

Unnecessarily Complicated: An Examination of Information Asymmetry in the Transfer Process

Dustin M. Grote, Virginia Tech

Dustin M. Grote currently serves as the Graduate Research Assistant for the Virginia Tech Network for Engineering Transfer Students (VT-NETS) Program with the Engineering Education Department at Virginia Tech. He is also a PhD student in the Higher Education Program with an emphasis in Research, Policy, and Finance. His research focuses primarily on access issues for underrepresented/minority and low income students, community college pathways, policy, organizational and systems structures, and assessment and evaluation in higher education contexts. Dustin has B.S. and B.A. degrees from the University of Portland and a M.A. degree from the University of Northern Colorado.

Dr. Walter C. Lee, Virginia Tech

Dr. Walter Lee is an assistant professor in the Department of Engineering Education and the assistant director for research in the Center for the Enhancement of Engineering Diversity (CEED), both at Virginia Tech. His research interests include co-curricular support, student success and retention, and diversity. Lee received his Ph.D in engineering education from Virginia Tech, his M.S. in industrial & systems engineering from Virginia Tech, and his B.S. in industrial engineering from Clemson University.

Dr. David B Knight, Virginia Tech

David B. Knight is an Associate Professor and Assistant Department Head of Graduate Programs in the Department of Engineering Education at Virginia Tech. He is also Director of International Engagement in Engineering Education, directs the Rising Sophomore Abroad Program, and is affiliate faculty with the Higher Education Program. His research tends to be at the macro-scale, focused on a systems-level perspective of how engineering education can become more effective, efficient, and inclusive, tends to be data-driven by leveraging large-scale institutional, state, or national data sets, and considers the intersection between policy and organizational contexts. He has B.S., M.S., and M.U.E.P. degrees from the University of Virginia and a Ph.D. in Higher Education from Pennsylvania State University.

Abbey Rowe Erwin, Virginia Polytechnic Institute & State University

Abbey Rowe Erwin is a Ph.D. student in the Higher Education Program at Virginia Tech. Her research interests focus on the transfer student experience, particularly the impact of institutional policies on transfer student success and the role of collaborative programming between two-year and four-year institutions. She has a B.B.A. from Roanoke College and a M.Ed. in Higher Education from the University of South Carolina.

Dr. Bevlee A. Watford P.E., Virginia Tech

Watford is Professor of Engineering Education, Associate Dean for Academic Affairs and Director of the Center for the Enhancement of Engineering Diversity.

Unnecessarily Complicated: An Examination of Information Asymmetry in the Transfer Process

Abstract

Efforts to expand access to undergraduate engineering programs increasingly suggests that community colleges have the potential to be lower-cost pathways to bachelor's degrees. However, little research has examined students' ability to navigate complexities in transfer of coursework processes and policies between partner institutions, despite this being essential for maintaining cost and time-efficiency for degree completion. To address this gap in the literature, we use semi-structured interviews to explore how transfer students receive information about transfer of coursework processes from the perspective of faculty and staff in the College of Engineering at a large research university as well as at two partner community colleges. Using thematic analysis of interview data, we find that while students have access to several different sources of information, they experience *information asymmetry* across those sources. Information asymmetry occurs when buyers (students) and sellers (colleges/universities) do not have the same information in a marketplace. In this context, these asymmetries act as a barrier to students' accrual of transfer student capital, a key factor in transfer student outcomes. These findings suggest a need for institutions to consider how they communicate information on transfer of coursework processes and policies, how they manage information accuracy, and how advising service structures may influence transfer students' access to accurate information on transfer of coursework.

Keywords: Transfer, Engineering, 2-Year Institution, 1st Generation

Motivation

The Engineer of 2020 [1] calls for the engineering field to broaden participation of underrepresented minority (URM), first-generation, and low income students in the workforce. Efforts to broaden participation must address challenges from early adolescence and high school (e.g., lack of exposure to engineering) [2-4] through college and university degree attainment (e.g., rising tuition and fees that are especially prohibitive to low-income, URM students and families) [5, 6] and into the workforce (e.g., cultures of exclusion and majority bias) [7, 8]. Mitigating these system-imposed barriers is no small feat and requires a comprehensive yet detailed examination of each part of the pathway to engineering.

