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