

Overview of Research Design: *The Larger Picture*

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Research Answers Questions

- **Engineers Solve Hard Problems!**
 - ▶ Client states the problem
 - ▶ Use standard methodologies
 - ▶ Provide immediate or near-term value
 - ▶ Success Metrics: *Efficiency, Effectiveness*

- **Scientists Answer Hard Questions!**
 - ▶ Researcher defines the question (takes time, effort)
 - ▶ Researcher may invent methodologies
 - ▶ Provide medium-term to long-term value
 - ▶ Success metrics: *Novelty; Surprise; Paradigm Shift, ...*

How to Ask Good Research Questions: 1

- Avoid “High Jump” questions
 - ▶ Can we develop a system to do x?
 - ▶ Is it true that x?
 - ▶ Is Design-Build more effective than traditional Design-Bid-Build construction?

- If you don’t get over the bar, you achieve nothing!



How to Ask Good Research Questions: 2

- Ask “**Broad Jump**” questions!
 - ▶ To what degree does a user with system x perform better than a user with system y or no system?
 - ▶ How much new predictive power is gained by incorporating x into a current approach/tool?
 - ▶ Which of two or more competing theories best explains phenomenon X?
- You will always get credit for advancing some distance toward answering the question!



Stepping Stones of Science

- Science is a social process not a solo adventure!
- Your research is neither the first step nor the last step in answering a question—it is the “**next step**”!
- Use the stepping stones already in place from prior research to advance toward your research question.
- Aim to have your research be the “next stepping stone” for others to use on the path to answering your research question



Writing a Good Proposal

- Motivation
 - ▶ Practical pain point/s that need therapy
- Research Question/s
 - ▶ If answered, they could help relieve the pain,
- Points of Departure
 - ▶ Distance from existing stepping stones to your question defines your contribution
- Approach and Methodology
 - ▶ How you will walk across the stepping stones and add the next one)
 - ▶ Focus on Validation and Testing
- Risks and Mitigation Strategies
- Research Plan (Graphical)
- Summarize Expected Contribution
 - ▶ Position your stepping stone, relative to previous and following stepping stones