Research that examines expanding access into engineering bachelor's degree programs increasingly acknowledges of the potential for community colleges to serve as lower cost pathways to bachelor's degrees in engineering [9-11]. Community colleges maintain lower levels of tuition and fees compared to any other sector of higher education [12-14] and serve as one

option for reducing costs before transferring to a four-year university. Thus, as enrollments and interest grows for engineering programs nationwide, colleges and universities could consider the community college transfer pathway as a mechanism to meet the aims set forth in the Engineer of 2020 to expand participation of marginalized groups.

To maintain cost and time-efficiency in degree completion, however, a student's ability to navigate complexities in transfer of coursework processes and policies between partner institutions is essential [14, 15]. Research has identified many factors associated with unsuccessful transfer, ranging from student background characteristics (e.g., academic preparation in high school, first generation status, socio-economic status) [16-18] to institutional and policy forces (e.g., credit creep, credit loss) [19, 20]. Laanan [21-25] established the Transfer Student Capital (TSC) Framework to outline factors that may both enable and inhibit success for transfer students. This framework considers how students' background characteristics, community college experiences, and accrual of knowledge about the transfer process (i.e., Transfer Student Capital) are predictive of students' university experiences and outcomes.

A key component of TSC not often explored in the transfer student literature is how students gain information about the transfer of their coursework from community college to university. Knowledge in this area is critical, particularly for students in engineering who will most likely confront rigid, sequenced curricular structures [13, 19, 20]. Our study focuses on this topic by analyzing interview data collected from engineering advising faculty and staff at a research university and two partner community colleges. We investigate advisors' perceptions of how students receive information on the transfer of coursework and address the following research questions:

- RQ1: How do students receive information on the transfer of courses from a community college to a university?
- RQ2: How (in)effective are these information sources in informing students of their transfer of coursework from community college to a university?

Addressing these questions will advance our understanding of what sources transfer students access to navigate the course transfer process and how that process impacts students' accrual of TSC. This information will be useful for practitioners, scholars, and policy-makers who seek to improve the community college transfer pathway to an engineering degree.

Theoretical Framework

Our theoretical framework combines Laanan's [21-25] Transfer Student Capital framework with the concept of information asymmetry in the postsecondary education marketplace [26]. Transfer Student Capital is an inputs-experiences-outputs (IEO) model that delineates the factors that

influence students as they transfer between institutions. The framework provides a lens for examining how students' background characteristics, experiences at community college, and the accrual of knowledge about the transfer process influence their experiences with the transfer and transition process within a university.

TSC can serve as a theoretical tool to ground both qualitative exploration to understand transfer students' experiences, as well as quantitative modeling to understand the impacts of policies, processes, programs and experiences on transfer student outcomes [27]. Its most recent iteration defines transfer student capital as a function of academic counseling experiences, perceptions of the transfer process, experiences with faculty, and learning and study skills [27]. We aim to further explore these factors by examining how transfer students are informed about the transfer of coursework process, which plays a major role in forming transfer student capital.

Understanding how students obtain information about transfer of coursework requires investigating what information exists, how it is disseminated, and how the information varies across contexts (i.e., between a community college and a four-year institution). A useful framework for understanding our findings within this context is information asymmetry. Originally authored in economic theory, information asymmetry exists when buyers and sellers in a market do not have access to perfect information, thereby causing the market to act inefficiently. Dunn [26] translates this theory into the context of postsecondary education--students are synonymous with buyers, and higher education institutions are synonymous with sellers in an educational market system. In our case, as students seek to accrue transfer student capital via understanding how the courses they have taken at a community college transfer to universities, the information they access about those processes is key to the generation of capital. If students and institutions do not have access to the same information, or if there is inconsistent information across contexts, transfer students can face barriers as they seek to build their TSC, perpetuating the equity gap for students in the transfer pathway to engineering.

Data and Methods

We explore how students receive information on the transfer of coursework through semi-structured interviews with faculty and academic advisors at a mid-Atlantic research university and two community college partner institutions. Leveraging the strengths of a case study approach, we are able to examine the types of information sources students utilize when attempting to transfer courses from the community college to a university while understanding how those sources, individually and collectively, support or inhibit transfer of courses.

