BEEC Share and Learn Report: April 2025

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Topic: Clinical Immersion Programs for Biomedical Engineering Undergraduate Students

Resources:

- BME IDEA: https://venturewell.org/bmeidea/bme-idea-meeting/
    - **Save the Date! October 8th, 2025, 1-6pm PST, University of California San Diego**
    - Registration will open in July
    - There will be opportunities to present a snapshot at the BME IDEA meeting in 2025, highlighting novel ways you are teaching design, innovation, and entrepreneurship in BME> You will receive more information about how to submit your snapshot once the registration form goes live.
- Nvivo Qualitative Analysis Software: https://lumivero.com/products/nvivo/
- KEEN Entrepreneurial Mindset: https://engineeringunleashed.com/what-is-keen
- AI Atlas for Qualitative Analysis: https://atlasti.com/guides/qualitative-research-guide-part-2/thematic-analysis
- Case studies from Gendered Innovations to bring up the effect of disparities in health care, treatment, and medical access: https://genderedinnovations.stanford.edu/
- Papers:
    - https://asmedigitalcollection.asme.org/biomechanical/article-abstract/143/12/121001/1114805/Employing-Faculty-Peer-Mentoring-and-Coaching-to
    - https://peer.asee.org/toward-equity-and-inclusivity-in-engineering-classrooms-understanding-students-disparities-in-response-to-clinical-observations-and-needs-finding-course-development
    - https://2024bmesannual.eventscribe.net/fsPopup.asp?PresentationID=1503072&returl=YWpheGNhbGxzL3Nlc3Npb25pbmZvLmFzcD9QcmVzZW50YXRpb25JRD0xNTAzMTU4&mode=presInfo

Discussion and Lecture Notes:

Lecture Notes:

- Engineering Education at Fayetville Arkansas is a fast growing region of the country. University of Arkansas BME program has ~60+ undergraduates in each class (sophomore/junior/senior) and 250+ students. Undergraduate enrollment has grown significantly in last decade
    - 3 hours from Little Rock with 8 hospitals in Fayetville metro area, but there's no teaching hospital "right next door"
    - Only 2 teaching hospitals in Arkansas
- Partnering Clinical Sites: UAMS Northwest (Physical Therapy Clinic, Internal Medicine Clinic), University of Arkansas Simulation Lab, Ozark Orthopedics, Arkansas Children's Northwest
    - Unique challenges since there's no medical school in Northwest Arkansas and there's a broad range of clinical participants from the community, that leads the projects focus, such as physical therapy, primary care, and ambulatory medicine
    - Nursing simulation lab is an interesting take that can help students think about projects that are more educational focused instead of direct treatments/etc.
- Clinical Observation and Needs Finding Course: lecture series + clinical observations (3 sessions up to ½ day) + clinician input -> initial project concepts (individual) -> down select and form groups (groups, preliminary design brief for future senior design projects) -> further down selection for senior design project (4-5 students)
    - Have industry partners who can help mentor and advise students on project ideas/engage students from observation class to learn about how to address a need from an engineering perspective and ethical/technical considerations. Gives exposure to professional development.
    - Project concept is individual – motivated by clinician input (midterm summary assignment)

    - Junior level class prior to senior capstone course
- Course Learning Objectives:
    - Use BME knowledge to solve meaningful problem
    - Go from idea to product
    - FDA and regulatory considerations
    - Human centered design
    - Commercialization concepts (IP) – mostly done in senior design but introduced here
    - Communicate ideas in professional setting
- *RQ:* How to evaluate the efficacy of this course given the constraints?
    - Q1: How do students feel about the class?
        - Self-efficacy
        - Value creation
        - Interest
        - Method: Qualtrics-managed student surveys at the beginning and end of the class (IRB approved)
        - Method: categorical, Likert-style survey and open ended free response questions using Nvivo qualitative analysis software https://lumivero.com/products/nvivo/
    - Q2: How do students from historically marginalized groups feel about the class?
        - Self-efficacy
        - Confidence
        - Community engagement
- Results: Reported in Horsey, JA, et al ASEE 2024; Navarro AP, Horsey JA, et al, BMES 2024
    - https://peer.asee.org/toward-equity-and-inclusivity-in-engineering-classrooms-understanding-students-disparities-in-response-to-clinical-observations-and-needs-finding-course-development
    - BMES paper not yet available on Google Scholar
    - Started in 2018
    - Goal in immersion class is find problem, goal in entrepreneurial class is to validate the problem, and then they validate the solution in the senior design class so 3 courses work together
        - Led to increase in patent applications from students
        - Increase in clinical partnership and national NSF iCorps participation
        - Work in collaboration with business school for commercialization
    - Pre-course survey increase – incorporated learning modules at sophomore level class prior to the clinical immersion class using the KEEN Framework
        - https://engineeringunleashed.com/what-is-keen
    - Seen an increase in female motivation post clinical immersion
- Exploration of Qualitative Analysis from open response questions:
    - AI Based Software ATLAS for qualitative analysis: https://atlasti.com/?x-source=pmax&x-campaign=pmax-en&x-id=21759486841&x-term=pmax-01&utm_source=google&utm_medium=pmax&utm_campaign=21759486841&utm_term=&utm_content=&utm_adgroup=&device=c&placement=&matchtype=&network=x&gad_source=1&gbraid=0AAAAApc8-YClBiQmH_ipC81bcPOwBmzUj&gclid=CjwKCAjwn6LABhBSEiwAsNJrjrOG0BFjRC-ACSHnBjZ5qGq3xhEja6hoqCqk9IG40o1mTqeg7myJ1xoCVI8QAvD_BwE
    - How to: https://atlasti.com/guides/qualitative-research-guide-part-2/thematic-analysis

Discussion:

- Elaborate on “stereotype threats” coming into the course some students feel?

    - Engineering females not well represented. If only one girl in room and rest of male, she may not feel able to respond to question and may feel threatened because they don't see anyone in room that are like her. So may not feel comfortable speaking up in class.
    - Professor teaching styles and choice of visuals on slides also can lead to "stereotype threat" and can make a difference
    - Case studies from Gendered Innovations to bring up the effect of disparities in health care, treatment, and medical access: https://genderedinnovations.stanford.edu/
    - https://asmedigitalcollection.asme.org/biomechanical/article-abstract/143/12/121001/1114805/Employing-Faculty-Peer-Mentoring-and-Coaching-to
- Findings of particular practices that impacted marginalized groups (informal findings)?
    - Team creation, choice of slides, choice of partners, all influenced student groups differently but haven't isolated a specific intervention
- Demographics and recordings of clinical collaborators?
    - The medical educational centers are more mixed (residents/PT students) and more diverse with diverse perspectives
    - Some industry sites may not be as diverse
    - https://2024bmesannual.eventscribe.net/fsPopup.asp?PresentationID=1503072&returl=YWpheGNhbGxzL3Nlc3Npb25pbmZvLmFzcD9QcmVzZW50YXRpb25JRD0xNTAzMTU4&mode=presInfo