



Exploring Transfer Student's Perceptions of Their Transition Experience in Calculus 2 at a Research Intensive Institution: A Phenomenological Study

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Dr. Karen High holds an academic appointment in the Engineering Science and Education Department (ESED) at Clemson University. Prior to this Dr. Karen was at Oklahoma State University where she was a professor for 24 years in Chemical Engineering. She received her B.S. in chemical engineering from University of Michigan in 1985 and her M.S. in 1988 and Ph.D. in 1991 in chemical engineering both from Pennsylvania State University. Dr. Karen's educational research emphasis includes faculty development and mentoring, graduate student development, critical thinking and communication skills, enhancing mathematical student success in Calculus (including Impact of COVID-19), and promoting women in STEM. Her technical research focuses on sustainable chemical process design, computer aided design, and multicriteria decision making. She also has extensive experience in K-12 STEM education and program evaluation and assessment. She has held a variety of administrative positions: 1) Director of STEM Faculty Development Initiatives-Clemson, 2) Associate Dean for Undergraduate Studies in the College of Engineering, Computing and Applied Sciences-Clemson, 3) Interim Director of Student Services-Oklahoma State University, 4) Coordinator of the Women in Engineering Program-Oklahoma State University, and 5) Director of the Oklahoma State University Measurement and Control Engineering Center-Oklahoma State University.

Work in Progress: Exploring Transfer Student's Perceptions of Their Transition Experience in Calculus 2 at a Research Intensive Institution: A Phenomenological Study

Introduction

Calculus continues to be a barrier for STEM students at institutions across the United States, in particular, Calculus 1 and Calculus 2 courses have proven to be the most difficult in the calculus sequence (Bressoud, D & Rasmussen, C., 2015). One study infers that transfer students contribute to a large enrollment in Calculus 2 (Bressoud et al., 2013). Another study suggests that transfer students have a low success rate in Calculus 2 at large land grant institutions (R1) (Laugerman et al., 2015). Most importantly, these studies inform the need to study transfer students in Calculus 2 at large land grant institutions in the United States.

Both qualitative and quantitative studies have explored community college transfer students perceptions of transitioning into a 4-year institution and their success rates at the larger institutions (Lazarowicz, T., 2015; Bonsangue et al., 2014). A study conducted at Berkley studied transfer student experiences and success at the institution. The results of this study found that transfer students do not perceive themselves as “real” students and their peers do not view them as “real” university students (Alexander et al., 2009). These studies suggest a need to understand transfer students transition experiences in an academic and social system further.

However, no studies have begun to explore the transition experiences of transfer students in a Calculus course, especially a Calculus 2 course at a research intensive institution. Ultimately, understanding the voice of transfer students at large research intensive institutions can provide an understanding of changes in policy for transfer student success. This is extremely important for STEM transfer students that have to be successful in the calculus sequence at any institution in order to progress to their degree completion.

Research Questions

For this work, we aim to explore the following research questions:

RQ1: How do transfer students perceive and make sense of their transition experience in Calculus 2 at a research intensive institution?

RQ2: How do transfer students who have completed Calculus 2 at a research-intensive institution reflect on and understand their transition experience? To what do they attribute to their success and/or lack of during the transition experience?

This paper will focus on RQ1 by preliminary results provided by a previously conducted pilot study using RQ1 as a guide.

Conceptual Framework Discussion

In this study, we are conceptualizing transfer students in Calculus 2 as students that have taken Calculus 1 elsewhere at a non-R1 institution. In order to address the research question, we need a framework that illustrates the perception of transitions and other components of transitioning experiences. We will be using Schlossberg's Transition Framework and Tinto's

Departure/Persistence Framework to frame the study. Below we will discuss the frameworks and provide depictions of each framework.

Transition Framework

Schlossberg claims transitions can be described in three phases of the experience. She suggests the three phases of transition are moving in, moving through, and moving out of the transition (Goodman et al., 2006). Additionally, Schlossberg argues that the moving through phase consists of taking stock of coping mechanisms that explore the assets and liabilities of personal characteristics, personal situation, forms of support, and strategies for understanding the transition experience (Schlossberg et al., 2012). Schlossberg emphasizes that the phases of transition are displayed as an assumption of individual perceptions of the transition process (Lazarowicz, 2015). A depiction of Schlossberg's framework is shown in Figure 1. In this study, we will be using constructs from the first two phases of the framework to understand transfer student perceptions of transition in Calculus 2. In particular, we will focus on the constructs from the Moving In phase and the Moving Through phase. Furthermore, we will be interested in understanding the type of transition the transfer students are experiencing and the coping resources (4 S's) transfer students perceive during their transition.

