Critical Professional Identity of Pre-service Teachers: Introducing Theories of Equity in a College Algebra Class

Susan Staats and Forster Ntow
University of Minnesota, USA

Pre-service primary school teachers in a college algebra class modelled high school graduation rate data while learning several theoretical perspectives on educational equity. Qualitative analysis of the students' writing reveals a strong interest in allocating responsibility for educational disparities towards teachers and school administrators. This may signal emerging identities of teachers as agents of change. "Positioning" statements that summarize relationships, goals and life trajectories of students, families, and educators varied from compassionate and self-reflective to stereotypical. Sociocultural theories of teacher development suggest that these students are at an early stage of learning about and navigating across significant professional positions in education.

Introduction

Pre-service teachers whose training addresses theories of educational disparities have a foundation for continuing, powerful self-reflection. We report on an interdisciplinary research-in-practice project in which pre-service teachers learn about educational equity theories at an early stage—their second undergraduate semester—in a college algebra class. We discuss ways in which an interdisciplinary algebra module that places analysis of achievement gap data within the context of several educational theories allows pre-service teachers to express emergent professional identities.

Background

Pre-service primary school teachers in a college algebra class

completed a module on equity mathematics based on high school graduation rates by ethnicity and by income level in the state of Minnesota, USA. The module included a lecture on three theories that address educational disparities: anthropologist Oscar Lewis' theory of the culture of poverty (1966), the funds of knowledge approach (Moll, Amanti, Neff & Gonzalez, 1992), and Delpit's position on institutional racism (2012). Students modelled trends in graduation using algebra or spreadsheets and they learned a professional equity calculation known as the risk ratio, in which the risk of not graduating for the member of a particular group is compared to that of all other groups. Students were asked to react to their mathematical work from the standpoint of the educational theories. In the final section of the assignment, students were asked to pose a question or scenario regarding equity in education and to answer it using both mathematics and educational theories. Suggested examples included:

- Is the graduation gap worse when you look at race data or socioeconomic status data?
- Describe an educational program that might improve graduation rates. Create a reasonable estimate of how much improvement you might observe.
- Would you recommend a different measure of student success? Discuss in detail how you would collect information, how you would analyze it, and why your method would be better.

Conceptual Framework

This study draws on a sociocultural perspective on teacher identity research, focusing on the interactions among the individual, culture, and society (Grootenboer, Smith, & Lowrie, 2006). It attempts to understand the shift from an individual, cognitive framework to a transformation which happens through participation in a community of practice involving other educators (Gainsburg, 2012). A sociocultural perspective promotes "identity formation as being "steered" by society with the individual attempting to "navigate predetermined passages" (Grootenboer, Smith, & Lowrie, 2006, p.613). In this initial report, we present students' emerging identities as they interpret graduation rates from the perspective of educational theorists. Students' reactions to

the various theorists offered a window to understand their emerging identities as prospective teachers at an early stage in their training.

Emerging Themes

We used a hybrid coding method on 22 completed essays that included students' mathematical and interpretive work. We used grounded theory to identify statements regarding responsibilities for educational equity (Charmaz, 2006). We coded students' interdisciplinary analysis using an established rubric for interdisciplinary writing (Boix-Mansilla, Duraisingh, Wolfe, & Haynes, 2009).). To receive a high rating in interdisciplinary analysis, a student's work had to demonstrate active use of mathematics, explicit and thoughtful reference to an educational theory, and it had to state a result or position that depended deeply on both of these.

Responsibility for Equity Outcomes

We identified students' written statements that allocated responsibility for educational disparities. Under our current coding protocol in this work-in-progress, out of 22 essays, two essays indicated that students bear some responsibility for educational disparities (code RESP-S) and fourteen essays identified teachers and school administrators (code RESP-ED). Nine of the essays indicated that social structures account for educational disparities (code RESP-SOC).

> Teaching the same to everyone is clearly not working. [RESP-ED].

> I do not think it is completely the school or teacher's fault. I think that it is partially the student lack of support from home or self-motivation [RESP-S].

Given the prominence of personal responsibility as a cultural value in middle-class America, the willingness to consider social structure as an explanation for social outcomes was somewhat surprising.

