

Characterizing and Modeling the experience of Transfer Students in Engineering

Dr. Matthew W. Ohland, Purdue University and Central Queensland University

Matthew W. Ohland is Professor of Engineering Education at Purdue University and a Professorial Research Fellow at Central Queensland University. He has degrees from Swarthmore College, Rensselaer Polytechnic Institute, and the University of Florida. His research on the longitudinal study of engineering students, team assignment, peer evaluation, and active and collaborative teaching methods has been supported by over \$12.8 million from the National Science Foundation and the Sloan Foundation and his team received Best Paper awards from the Journal of Engineering Education in 2008 and 2011 and from the IEEE Transactions on Education in 2011. Dr. Ohland is past Chair of ASEE's Educational Research and Methods division and a member the Board of Governors of the IEEE Education Society. He was the 2002–2006 President of Tau Beta Pi.

Dr. Catherine E. Brawner, Research Triangle Educational Consultants

Catherine E. Brawner is President of Research Triangle Educational Consultants. She received her Ph.D. in Educational Research and Policy Analysis from NC State University in 1996. She also has an MBA from Indiana University (Bloomington) and a bachelor's degree from Duke University. She specializes in evaluation and research in engineering education, computer science education, teacher education, and technology education. Dr. Brawner is a founding member and former treasurer of Research Triangle Park Evaluators, an American Evaluation Association affiliate organization and is a member of the American Educational Research Association and American Evaluation Association, in addition to ASEE. Dr. Brawner is also an Extension Services Consultant for the National Center for Women in Information Technology (NCWIT) and, in that role, advises computer science departments on diversifying their undergraduate student population. Dr. Brawner previously served as principal evaluator of the NSF-sponsored SUCCEED Coalition. She remains an active researcher with MIDFIELD, studying gender issues, transfers, and matriculation models in engineering.

Dr. Catherine Mobley, Clemson University

Dr. Mobley is a Professor of Sociology at Clemson University. In recent years, her research has focused on science, technology, engineering and mathematics (STEM) education, sustainability, environmental sociology, and policy and advocacy. Her focus is on identifying the human factors (cultural, social, economic and political) that influence environmental and educational policies. She has more than 15 years experience in developing surveys (traditional and web-based), conducting in-depth interviews, and moderating focus groups. In 2004, Dr. Mobley joined the NSF-funded MIDFIELD interdisciplinary research team which is examining the educational pathways of engineering students at eleven universities. She is currently serving as Co-PI and is co-leading the qualitative component of a project on transfer students in engineering.

Dr. Richard A. Layton, Rose-Hulman Institute of Technology

Mr. Russell Andrew Long, Purdue University, West Lafayette

Russell Long is Director of Project Assessment at the Purdue University School of Engineering Education. He has extensive experience in assessment and student services in higher education and has worked for eight years as the Data Steward of the MIDFIELD project.

Dr. Clemencia M. Cosentino, Mathematica Policy Research

Clemencia Cosentino (Ph.D., Sociology, Princeton University), a Senior Researcher at Mathematica Policy Research, is the former director of the Program for Evaluation and Equity Research at the Urban Institute. For close to 20 years, her work has focused on evaluating efforts to improve the participation of underrepresented groups in science, engineering, technology, and mathematics studies and employment.

Margaret D Sullivan, Mathematica Policy Research

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HIGHLIGHTED ACTIVITIES OF THE PAST YEAR

- Completed 59 in-depth interviews at three additional institutions bringing the total number to 86 interviews conducted at 5 institutions.
- Transcribed and validated the 86 in-depth interviews.
- Conducted preliminary analysis of interview data with respect to student experiences with orientation and advising.
- Analyzed interview volunteer survey data for 126 prospective interviewees.
- Analyzed 38 in-depth interviews of engineering transfer students attending four-different institutions to learn more about transfer student orientation and advising and influence of parental education on negotiating the transfer process.
- Completed 3 papers based on the qualitative research.
- Created and presented a research poster on the qualitative research, which was awarded second place in the symposium.
- Attended training session on qualitative coding and memo-writing and generating theory for qualitative research.
- Made 4 conference presentations and contributed to 1 workshop. Three of the conference presentations were on the above papers.