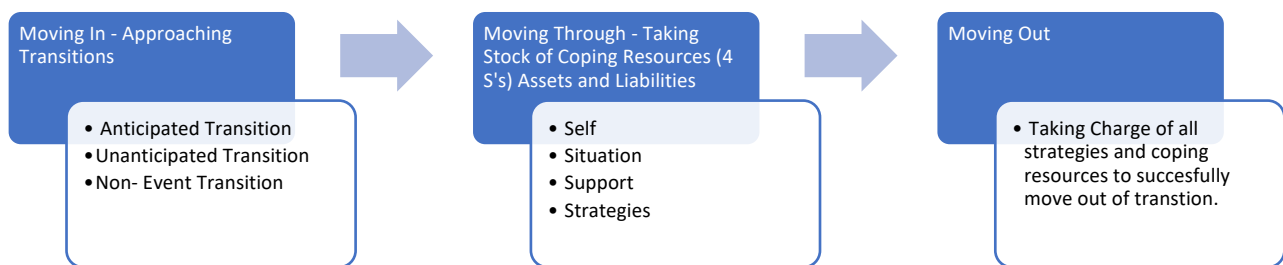


Figure 1. Schlossberg's Transition Framework (Schlossberg et al., 2012)

This framework is very useful in understanding perceptions of the transition process. However, a limitation of using this framework is that it was originally developed from counseling psychology as a framework to understand working adults perceptions of transitioning into retirement. The framework was not originally intended for usage on students. Several dissertation studies in education research have used this framework (Lazarowicz, T., 2015; Powers, M., 2010; Pendleton, K., 2007). Lazarowicz (2015) used Schlossberg's framework to understand the perceptions of community college transfer students transition experience to a 4-year university. Powers (2010) incorporated aspects of the three phases of Schlossberg's Theory to study nontraditional male dropout students. Pendleton (2009) studied welfare recipients attending postsecondary institutions by framing the study around Schlossberg's 4 S Model of the Moving Through phase of the framework in order to understand the coping strategies used by the welfare recipients.

Tinto's Framework

Other additional constructs that we need to address in our study are transfer students goals, academic and social systems approaching the transition and moving through the transition. Schlossberg's framework does not account for these constructs. However, Tinto's

Departure/Persistence Framework accounts for goal commitments, academic and social systems (Tinto, V., 2012). A depiction of Tinto’s framework is shown below in Figure 2.

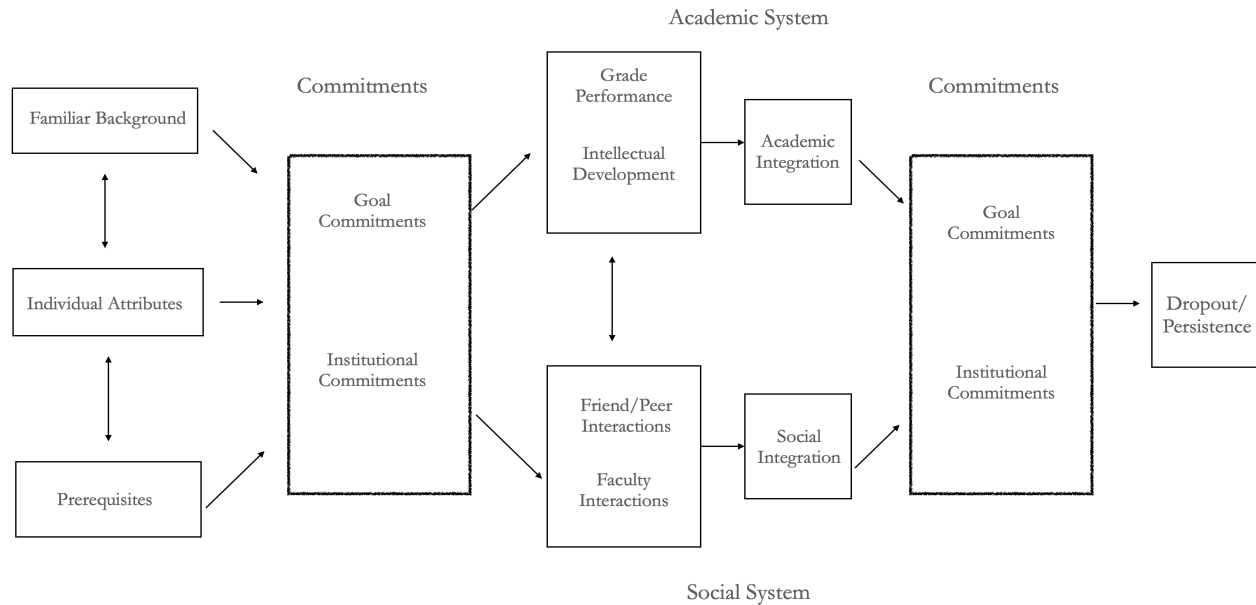


Figure 2. Tinto’s Departure/Persistence Framework (Tinto, V., 2012)