Positioning Self, Educators, Students, and Families

We used "positioning" as a theme for portrayals of self, educator, students, and families in terms of belief, behaviour, and action. Ten of the essays offered positionings of the student's self as a future educator or of educators in general (code POS-ED). Fifteen of the essays offered positionings of students and their families (code POS-FAM; a few could arguably be re-classified as responsibility statements).

> As a future teacher, like all future teachers, I hope to change the trends. [POS-ED].

> I think stereotypes play a large part in it—people don't expect non-Whites to graduate as much as they expect Whites to graduate. [POS-ED or RESP-SOC].

> A Mexican student may have a higher risk factor living with 1st generation parents. [POS-FAM].

> A major issue for low-income and students of color is that they do not have a positive role model in their life. [POS-FAM].

Students sometimes aligned themselves with Delpit's social criticism or the Funds of Knowledge celebration of student knowledge, or acknowledged their own privileged status, yet elsewhere expressed a troubling stereotype of students and their families.

Interdisciplinary Synthesis of Mathematics and Educational Theory

We rated only two of the essays as displaying a high level of interdisciplinary synthesis. Both of these students described educational intervention programs, one that the student had observed through volunteer teaching and one that the student had read about elsewhere. Both students estimated potential improvements due to

the interventions using either graduation rates or risk ratio. Two additional essays were rated as "emerging," and 18 were rated as minimal. Many students relied more strongly on either mathematics or on educational theory in their interdisciplinary commentary, so that insufficient synthesis resulted in a lower analytical rating. The interdisciplinary component of the assignment was accessible but challenging; this pedagogy merits more attention from pedagogical researchers.

Discussion

Pre-service teachers modelled educational disparities, and then allocated responsibility to teachers and administrators more often than to students and families. This seems to represent a desire to be an agent for change through the practice of education. In contrast, when pre-service teachers' wrote about students and families, they tended to use both positioning statements and responsibility statements. Positioning statements were a way to practice an opinion about families and students, to generalise about their relationships and trajectories and in general, or to construct an ideological framework for understanding them.

In many cases, positioning and responsibility statements were compassionate. In other cases, they expressed stereotypes that one hopes would become more complex as the pre-service teacher moves through their academic program and initial professional practice. Giving voice to an emerging professional identity, even one that admits stereotypes, is an opportunity to become aware of the complexity of the social field of schooling.

Conclusion

This interdisciplinary algebra assignment makes pre-service teachers aware of the severity of educational disparities in their state and encourages them to begin establishing a theory-based perspective on them. These early-stage identities were complex, professionally-engaged and contradictory. Interdisciplinary algebra can reduce slightly what Britzman calls the "fragmentations" inherent in teacher

education curriculum: 'the compartmentalization of knowledge; the separation of content from pedagogy; the separation of knowledge from interests; and the separation of theory and practice' (1991, p.33). By studying equity issues in an algebra class, students have support for using mathematics critically in a professionally relevant way.

References

Boix-Mansilla, V., Duraisingh, E., Wolfe, C., & Haynes, C. (2009). Targeted assessment rubric: An empirically grounded rubric for interdisciplinary writing. *The Journal of Higher Education, 80*(3), 334–353.

Britzman, D. P. (1991). *Practice makes practice: A critical study of learning to teach.* Albany, NY: State University of New York Press.

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis.* Los Angeles, CA: Sage.

Delpit, L. (2012). *Multiplication is for White people: Raising expectations for other people's children.* New York, NY: The New Press.

Gainsburg, J. (2012). Why new mathematics teachers do or don't use practices emphasized in their credential program. *Journal of Mathematics Teacher Education, 15*(5), 359–379.

Grootenboer, P., Smith, T., & Lowrie, T. (2006). Researching identity in mathematics education: The lay of the land. In P. Grootenboer, R. Zevenbergen & M. Chinnappan (Eds.), *Identities, Cultures, and Learning Spaces* (pp. 612–615). Canberra, Australia: Mathematics Education Research Group of Australasia.

Lewis, O. (1966). The culture of poverty. *Scientific American, 215,* 19–25.

Moll, L., Amanti, C., Neff, D., & Gonzalez, N. (1992). Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms. *Theory into Practice, 31*(2), 132–141.