Data Collection

We invited faculty and academic advisors within the College of Engineering at the four-year university who engage with transfer students to participate in this study. These individuals had positions within a general engineering program (to which all incoming first-time-in-college and transfer students matriculate), discipline-specific degree-granting programs (e.g., mechanical

engineering), and the college-level undergraduate education office. Similarly, community college faculty and staff who supported or advised pre-engineering students through the transfer process were invited to participate.

In total, we conducted 26 interviews: 21 with university faculty and academic advisors, and 5 with community college faculty. Interviews explored five primary areas of the transfer of coursework process: 1) how students receive information on transfer of coursework prior to transfer, 2) the role of academic advisors in the course transfer process, 3) the application of transfer articulation agreements in practice, 4) perceived (in)sufficiency of academic preparedness for incoming transfer students, and 5) how transfer of courses and academic programs impact transfer student success. The use of semi-structured interviews provided consistency through a prescribed set of questions asked of all participants while also allowing flexibility for in-depth discussion. The interview protocol is approved through the Institutional Review Board (IRB), and all participants provided informed consent.

Data Analysis

We used thematic analysis of transcribed interviews to address the two research questions. First, we used descriptive coding to identify information sources that students commonly accessed to navigate the coursework transfer process. Next, we further analyzed each mention of an information source using focused coding techniques, a combination of detailed descriptive and evaluation coding [28]. Descriptive coding helped to clarify initial information source codes into more nuanced and specific information sources. Once identified, evaluation coding was used to examine the efficacy of each source. As a tangential way to measure the quantity or frequency of information sources, focused descriptive codes representing each information source and the associated evaluative code were quantitized [29] as descriptive data for discussion. Theoretically, we can understand frequency of mention as an indicator of the extent to which an information source helps students gain knowledge of transfer of coursework processes. Along the same lines, information sources with a higher frequency of positive evaluations could be interpreted as being more effective sources of information compared with those that have higher numbers of negative evaluations.

To clarify this method, we provide an example. In the initial coding process, *Websites* emerged as a common information source for students in transferring courses. In the focused coding stage, this source became several more nuanced information sources housed at the *Community College* (*Website, Course Catalog*) and *University* (*Website, Transfer Course Equivalency Guide, and Checksheets*). Next, each instance of an information source (e.g., *Community College Course Catalog*) was given a positive (+), negative (-), or neutral evaluation based on the participant's discussion of the effectiveness, clarity, and availability of a source to inform students about course transfer. We next conducted an analysis across information sources and their evaluation codes.

Findings

First, we summarize the types of information sources and which institution (i.e., university of community college) maintains them. Next, we examine and compare frequency counts of information sources by type of source. We also compare and contrast quantitized evaluation

codes for each information source. Then, we highlight several instances of information asymmetry across information sources. Finally, we discuss the implications of the findings for transfer students' accrual of TSC.

Information Sources

Students receive information on the transfer of coursework process from 17 different sources. Unsurprisingly, the overwhelming majority of information sources are authored and updated by the university (65%) (i.e., the receiving institution of transfer student courses), with some information provided only by the community college (24%), and the rest from both institutions (12%) (Figure 1). The types of information sources include web resources (35%), direct communication with advising faculty/staff (24%), support programs (18%), non-advising staff (18%), and peers (2%) (Figure 2).