Conceptual Framework

The theoretical frameworks were combined to develop a conceptual framework to understand transfer student perceptions and sense making of their transition. The conceptual framework emphasizes Schlossberg’s Theory by using the constructs as a foundation for the framework with concepts of Tinto’s theory embedded within the theory. A depiction of the conceptual framework used in this study is provided in Figure 3.

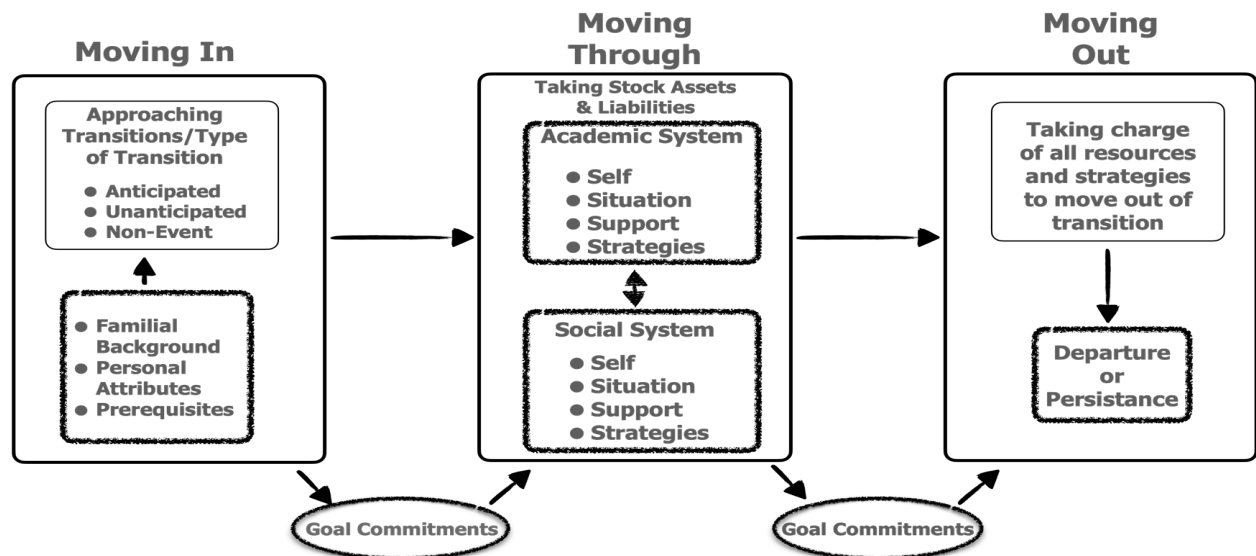


Figure 3. Conceptual Framework adapted from Schlossberg (2012) & Tinto (2012)

Longitudinal Research Design

Since our study is exploring the essence of human lived experiences, transition, we employ the usage of phenomenological research methods. Creswell argues in order to capture the true essence of the phenomenon the researcher needs to conduct 4 – 16 in-depth interviews with participants that have lived the experience (Creswell, J., 2007). This work in progress paper focuses on the pilot study of the overall research design presented as we are currently collecting more interview for further data analysis. This study has been approved by IRB2021-0283. A depiction of the research design that will be conducted is shown in Figure 4.

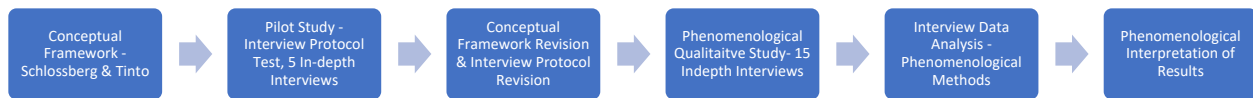


Figure 4. Research Design for Future Longitudinal Study

Pilot Study

To gain a deeper insight into the use of our conceptual framework, development of research questions and revising interview protocols, we conducted a pilot study during 2021.

