# Graduate Student Coaching of Undergraduate Researchers

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## Background of Creative Inquiry Projects
- **Sand Traction**
  - **Goal:** To improve the traction of tire treads while maintaining current pneumatic tire tread endurance  
  - **Sponsored by:** NASA  
  - **Project start date:** Fall 2007  
  - **Demographics of student members (Fall 2014)**
    - 5 Mechanical Engineering majors  
    - 4 males, 1 female  
    - 2 freshmen, 2 sophomores, 1 junior, 0 seniors

- **Feasibility Studies**
  - **Goal:** Determine the feasibility of product improvement concepts proposed by TechTronic Industries (TTi) engineers.  
  - **Sponsored by:** TTi  
  - **Project start date:** Spring 2014  
  - **Demographics of student members (Fall 2014)**
    - 9 Mechanical Engineering majors  
    - 9 males, 0 females  
    - 0 freshmen, 2 sophomores, 4 juniors, 3 seniors

## Comparison of Research and Coaching Experiences

<table>
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<tr>
<th>Graduate Coach (GC)</th>
<th>Sand Traction (ST)</th>
<th>Similarities Between ST and FS</th>
<th>Feasibility Studies (FS)</th>
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</table>
| - No direct contact with sponsor | - Students ask questions related to development procedure and concept testing process. Not only future tasks and deliverables | - Professional leader/advisor  
- Different level of respect from undergraduates  
- Students want feedback from coaches and advisors  
  - We have more experience so we receive more questions  
  - Give appropriate feedback | - When meeting with TTi, allow the students to speak for themselves  
- Only interject when necessary (e.g. administrative, clarify ideas, additional comments, etc.) |
| - Self-sustaining project (operated for approximately 14 semesters) | - Requests all results to be documented | - Communication between sponsor and students is crucial to project success  
- Clarify objectives and project feedback  
- More guidance and feedback required (only 2 semesters old)  
- TTi requests 3 deliverables each semester |
| - Overall, 1 deliverable requested by NASA | | |

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<tr>
<th>Undergraduate Student (US)</th>
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| - Students asked for future tasks and deliverables | - Presented weekly project updates  
- Of equal standing within the team  
- Worked on projects each week | - Constant contact with TTi  
- Documentation requested by sponsor  
- Progress/results reported to sponsor weekly |
| - Documented results as requested | | |

## Motivation
- Documenting changes in leadership experiences when moving from a researcher to an advisor for a project  
- Comparison of working in the Creative Inquiry as an undergraduate participant and as a graduate coach  
- Comparison of two Creative Inquiry projects, in terms of advising

## Personal Research Experience
- **Justin Moylan**  
  - 3 semesters of Sand Traction Creative Inquiry  
  - Published 2 ASME IDETC papers  
  - 1 semester of Feasibility Studies Creative Inquiry  
    - Team Leader  
- **Steven O’Sheilds**  
  - 4 semesters of Sand Traction Creative Inquiry  
    - Team Leader for 3 semesters  
    - Published 2 ASME IDETC papers

## Conclusions
- Ensuring students are making appropriate progress  
  - Focus is placed on student learning  
  - Different mindset coaching the project  
  - Allow students to lead the project and make mistakes  
  - Guide (and do not necessarily instruct) the team  
  - Leadership plays a larger role

## Future Work
- Gather information from other Creative Inquiry projects  
  - For example: Dr. Fadel’s Meso-Structure CI  
    - 3 chemical engineering students  
    - 0 freshmen, 3 sophomores, 0 juniors, 0 seniors  
    - Analyze differences when coaching ME and non-ME majors

## Acknowledgements
- Andrew Shumaker and Keith Karmilovich for their picture of the Tweel prototype