Figure 1

Counts of Information Sources by Institution Type

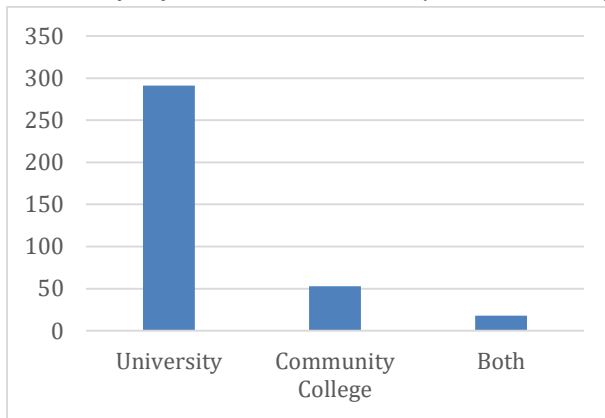


Figure 2

Counts of Information Sources by Type of Information Source

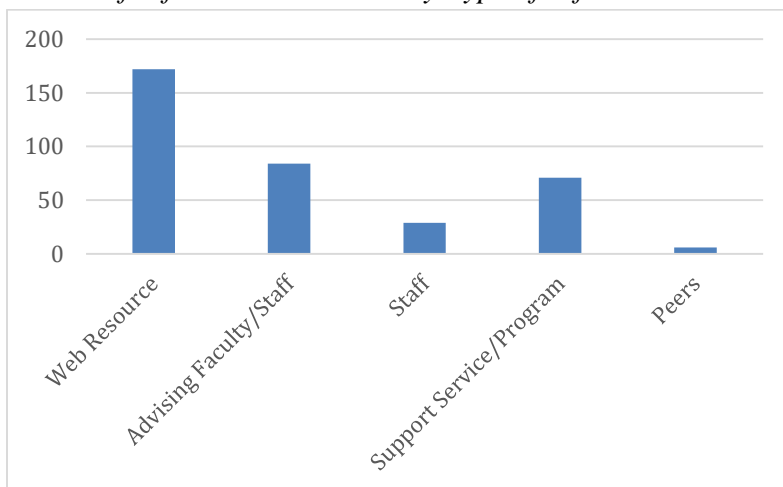


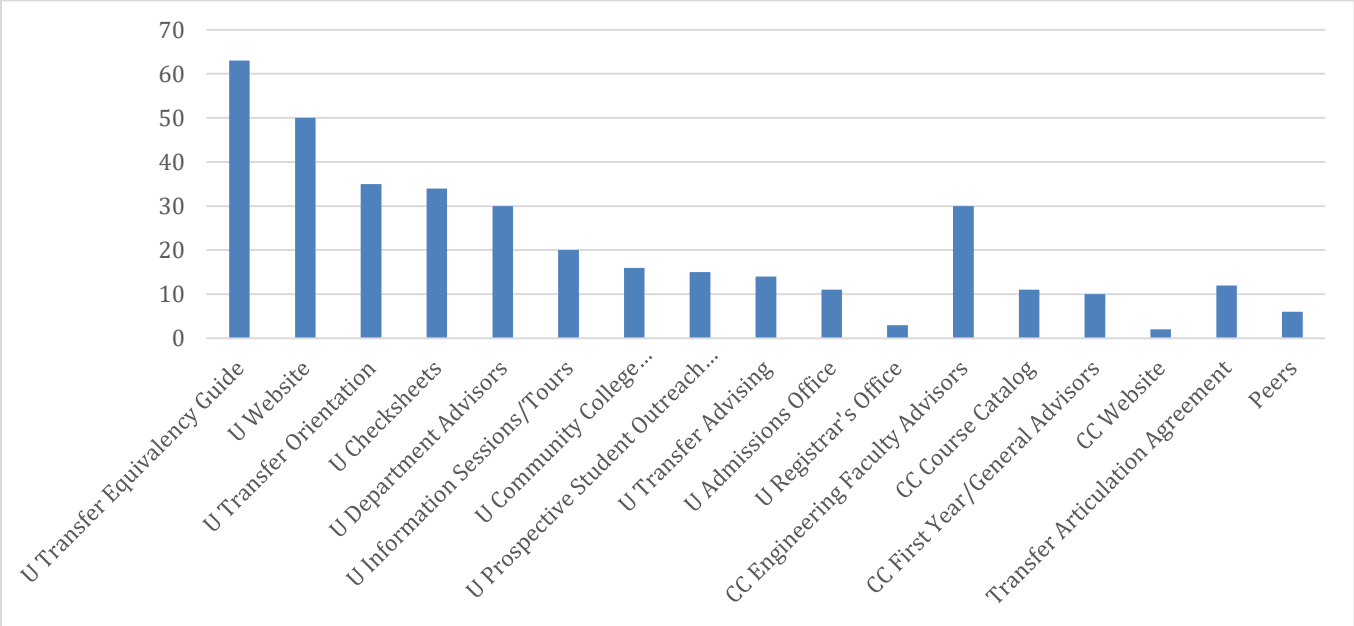
Table 1 provides a more fine-grained summary of each information source, including a brief descriptive summary. Figure 3 summarizes the total number of times each information source appeared in interviews. Participants mentioned the university’s transfer equivalency guide (17%) most frequently. As a web resource, the equivalency guide is accessible to students at all times and thus is more convenient than scheduling appointments to meet with advisors. It is also one of the few resources, and the only web resource, that links coursework from the community college directly to an equivalent course at the university. The university website was the second most frequently mentioned resource (14%). This information source captured more generic websites within the university’s webpage that provided transfer students with information relevant for transfer of courses (e.g., GPA requirements, list of courses that must be complete before transfer, degree program information). Transfer orientation, a program recently mandated for all incoming transfer students and a program under programmatic reconstruction over the past few years, was the most frequent program or service mentioned as a source of information for course transfer. The most frequent “people” sources of information (i.e. Advising Faculty/Staff, Staff, Support Service/Program, Peers) were departmental advisors at the university (8%) and engineering faculty advisors at the community college (8%). The registrar’s office who handles the course equivalency process (1%), community college websites (1%), and peers (2%) were mentioned least frequently.

