

# Exploration of Students' Experiences Transitioning from Secondary to Tertiary Mathematics

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Early experiences in undergraduate mathematics contribute to student persistence STEM majors (Courturier & Cullinane, 2015). The transition from high school to undergraduate mathematics remains problematic for both students and instructors despite increased attention on the issue (O'Shea & Breen, 2021). Motivated by the need to understand STEM-specific issues related to student transitions to college, this study investigated two research questions: (a) What is the essence of the lived-experiences of first-year undergraduate students transitioning to their first post-secondary mathematics course? and (b) How do students view their transition after their first undergraduate mathematics course?

Previous research on transition to college found when students do not feel like they belong at their institution or in a classroom, there is less academic engagement and lower achievement (Bowman et al., 2019). While many researchers have investigated the transition to collegiate mathematics, most are focused on specific aspects of the mathematics courses such as content, instruction, or classroom environment (Blackmore, 2021; Chuene, 2011; O'Shea & Breen, 2021). This study enhanced existing research by taking a more holistic view of transitions including factors in and out of the mathematics classroom.

Through a constructivist lens, this study focused on the meaning that students construct while experiencing their transition to undergraduate mathematics and their reflections on these experiences. As the qualitative approach of the study, an interpretative phenomenological analysis (IPA) centered the study on individual experiences and the meaning-making of both participant and the researcher (Smith & Shinebourne, 2012). Goodman et al.'s (2006) transition theory served as an analytical framework. Participants were three first-year students who were enrolled in College Algebra during their first semester at a mid-sized university. The first interview occurred at week ten of the first mathematics course. One participant was selected for a follow-up interview at the start of their second semester. Each interview was transcribed and coded using In Vivo coding followed by pattern coding to identify themes.

Three overarching themes were: (a) adjusting to new course expectations, (b) navigating challenges outside the classroom, and (c) changes in mindset and motivation. All participants shared experiences adjusting to new expectations for participation and working with others, which two participants noted helped them learn and made them more comfortable in the classroom. Participants described an emerging independence which contributed to changing mindsets in the mathematics classroom. One participant shared that since he was in college now, "I had to think differently... I had to change the mindset of what I needed to do." Another spoke about how her experiences in College Algebra provided an outlet to explore a new sense of self, stating "I felt more in my own skin." Findings from this study point to several implications for instructors including setting and communicating clear expectations to assist students in understanding their new environment. Encouraging group work early in courses can help students build connections and develop a sense of belonging both socially and academically within the classroom. Further research can explore how students' mathematical identities change during the transition to college mathematics.

## References

- Blackmore, C., Vitali, J., Ainscough, L., Langfield, T., & Colthorpe, K. (2021). A review of self-regulated learning and self-efficacy: The key to tertiary transition in Science, Technology, Engineering and Mathematics (STEM). *International Journal of Higher Education*, 10(3), 169-177.
- Bowman, N. A., Jarratt, L., Jang, N., & Bono, T. J. (2019). The unfolding of student adjustment during the first semester of college. *Research in Higher Education*, 60, 273-292.
- Chuene, K. M. (2011). Socio and socio-mathematical norms: Traits of interaction in a first year undergraduate mathematics talking classroom. *South African Journal of Higher Education*, 25(8), 1487-1512.
- Couturier, L. K. & Cullinane, J. (2015). A call to action to improve math placement policies and processes: Six policy recommendations to increase STEM student aspirations and success while decreasing racial and income gaps. *Jobs for the Future*. Retrieved from <https://files.eric.ed.gov/fulltext/ED559677.pdf>
- Goodman, J., Schlossberg, N.K., & Anderson, M.L. (2006). *Counseling adults in transition: Linking practice with theory*. Springer Publishing Company.
- O'Shea, A. & Breen, S. (2021). Students' views on transition to university: The role of mathematical tasks. *Canadian Journal of Science, Mathematics, and Technology Education*, 21(1), 29-43.
- Smith, J. A., & Shinebourne, P. (2012). Interpretative phenomenological analysis. In H. Cooper, P. M. Camic, D. L. Long, A. T. Panter, D. Rindskopf, & K. J. Sher (Eds.), *APA handbook of research methods in psychology, Vol. 2. Research designs: Quantitative, qualitative, neuropsychological, and biological* (pp. 73–82). American Psychological Association.



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## Motivation, Purpose, Research Questions

### Motivation

- High dropout rates at universities linked to failure in mathematics point to a remarkable **subject-specific challenges** for students transitioning from secondary to tertiary educational environments (Rach & Heinze, 2017).
- Understanding student experiences provides institutions and faculty with needed information to set up supports and interventions to promote student success in mathematics (Blackmore et al., 2021).

### Purpose

The purpose of this longitudinal phenomenological study was to describe first-year undergraduate students’ experiences transitioning from high school to undergraduate mathematics classrooms.