Quantitative analysis of MIDFIELD database

Our analysis used records for 94,732 undergraduate students from the Multiple-Institution Database for Investigating Engineering Longitudinal Development (MIDFIELD). MIDFIELD comprises a census of undergraduate students who attended 11 public institutions between 1988 and 2008. MIDFIELD institutions represent public universities that educate large numbers of engineering students.

From the 977,950 records available, we restricted our sample to those who (1) were domestic students (927,350), (2) were in the data set early enough for us to observe the possibility of graduation within six years (677,691), and (3) declared a major in engineering or otherwise expressed the intent to study engineering in the fifth semester of their programs (94,732). For transfer students, we estimated placement using transfer hours, assuming that 15 credit hours equals one semester; we also used the fifth semester as the reference point to capture most transfer students at the point of matriculation to ensure a valid comparison of transfers to non-transfers. This approach resulted in a sample of 21,542 transfer and 73,190 non-transfer engineering students included in this analysis.

We used standard t- and chi-square tests to establish whether observed differences were significant, calculated Cohen's d and Cramer's V to estimate the magnitude of differences between groups irrespective of sample size, and used the Bonferroni adjustment to reduce the probability of false discovery due to the number of significance tests that were run. To facilitate replication, we present unweighted and unadjusted results but replicated the comparisons of transfers to non-transfers by (1) weighing the data to account for different population sizes across institutions and (2) adjusting for clustering that might have led to underestimated standard errors. The adjusted results indicate only one noteworthy change to the gender distribution by transfer status and, in a few other instances, slightly different point estimates.

Semi-structured interviews

Campus representatives at two MIDFIELD institutions sent an invitation to all engineering students who had transferred into the institution in the two semesters preceding the semester of the interview. Interested students completed a survey to provide demographic and scheduling information. Participants were chosen from six engineering majors - civil, chemical, computer, electrical, industrial, and mechanical - and were diverse with respect to gender and ethnicity. Selected students were interviewed in Fall 2011, Spring 2012, Fall 2012, and Spring 2013.

We used a semi-structured interview protocol to learn about student experiences with the transfer process. Interviews ranged from 19 to 65 minutes and averaged 37 minutes. Participants were paid \$20 upon completion of the interview. Interviews were audio-taped and then transcribed verbatim and verified. We used a constant comparative coding method, whereby emerging concepts were constantly compared to data that had already been coded.

Review of Institutional Policies

A review of institutional policies regarding transfer students was conducted. This review identified the following information for each institution:

- Onsite personnel at sending institution
- Whether the receiving institution delivers distance education classes to sending institution
- Whether the receiving institution guarantees admission from some institutions if prospective transfer students meet minimum requirements.
- How many 3+2 programs the receiving institution has. These students are from four-year institutions. Students receive a degree from both institutions.
- How many 2+2 programs the receiving institution has. These students are generally, but not exclusively, from two-year colleges where they are part of a formal transfer program from the sending to receiving institution. Students may or may not receive an AA degree.
- Whether the receiving institution has a “transfer block” – a specific set of courses from community/technical colleges that are guaranteed to transfer.
- How many articulation agreement an institution has – agreements between institutions for transfer that do not necessarily include specific courses.
- % of engineering students who are transfers

PUBLICATIONS (cumulative Journal and Conference)

- Sullivan, M., C. Cosentino de Cohen, M.K. Orr, R.A. Long, and M.W. Ohland, “Understanding Engineering Transfer Students: Demographic Characteristics and Educational Outcomes,” *Proc. 2012 IEEE/ASEE Frontiers in Education Conference*, Seattle, WA, October 3-6, 2012.
- Ohland, M.W., M.K. Orr, R.A. Long, R.A. Layton, and S.M. Lord, “Introducing ‘Stickiness’ as a Versatile Metric of Engineering Persistence,” *Proc. 2012 IEEE/ASEE Frontiers in Education Conference*, Seattle, WA, October 3-6, 2012.
- Mobley, C. and C.E. Brawner. “Work in Progress: Transfer Students in Engineering: A Qualitative Study of Pathways and Persistence.” *Proc. 2012 IEEE/ASEE Frontiers in Education Conference*, Seattle, WA, October 3-6, 2012.