Table 1
Information Sources Summary Table

Information Source	Source Type	Brief Description
U Transfer Equivalency Guide	Web Resource	University web interface which documents all courses previously reviewed and approved for transfer to university
U Website	Web Resource	General information available to students via the university website
U Transfer Orientation	Support Service/Program	Orientation program required for all admitted engineering transfer students
U Checksheets	Web Resource	Official plans of study by engineering degree/major with required courses for degree completion
U Department Advisors	Advising Faculty/Staff	Advising staff/faculty within each engineering department/major
U Information Sessions/Tours	Support Service/Program	University information sessions, college tours, and campus visit programs for prospective students
U Community College Visits/Information Sessions	Support Service/Program	University staff visits to community colleges to facilitate information sessions for prospective transfer students
U Prospective Student Outreach Staff	Staff	Staff member in college of engineering with responsibilities to provide information and services to prospective transfer students
U Transfer Advising	Advising Faculty/Staff	Advising staff/faculty within college of engineering & engineering education department designated to provide advising services to first-semester transfer students
U Admissions Office	Staff	Admissions staff who coordinate and make admissions decisions on applied transfer students

Information Source	Source Type	Brief Description
U Registrar's Office	Staff	Staff members who coordinate the transfer equivalency and review process for students
CC Engineering Faculty Advisors	Advising Faculty/Staff	Faculty advisors in engineering programs at the community colleges
CC Course Catalog	Web Resource	Formal document containing degree program requirements for community college students
CC First Year/General Advisors	Advising Faculty/Staff	Professional advising service staff for first-year students at the community colleges
CC Website	Web Resource	General information available to students via the community college website
Transfer Articulation Agreement	Web Resource	Formal guaranteed transfer agreement and requirements signed by university and community college leadership
Peers	Peers	Receiving transfer of coursework information from fellow students

Figure 3
Counts of Information Sources



Evaluation of Information Sources

Our second research question stretches beyond the types of information sources transfer students can access and addresses the efficacy of each information source in increasing students' knowledge of coursework transfer. Using evaluation coding, each mention of an information source was analyzed for participants' evaluation of quality of the source. Table 4 quantizes participants' evaluative responses for all information sources.

Table 2

Evaluative Codes Summary Table

Information Source	(+ Evaluation		(-) Evaluation		Neutral Evaluation	
U Website	36	72%	11	22%	3	6%
U Checksheets	24	71%	9	27%	1	3%
U Transfer Equivalency Guide	44	70%	13	21%	6	10%
U Information Sessions/Tours	12	60%	7	35%	1	5%
U Prospective Student Outreach Staff	9	60%	4	25%	1	6%
U Transfer Orientation	20	57%	9	26%	6	17%
U Department Advisors	17	57%	12	40%	1	3%
U Transfer Advising	6	43%	6	43%	2	14%
U Admissions Office	1	9%	7	64%	3	27%
U Registrar's Office	0	0%	3	100%	0	0%
CC Website	2	100%	0	0%	0	0%
CC Visits/Information Sessions	11	69%	4	25%	1	6%
CC Engineering Faculty Advisors	16	53%	12	40%	2	7%
CC First-Year/General Advisors	3	30%	4	40%	3	30%
CC Course Catalog	3	27%	6	55%	2	18%
Transfer Articulation Agreement	6	50%	5	42%	1	8%