Data Collection

We recruited 4 transfer students enrolled in Calculus 2 at a R1 institution in the southeastern region of the United States for an in-depth interview. Each student was provided a \$20 Amazon gift card as a research incentive. Two of the transfer students were bridge transfer students. Bridge transfer students are students that begin their college career at a 2-year institution that has a bridge commitment with a larger 4 year or R1 institution. These programs are designed to help students get started with their core curriculum courses at smaller institutions and bridge over to the larger institution once they meet a certain criterion developed by the bridge program. In addition to the two bridge students, the other two students were dual enrollment students during their Calculus 1 enrollment. Dual enrollment students usually are high school students that can enroll in college courses at 2 year and 4-year institutions while they are completing their high school curriculum.

Data Analysis

The interviews were transcribed using a transcription service and the transcripts were cleaned by a coding team of myself and a couple of UPIC students at a R1 institution. The coding team developed *a priori* codes using the conceptual framework before analysis began (Saldana, 2016). Once we began analyzing the transcripts, we used an *emergent coding* approach with predetermined *a priori* codes and kept track of other codes that emerged throughout the analysis. Categories were then developed and clustered based on common themes that emerged throughout the analysis. In order to ensure quality during the analysis, the coding team used interrater reliability by coding together and separately, and meeting to reach agreements on codes or disagreements with at least an 80% reliability (Belur et al., 2021).

Preliminary Results

Analysis of the pilot data revealed many perceptions of transfer students experiences in Calculus 1 and their transition into Calculus 2 at a R1 institution. The emergent themes appeared

to align with Schlossberg's Framework and the Academic and Social System constructs of Tinto's Framework. Additionally, the emergent themes influenced my research questions and interview protocol refinement. To summarize, the main themes emphasized by the transfer students

Theme 1 - Students expressed positive experience in Calculus 1 at the students transfer institution which influenced personal strengths approaching their transition to Calculus 2.

"Because I had such easy access to tutors and assistance, and because my professor was so good in my Calc one class, I for some reason just expected it to be the same when I transferred. When I transferred, I had this idea that all professors genuinely cared about you, and they genuinely cared about your success, and then I got to R1 University and learned that I was wrong." - Jennifer

Theme 2 - Negative experience in Calculus 2 at R1 institution by feelings of despair, lack of support, and set up for failure.

"There was no prep, there wasn't a lot of assistance. And then when I say they threw us into the deep end, I also mean that they threw us in without any type of floatie or anything to keep our head above water. They threw us in, and then pushed on our heads. It felt just so ... like we were not going to be set up for success." - Jake

Theme 3 - Transfer students sought support and utilized their strategies in order to be successful in Calculus 2 at R1.

"I personally feel like I did all the things that you should have done as a student, which was seek your professors help, and then seek a tutor and then I went to the Academic Success Center, realized I wasn't getting enough help and then saw a separate tutor, like a private tutor, and I paid for him." - Mary

Theme 4 - Transfer students expressed feelings of a negative transition into Calculus 2 at a R1 institution and feelings of not knowing anything and of having to relearn prior content.

"But my transition into the Calc two class was negative, it just felt like everything intensified, tenfold. All the concepts that I thought that I knew, I felt like I knew nothing, and they were teaching them in a different way than I learned them. So then to do the math the way that they wanted, I had to relearn the initial math that I learned that we're supposed to be building on, and then teach myself, or have them teach me or assist me in the second part of the learning which is the building upon part. And so, I felt like I was basically retaking Calc one and Calc two at the same time, but relearning and reteaching myself everything from Calc one, because they weren't providing that assistance and then also doing the build upon stuff that was supposed to be for Calc two." - Cassie

The themes represent a small cohort of transfer student perceptions and warrant the need for further exploration. Moreover, it is worth noting that these results are reflective of student perceptions during the COVID-19 pandemic which we recognize could result in the negative themes presented. The positive experience in Calculus 1 could be attributed to pre-Covid

environments and the negativity as a result of the classroom environments changing from in-person classes to an online classroom in such an abrupt manner.

Conclusions and Next Steps

In this work in progress, we have presented preliminary results of a pilot study conducted. The results provide some insight into the transfer student perceptions of their transition into Calculus 2 at a research intensive institution. The results warrant a negative experience in Calculus 2 at a research intensive institution and a positive experience in Calculus 1 at a community college. However, further investigation and more qualitative data is currently being collected and analyzed to incorporate transfer students' sense making of their transition into Calculus 2. This work can be used in mathematics education to understand transfer student perceptions and sense making of their transition in Calculus 2. Concluding, the results of this study can provide research intensive institutions the voice of transfer students in the calculus sequence and further attention to the needs of transfer students in Calculus 2 at research intensive institutions.

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