### Research Questions

- Q1 What is the essence of the lived-experiences of first-year undergraduate students transitioning to their first post-secondary mathematics course?
- Q2 How do students view their transition after their first undergraduate mathematics course?

## Research Design and Methods

### Research Paradigm: Constructivism

The central tenant of constructivism is that meaning is constructed by human beings as they interact with the world; reality cannot exist separate from the knower’s experiences (Crotty, 1998).

### Methodology: Interpretive Phenomenological Analysis (IPA)

Phenomenological studies attempt to describe a phenomenon by focusing on the common meanings that individuals have towards a shared experience (Creswell & Poth, 2018).

**Setting:** mid-sized, regional university in the Rocky Mountain Region

**Participants:** Participants were three undergraduate student volunteers enrolled in College Algebra during Fall 2021, their first semester of college after graduating high school in Spring 2022.

|                |                                                                                                       |
|----------------|-------------------------------------------------------------------------------------------------------|
| Dan (he/him)   | Caucasian; majoring in English Education; enjoys fantasy and board games                              |
| Sela (she/her) | Hispanic; majoring in Psychology; oldest of five; first-generation college student; “quiet and chill” |
| Solus (he/him) | Hispanic; majoring in Business Marketing; out-of-state student; “shy”                                 |

Note: Pseudonyms, pronouns, and all personal descriptors were selected and provided by the participants

**Data Collection:** Each participant partook in an interview ten to twelve weeks into their first semester. One participant, Sela, was selected for follow-up and was interviewed two additional times during Spring 2022.

**Data Analysis:** Interview transcripts were reviewed and coded using in vivo and descriptive codes. Codes were also initially categorized based on Schlossberg’s 4S components. Pattern coding was then used to identify main themes.

## Students’ Voices

“when I walked into college my first day, **I didn’t really see myself [how I do] now.**” - Sela

“I feel like it [College Algebra] just made the semester a bit more better, I guess. **I felt more in my own skin** than I did...a class that I actually felt motivated doing, felt pretty good in.” - Sela

“I guess the thing that changed was **having a new mindset since it was college now.** I had to think differently... I had to change the mindset of what I needed to do and what I needed to change about myself.” – Solus

“During the year I'd been really good about sticking to a sleep schedule and just overall I was doing a lot better with mental health and physical health and a lot of that stuff. **So a lot of the reasons I really loved that math class weren't exactly about the math class. There was other contributing things.**” - Dan

## Results

### Adjusting to New Course Expectations

| Description                                              | Example                                                                                                                                                                                                                               |
|----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Differences in perceived instructor support              | “A lot of professors aren’t really there to teach.” – Dan                                                                                                                                                                             |
| Greater focus on process and conceptual understanding.   | In high school math class, “I didn’t have to explain a lot of it and you just had to get the answer.” - Solus                                                                                                                         |
| Access to peer supports and multiple solution strategies | “I got to learn more about how the other peers did math, like how they solved their problems. They would explain it and it taught me a new way than the original way I learned and so it’s a new strategy to put in the books.” –Sela |



### Navigating Challenges Outside the Classroom

| Description                                 | Example                                                                                                                                                                                                                                                                                                |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Other responsibilities                      | “I started working this semester my first job because I never really worked before, so it's something new that I've been trying to get used to and then also [getting] used to making time around it. I get less time to complete it [homework] and so I think I'm rushed to do it [homework].” - Sela |
| Difficulty in making friends                | “I've been really slow to meet new people and make friends.” – Dan                                                                                                                                                                                                                                     |
| Outside stress interacting with mathematics | “it’s getting to the point where I'm just like, I need to ask for an extension time because there’s too many things to do. And so, when I do have time, it’s usually for more work.” - Solus                                                                                                           |



### Changes in Mindset and Motivation

| Description                        | Example                                                                                                                                          |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Growing sense of independence      | “It’s just adjusting to living on my own.” – Dan                                                                                                 |
| Independence related to mindset    | Solus made a conscious decision to adopt a new mindset when entering college (quoted above).<br>“Not having to rely too much on others.” – Solus |
| Independence related to motivation | Dan took ownership of his own learning and did not rely on others for motivation in mathematics.                                                 |