Commonly used university web resources were viewed as overwhelmingly effective sources of information on course transfer including the university transfer equivalency guide (+ 70%), university website (+ 72%), and university checksheets (+ 71%). In contrast, participants were often critical of the quality of information students received from community college web resources including critical documents like the course catalog (- 55%) and the transfer articulation agreement with the university (- 42%). Participants were surprisingly critical of “people” resources as reliable information sources for course transfer both at the university and community colleges: university department advising faculty/staff (- 40%), transfer advising (- 43%), admissions office (- 64%), community college engineering faculty advisors (- 40%), and general engineering advisors at the university (- 40%).

Information Asymmetry in Web Information Sources

Instances where participants attributed a negative evaluation to an information source were analyzed qualitatively for themes. The prominent theme in participants’ critical evaluations of information sources for coursework transfer was information asymmetry within and across information sources. We found ample evidence of information asymmetry and explore a few examples in detail.

Course catalogs serve as a critical information source for students. These documents act as the contract between a student and the institution on the set of courses and other items required to be

complete for degree attainment. However, participants found community college catalogs to be misleading for students, particularly in preparing them for coursework transfer to the university. One community college advisor expressed concern for inaccuracies of course information that prompted immediate attention and revision of course catalog and degree information:

So I think the thing that they look at is the degree requirements and then the notes that are associated with that. As we have found in the last, I don't know, year and a half, that that's a big problem... In our old degree, there's a note that says we have one engineering elective. The only footnote associated with that elective is [COURSE NAME] is required at [UNIVERSITY], desired everywhere else, and that's not really true. [COURSE NAME] is really only good for a couple of disciplines at [UNIVERSITY], but that's what our footnote says. So we have a lot of students take that class because that's the information they have. I hope, with the new degree, we're putting good information, valid information, where students look for that information.

Instead, many participants suggested that the university's transfer equivalency guide serves as a better, more accurate tool for students. However, some students may lack the knowledge to find information sources beyond their community college catalog and wrongly assume that the institutions are aligned in coursework transfer processes. For example, one participant acknowledged the value of the transfer equivalency guide but also noted that not all prospective transfer students will find it easy to navigate: "I think, while it's helpful, it's a very static tool, and I think they've done a really nice job of updating it, making it more easily searchable in the past 18 months or so. But I think if you're a prospective student, digging around, or if you're not a really well ... If you're not a super savvy transfer student, I think it's kind of hard to navigate."

Information Asymmetry in Human Information Sources and Processes

Even students who are able to navigate the transfer system sufficiently to take advantage of advising services, both at the community college and university, will encounter information asymmetry, and perhaps even more so than students who rely only on web resources. One participant describes the challenge that less experienced or non-discipline-specific advisors have at the community college to address increasingly complex coursework questions:

Anecdotally, students that come to me don't seem to have questions about how do I apply and what do I need to do and do I qualify. Those aren't the questions that I get. The questions that I get are harder questions. I got a C in Calc I, should I retake it? Do I stay here and finish the degree or go in the fall without the degree because I only have one semester's worth of credit--but they only accept students in the fall, those types of questions.

It seems as though the quality of information received by students depends entirely on the specific advisor to whom they gain access, and advisors with specialized knowledge and experience with engineering transfer are rare: “Those, I think, are harder for the advisors, the general academic advisors, and for faculty advisors that aren't familiar with the program.”

Evidence of information asymmetry in coursework transfer was particularly salient in the application process coordinated through university-level admissions. The asymmetry occurred because the university did not review or evaluate transcripts from community college students until the prospective transfer student had applied, been admitted, and accepted admission into the university. One advisor recounted difficult conversations with students around this issue: “Unfortunately, we say to the student, ‘We won't evaluate this until you've been admitted.’”. Thus, the university forced incoming students to pay a matriculation fee prior to having information about which of their prior courses would transfer, which is a form of information asymmetry grounded in university policy. Further, even if admissions staff members unofficially evaluate transcripts, they may lack the necessary expertise and background to do it well. As one participant indicated, “then, we ask people in the Undergraduate Admissions Office who, like me, aren't necessarily engineers and maybe never took calculus. I never took calculus. We're asking them to look at the transcript and make the decision of whether or not the student has the right courses.” An improper evaluation could worsen asymmetry by providing inaccurate information to a student; prior to this interaction, the student only had incomplete information.