- Houghland, J., C.E. Brawner, M. Camacho, M. Harte, L. Joyner, and C. Mobley. “Improving Student Retention and Completion: Lessons from Research and Evaluation.” Workshop presented at the American Sociological Association Annual Conference. Denver, CO, August, 2012.
- Ohland, M.W. and C.E. Brawner. “A Mixed Methods Approach to Characterizing the Experience of Transfer Students in Engineering. Presentation to the 11th National Institute for the Study of Transfer Students Annual Conference. Frisco, TX, February 2013.
- Shealy, E. C. E. Brawner, C. Mobley, and R. A. Layton. “A Descriptive Study of Engineering Transfer Students at Four Institutions: Comparing Lateral and Vertical Transfer Pathways.” Poster presented at the First Annual Graduate Research and Discovery Symposium (GRADS), Clemson University, Clemson, SC, April 2013. Poster awarded Second Place Prize.
- Mobley C. and C. E. Brawner. “Engineering Transfer Students’ Views on Orientation and Advising.” Proceedings of the American Society for Engineering Education Annual Conference, Atlanta, GA, June 2013.
- Shealy, E., C. E. Brawner, C. Mobley, and R. A. Layton. “A Descriptive Study of Engineering Transfer Students at Four Institutions: Comparing Lateral and Vertical Transfer Pathways.” Proceedings of the American Society for Engineering Education Annual Conference, Atlanta, GA, June 2013.
- Mobley, C. and C. E. Brawner. “First-Generation Engineering Transfer Students: A Qualitative Study of Social and Cultural Capital.” *Proc. 2013 IEEE/ASEE Frontiers in Education Conference*, Oklahoma City, OK, October 25-27, 2013.

PRESENTATIONS (cumulative)

- Ohland, M.W., and R.A. Long, “A Logit Model for Studying Engineering Transfer Students,” Creating Pathways for STEM Transfer Student Success, Asheville, NC, September 21, 2010.
- Mobley, C., C.E. Brawner, C. Cosentino, and M. Sullivan, “Poster: Characterizing and Modeling the Experience of Transfer Students in Engineering,” STEP PI Meeting, February 17-20, 2012.
- Mobley, C., “Transfer Students in Engineering.” Invited Panelist for NSF STEP Grantees Meeting, for panel “Improving Retention and Student Success through Cohort Building and Social Networks. Washington, DC, March.
- Sullivan, M., C. Cosentino de Cohen, M.K. Orr, R.A. Long, and M.W. Ohland, “Understanding Engineering Transfer Students: Demographic Characteristics and Educational Outcomes,” *Proc. 2012 IEEE/ASEE Frontiers in Education Conference*, Seattle, WA, October 3-6, 2012.
- Ohland, M.W., M.K. Orr, R.A. Long, R.A. Layton, and S.M. Lord, “Introducing ‘Stickiness’ as a Versatile Metric of Engineering Persistence,” *Proc. 2012 IEEE/ASEE Frontiers in Education Conference*, Seattle, WA, October 3-6, 2012.
- Mobley, C., C.E. Brawner, and E. G. Shealy, “Transfer Students in Engineering: A Qualitative Study of Pathways and Persistence,” *Proc. 2012 IEEE/ASEE Frontiers in Education Conference*, Seattle, WA, October 3-6, 2012.

- Mobley, C. and C. E. Brawner. “First-Generation Engineering Transfer Students: A Qualitative Study of Social and Cultural Capital.” *Proc. 2013 IEEE/ASEE Frontiers in Education Conference*, Oklahoma City, OK, October 25-27, 2013.
- Mobley, C., C.E. Brawner, M. Orr, R. Long and M.W. Ohland. “STEM Transfer Pathways: Transfer Student Capital, Parental Education, and Transfer Shock.” Accepted for Presentation at the National Institute for the Study of Transfer Students, Atlanta, GA, February 2014.