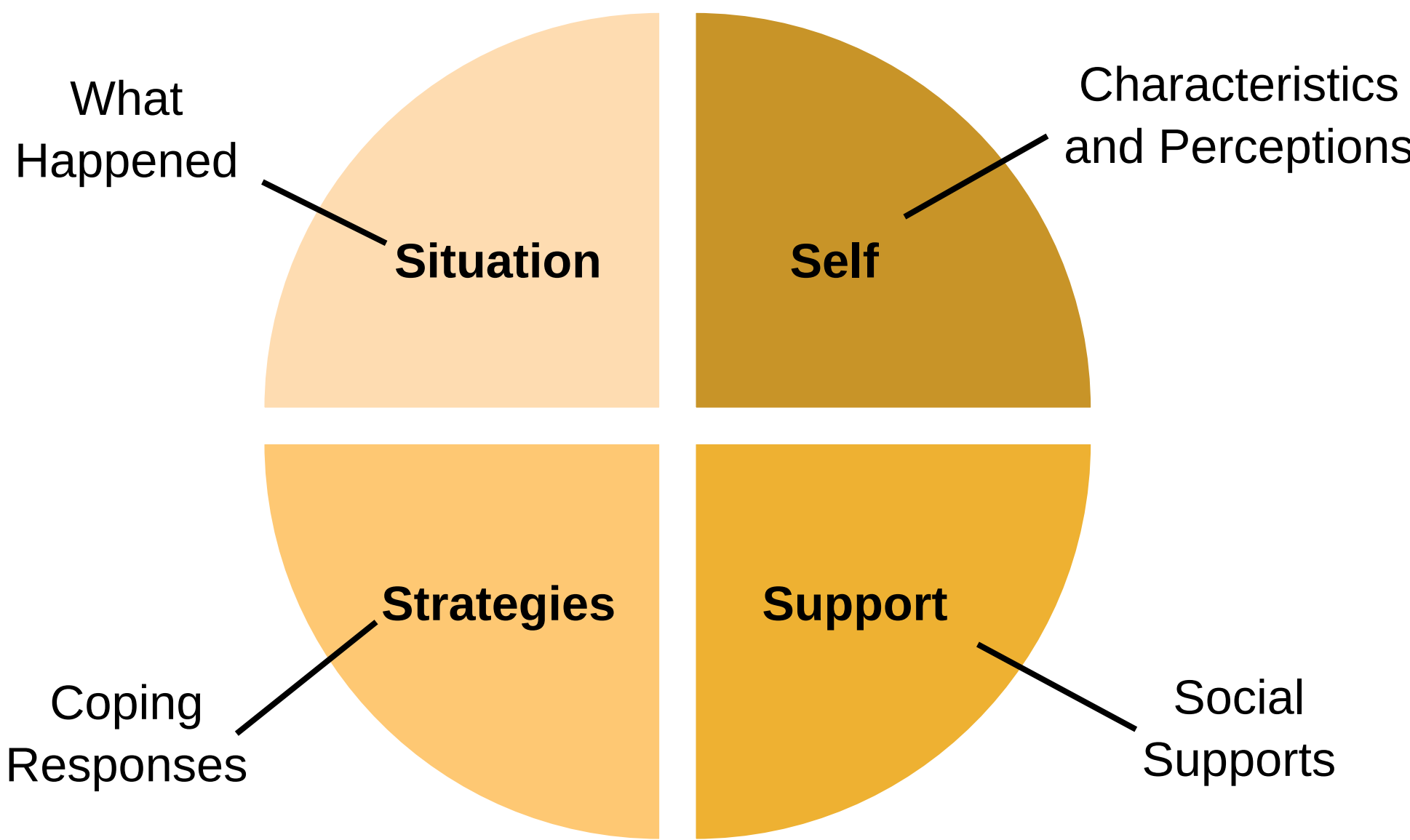


### Reflections on the Transition

| Description                             | Example                                                                                                                                                                                                                                                |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Assessing support and strategies        | “teaching them was teaching myself” – Sela                                                                                                                                                                                                             |
| Developing independent identity         | Sela was able to see herself as an individual instead of just as a member of her family. The interactions Sela had in her mathematics course provided an outlet to explore this new sense of self (quoted above).                                      |
| Applying lessons learned moving forward | “Because of that previous group work I had in College Algebra... I didn’t feel pressure...I felt easily able to really speak with them and share my opinion as well...I know that if it were younger me, I wouldn’t have been able to do that.” - Sela |

## Analytical Framework

### Schlossberg et al.’s (1995) Transition Theory



## Trustworthiness and Limitations

### Trustworthiness

- Research journal, reflexivity, and bracketing
- External checks from peers and other researchers
- Member checks during and after interviews

### Limitations

- Sample: size; same course at same institution; enrolled in mathematics in first semester right after high school
- Dan and Solus were only interviewed once

## Implications and Future Research

### Implications for Practice

- Undergraduate instructors can reflect on how they communicate course expectations to help students assess their new situations.
- Consider how to incorporate group work early in the course to assist students with their academic and social transitions.
- Be understanding of factors outside of class that might be contributing to academic challenges.
- Build structured peer supports to take advantage of lessons learned by students who have gone through the transition.

### Recommendations for Future Research

- Examine secondary-to-tertiary mathematics transitions in other settings (e.g., institutions, courses, etc.)
- Investigate how transitions are impacted by recent and ongoing educational experiences related to COVID-19
- Further explore the potential of group work to facilitate student transitions in mathematics.
- Research how students’ mathematical identities change during transition.

## References