Additional instances of information asymmetry occur in the complex advising structures for transfer students when they arrive on the university campus. For this university, transfer students are accepted into general engineering and then must complete a semester of coursework at a 3.0 GPA to be eligible for entry into their engineering degree program of choice. This enrollment management policy means that these students work with general engineering advisors for coursework during their first term at the university and then transition to discipline-specific advisors after the first semester. An advisor describes the impact of this approach on information asymmetry in course plans that ultimately influence timely graduation: “They were put in classes they didn't need to be in. They were told wrong information. For an incoming student, they need two classes. They were only put in one of the two.” We are not commenting on the validity of the piece of advice given to the student, as advisors in the general engineering department may have been operating under a different set constraints or goals. However, considering this situation from a student’s perspective, it represents information asymmetry across different units of the organization.

In some cases, information asymmetry occurs not between the institution and prospective transfer students, but between units at the same institution. In this instance, a participant reflects on how inaccurate transcript evaluations by one department hinders an advisor’s ability to accurately advise students into courses at orientation:

I think as advisors, it gives us bad information. Quite often, we're looking at incorrect transcript evaluations at orientation. I think as students, it does not give them the resources and information they need to make educated decisions about their academics. I don't think we're going to do anything well with transfer students until we improve that process.

With a relatively complex system and partnership between universities and community colleges, some misinformation should be expected. However, our analysis of conversations with faculty and staff at one university and two partner community colleges reveals multiple forms of information asymmetry in the coursework transfer process. From students' perspectives, each additional source of asymmetry creates yet another barrier for their accumulation of transfer student capital.

Concluding Discussion

Exploring how students receive information on the transfer of coursework process in engineering reveals a diverse array of information sources ranging from web resources to advising faculty/staff at the college and university. However, information asymmetry abounds within and between these information sources that limit students' accrual of TSC. Thus, even though information about how courses transfer could be found in multiple places, the information either was not always in alignment across sources, or students may have been pointed to individuals who had incomplete or inaccurate information. Reducing the complexity of this information maze would help make the transfer process more efficient and effective. Translating our findings into other institutional contexts, we suggest that universities and community colleges who seek to improve their partnerships for transfer students would benefit from an in-depth analysis of sources that provide information on transfer of coursework to identify and remedy information gaps, inaccuracies, and misalignments.

This paper advances prior research on transfer student capital by providing a detailed examination of how students access information about course transfer and identifies information asymmetry as a barrier to its successful accrual. From a policy perspective, this research highlights the need for institutions and state systems to consider how transfer information is presented to prospective transfer students; doing so could improve inefficiencies in transfer students' college and program choice. Practitioners at community colleges and universities can benefit from this research by understanding their role in providing accurate, consistent information to students who seek to attain a bachelor's degree through the community college transfer path. Additionally, institutions could adopt the methods used in our paper as a way to identify and evaluate how students receive information on coursework transfer. We hope our

paper sheds light on the complexities of information sharing in the coursework transfer process and the critical role institutions can play in reducing asymmetries as it relates to transfer students.

Acknowledgements

This material is based upon work supported by the National Science Foundation Engineering Education and Centers under Grant Number DUE-1644138. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

