

## **Trajectories of Knowledge and Action in Becoming an Engineer**

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This paper focuses on how the notion of a trajectory of identification can be traced between different timescales and different sets of data that pertain to the student. The development of a specific student's trajectory is traced through his ability to talk-engineering along two different timescales: the entire four years of undergraduate education and the final 10 week quarter that includes work on the senior design project.

### **Implications of this Case Study for Tracing Engineering Student Trajectories**

The kind of language that makes up the life worlds and social spaces of engineers, what is referred to here as talk-engineering, has enabled researchers to perceive how engineering students construct their own figured worlds. The analysis in this paper suggests that the patterns of behavior along one student's trajectory of identification

(where he uses talk-engineering) have enabled the team to trace his "trajectory of knowledge" (based on his ethnographic interviews) to that of a "trajectory of action" (derived from his senior/fourth year design class project). This analysis captured a glimpse of what this student perceives engineering to entail (along the trajectory of knowledge) and of how he uses his engineering skills in real-time social interaction (along the trajectory of action). Depending upon the timescale one chooses, trajectories of identification do not necessarily end, but are transforming.

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### **Methods and Background**

This analysis is drawn from data collected as part of the Academic Pathways Study, a longitudinal, multi-institution study designed to gain insight into learning and development within engineering education.

The ethnographic aspect of the Academic Pathways Study has worked with 16 engineering students on each of four campuses involved in the study. Of the 16 students on each campus, eight students (4 female and 4 male) were selected to participate in more intimate ethnographic work involving observations of classes, study groups, and other on-campus activities. In a few cases, video and/or audio data was obtained from engineering students' work on their senior design/capstone projects.

This study is based on results from longitudinal ethnographic interview texts and video data from senior design and capstone projects. The focus of this paper is on one student at Large Public University (LPub)— a male electrical engineering major—and how his trajectory of identification develops over time.

### **What We Found**

During the first two years of engineering education at Large Public University (LPub), students take many prerequisite courses to fill requirements in the College of Engineering. Many students must take these courses without an assurance that they will be allowed to pursue an engineering major, since most must apply for admission to a specific department before their junior year and risk being rejected. The student in this study (“Colin”), however, was a direct admit to electrical engineering as a freshman and did not face this situation.

The student’s trajectory of identification as an engineering student manifested in his year 1 interview in terms of what engineering knowledge and practice entails. His understanding of engineering as a science was somewhat stereotypical, he assumed that there was only one good design and that there would be more “engineering leaders” in real engineering (referring to his observation during an introductory engineering class that there were more followers than leaders). In Colin’s year 2 interview he began to be more specific in his understanding of engineering as a science.

Besides references to engineering as a science in his first two years of interviews, Colin referred, more importantly, to what he felt engineering knowledge was – that is to say that for Colin, there was coursework that was more closely related to engineering than others and that more closely resembled something he could see himself doing as an engineer.

A shift in Colin’s responses was noticed during his year 3 and 4 interviews. This shift emerged in his ability to talk–engineering. In one interview in year 3, Colin “repairs” the interviewers comments by correcting the use of an engineering term. Colin’s ability to talk-engineering was not just a matter of him spouting off these terms. Rather, Colin knew when to use talk-engineering as a discourse strategy through displaying his understanding of these concepts. A shift in his use of technical engineering knowledge during his third year was illustrated by a response during his interview where he displayed his understanding of a problem. This illustrates how much Colin’s use of talk-engineering as an interactional strategy emerged in the trajectory of identification that traces his stance as a knowledgeable person who could now talk-engineering.

In Colin’s fourth year interview his conceptual understanding of engineering was traceable. Where in his third year he used technical jargon in talking engineering, Colin shifts in the fourth year in how he describes these concepts by anthropomorphizing them. This suggests that this usage is evidence of how comfortable he was with these topics as well as further evidence of his ability to talk-engineering.

What the team observed over time with Colin is an increasing use of what has been called talk-engineering in his responses during ethnographic interviews. Colin’s presentation of himself as a

knowledgeable person was traced over time from when he first developed stereotypical images of engineering as a science in years 1 and 2 of his education, to his image of engineering as a science that became tied more to his coursework in years 3 and 4 when he built and designed things. This analysis has shown, through tracing Colin's trajectory of identification over time, how his identification practices as an engineering student developed such that towards the endpoint of his trajectory he could talk-engineering.

Analysis then shifted from a year by year timescale to a single event that occurred during Colin's senior (fourth year) design project. This switch in timescale shows not only how the two timescales intersect, but how they also reflect different aspects of Colin's trajectory of identification. The focus of the analysis of this event was to observe how he used talk-engineering during interaction with his peers.

In this example, Colin used talk-engineering to take an authoritative stance during group interactions as part of his senior design project. Colin used talk-engineering to argue for a particular design for short circuit protection. This ethnographic observation of Colin during his senior design group work added a new dimension to the ethnographic interviews. In the interviews he made only mention of design, whereas in the group work example he was actually observed not only implementing design, but using talk-engineering to take an authoritative stance as well.

As the team traced Colin's trajectory of identification over time, a change in his use of technical language was noted—as his familiarity with this vocabulary became fluent he was able to use it mixed with ordinary language. In tracing Colin's trajectory of identification across the two time scales, the team suggests it is possible to refer to one as a trajectory of knowledge and the other as a trajectory of action.

The full text, including references, can be viewed in: Andrew Jocuns and Reed Stevens. 2008. Trajectories of Knowledge and Action in Becoming an Engineer. Paper presented at the Sociolinguistic Symposium 17, Amsterdam, The Netherlands, April 3-5, 2008.

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