HIGHLIGHTED FINDINGS OF THE PAST YEAR

- *Transfer student orientation*: Based on our analysis of in-depth interviews with 38 engineering transfer students attending four different 4-year universities, we found that students had mixed experiences with orientation:
 - As a whole, significantly more students found that transfer student orientation did not meet their needs for information about the academic requirements, educational opportunities, or sociocultural milieu of the sending institution.
 - Despite the benefits of participating in orientation, a vast majority of respondents indicated that orientation was not particularly helpful to them for a variety of reasons. The amount of information fell far short of what several respondents expected, with one student describing the orientation more as a “*briefing*.”
 - Others claimed that the orientation was not at all targeted to their information needs and was rather pedantic in its delivery. In these cases, the departmental-level orientations were more useful.
 - Respondents were frustrated at being treated like freshmen during orientation and not being given credit for their existing knowledge and experiences.
 - The knowledge about orientation programs and the levels of participation varied widely across the institutions and student interviews.
 - Many students reported engaging in their own “personal orientation” whereby they conducted background research on their own, independent of any institutional efforts to introduce them to the campus, their department, and their major.
- *Transfer student advising*
 - Formal academic advising for students intending to transfer can take place at the sending institution, the receiving institution, at both institutions, or at neither institution. In many cases, the students we interviewed received all of the advice they got through their own research on line. In these cases, they relied on the websites at the receiving institution for information about the transfer process, course credits, and required prerequisites. Depending on the institution, this information was either satisfactory or sorely lacking.
 - A positive advising experience at the sending institution was more likely to be found at an institution that had some sort of formal agreement or working relationship with the receiving institution.
 - Although positive advising from the sending institutions was welcome and generally helpful, more often the students believed that they needed to find information on their own.
 - The overarching theme for advising is that there is not a systematic advising process in place at any of the institutions, perhaps constituting “institutional

neglect” on the part of both the sending and the receiving institutions.¹ Many students experienced frustration at receiving inaccurate information and ultimately not being able to get credit for many classes.

- In many cases, students had to be very persistent to obtain the information they needed, being very proactive by making campus visits, calling university personnel and faculty, and utilizing personal networks.
- Overall, students used a combination of social capital (personal networks), cultural capital (knowledge of higher education environments) and transfer student capital (a combination of “agency, knowledge and action”) to navigate through the early stages of the transfer process. Personal motivation and resourcefulness seemed to be more important for this sample of engineering transfer students than were the more formal institutional orientation and advising processes.
- *Descriptive characteristics and lateral and vertical pathways:* From our prospective interviewee surveys we learned that:
 - Most students transfer to a MIDFIELD school from a school with which the MIDFIELD school has some sort of formal transfer arrangement.
 - Transfers were on average a bit older (average age = 22.3) than first time in college students at the same point in the curriculum. Nineteen percent of respondents were age 25 or older.
 - Thirty four percent of survey respondents attended more than one institution prior to transfer.
 - Nearly half (46%) of students transferred to the MIDFIELD institution from another 4-year institution (lateral transfers). Most (80%) transferred from another institution in the same state.
 - Male students (56%) were more likely to transfer from a 2-year institution than were female students (48%). Hispanic students (71%) were more likely to transfer from a 2-year school than other ethnic groups (White – 55%; Black – 33%; Asian – 18%).
 - Of those asked about their parents’ education (N=63), 63% had at least one parent who had obtained a bachelor’s degree.
 - Half of the students reported “GPA shock” where the GPA they’ve attained at their new school is worse than the GPA at their prior school. The students most likely to experience GPA shock were transfers from 2-year schools who had 3.5-4.0 GPAs at their prior school.
- *First generation engineering transfer students:* Based on our analysis of 18 engineering transfer students:
 - Students were categorized according to parental education level: both parents’ highest level of education was graduating high school or lower (“low parental education” - LPE); (2) both parents graduated high school and one or both parents attended college and/or earned an associate’s degree (“mid-level parental education” - MPE); or (3) both parents’ highest level of education was a bachelor’s degree or higher (“high parental education” - HPE).
 - Regarding the transfer process itself, MPE students were more likely than LPE students to report meeting with counselors to learn more about the transfer requirements. They consulted individuals at both the sending and receiving

institution. HPE students were most likely of the three groups of students to describe the transfer process in positive terms as “not so bad” and “smooth.”

- There were distinct differences in student descriptions of their advising experiences. While all HPE students reported receiving in-depth support from their advisors, LPE students were most likely to describe their advising as “self-initiated” or as inadequate, especially at the sending institutions.
- In terms of involvement in extracurricular activities, all LPE students said they were very involved with extracurricular academic and social groups, While HPE students were more likely to indicate they joined a variety of groups, they did not describe taking an active role in these organizations to the extent that MPE and LPE students did.
- An HPE student reported receiving practical and logistical support from parents in applying to school and negotiating the transfer process; however, several LPE and MPE students said their parents could not at all relate to the logistical and practical challenges posed by both the transfer process and majoring in engineering.

References

¹ Tobolowski, B.F., & Cox, B.E. (2012) Rationalizing neglect: An institutional response to transfer students. *The Journal of Higher Education*, 83(3): 389-410.