References

1. National Academy of Engineering, U., *The engineer of 2020: Visions of engineering in the new century*. 2004: National Academies Press Washington, DC.
2. Carr, R.L., L.D. Bennett IV, and J. Strobel, *Engineering in the K-12 STEM standards of the 50 US states: An analysis of presence and extent*. *Journal of Engineering Education*, 2012. **101**(3): p. 539-564.
3. Lopez, S.E. and W.H. Goodridge. *The State of Engineering Integration in K-12 Science Standards: Five Years After NGSS (Fundamental)*. in *2018 ASEE Annual Conference & Exposition*. 2018.
4. Roehrig, G.H., et al., *Is adding the E enough? Investigating the impact of K-12 engineering standards on the implementation of STEM integration*. *School Science and Mathematics*, 2012. **112**(1): p. 31-44.
5. Bastedo, M.N. and O. Jaquette, *Running in place: Low-income students and the dynamics of higher education stratification*. *Educational Evaluation and Policy Analysis*, 2011. **33**(3): p. 318-339.
6. Ehrenberg, R.G., *Tuition rising*. 2000: Harvard University Press.
7. Lord, S.M., et al., *Who's persisting in engineering? A comparative analysis of female and male Asian, black, Hispanic, Native American, and white students*. *Journal of Women and Minorities in Science and Engineering*, 2009. **15**(2).
8. Science, C.o.M.t.P.o.W.i.A. and Engineering, *Beyond bias and barriers: Fulfilling the potential of women in academic science and engineering*. 2007: National Academies Press Washington, DC.
9. Laugerman, M., et al., *Determining Graduation Rates in Engineering for Community College Transfer Students Using Data Mining*. *International Journal of Engineering Education*, 2015. **31**(6A): p. 1448-1457.
10. Orr, M.K., et al. *Engineering matriculation paths: Outcomes of direct matriculation, first-year engineering, and post-general education models*. in *Frontiers in Education Conference (FIE), 2012*. 2012. IEEE.
11. Packard, B.W.-L., et al., *Women's experiences in the STEM community college transfer pathway*. *Journal of Women and Minorities in Science and Engineering*, 2011. **17**(2).
12. Garcia Falconetti, A.M., *2+2 Statewide Articulation Policy, Student Persistence, and Success in Florida Universities*. *Community College Journal of Research and Practice*, 2009. **33**(3-4): p. 238-255.
13. Hodara, M., et al., *Exploring Credit Mobility and Major-Specific Pathways: A Policy Analysis and Student Perspective on Community College to University Transfer*. *Community College Review*, 2017. **45**(4): p. 331-349.
14. LaSota, R. and W. Zumeta, *What Matters in Increasing Community College Students' Upward Transfer to the Baccalaureate Degree: Findings from the Beginning Postsecondary Study 2003-2009*. *Research in Higher Education*, 2016. **57**(2): p. 152-189.
15. D'Amico, M.M., et al., *Early integration and other outcomes for community college transfer students*. *Research in Higher Education*, 2014. **55**(4): p. 370-399.
16. Flaga, C.T., *The process of transition for community college transfer students*. *Community College Journal of Research and Practice*, 2006. **30**(1): p. 3-19.
17. Hills, J.R., *Transfer shock: The academic performance of the junior college transfer*. *The Journal of Experimental Education*, 1965. **33**(3): p. 201-215.

18. Jr, J.C.G. and A.R. Harrington, *Academic performance of community college transfer students and "native" students at a large state university*. Community College Journal of Research and Practice, 2002. **26**(5): p. 415-430.
19. Roksa, J. and B. Keith, *Credits, Time, and Attainment: Articulation Policies and Success After Transfer*. Educational Evaluation and Policy Analysis, 2008. **30**(3): p. 236-254.
20. Weldon, T., *Reducing time to degree by cutting credit creep*. Capital Research Education, 2013.
21. Laanan, F.S., *Making the transition: Understanding the adjustment process of community college transfer students*. Community College Review, 1996. **23**(4): p. 69-84.
22. Laanan, F.S., *Beyond Transfer Shock: Dimensions of Transfer Students' Adjustment*. 2000.
23. Laanan, F.S., *Transfer student adjustment*. New directions for community colleges, 2001. **2001**(114): p. 5-13.
24. Laanan, F.S., *Studying transfer students: Part I: Instrument design and implications*. Community College Journal of Research and Practice, 2004. **28**(4): p. 331-351.
25. Santos Laanan, F., *Studying transfer students: Part II: Dimensions of transfer students' adjustment*. Community College Journal of Research and Practice, 2007. **31**(1): p. 37-59.
26. Dunn, W.N., *Public policy analysis*. 2015: Routledge.
27. Laanan, F.S., S.S. Starobin, and L.E. Eggleston, *Adjustment of community college students at a four-year university: Role and relevance of transfer student capital for student retention*. Journal of College Student Retention: Research, Theory & Practice, 2010. **12**(2): p. 175-209.
28. Saldaña, J., *The coding manual for qualitative researchers*. 2015: Sage.
29. Creamer, E.G., *An introduction to fully integrated mixed methods research*. 2017: SAGE Publications.