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ABSTRACT

The proposed study is a qualitative analysis of the reasoning-and-proving opportunities contained in South African curriculum materials for high school geometry and exploratory interviews with geometry teachers about their perceptions of the role of reasoning-and-proving in the high school curriculum. The South African context provides a rich opportunity to study these topics because, in recent years, they removed geometry from the official curriculum but have now reinstated it. For this reason, some mathematics teachers have experience teaching reasoning-and-proving outside of geometry (a rarity in the United States) and are also likely to have formed strong ideas about the desired role of reasoning-and-proving in the mathematics curriculum. Dr. Otten has published multiple studies that established frameworks for this analysis and Dr. Govender provides mathematical knowledge and awareness of the unique aspects of the South African context of this study.

The following research questions are guiding the study:

1. What is the nature and extent of reasoning-and-proving opportunities contained in secondary-level geometry textbooks?
2. What types of reasoning-and-proving opportunities do secondary-level mathematics teachers value for the students and how do they describe their desired role for reasoning-and-proving in their mathematics classes?

To support Dr. Otten's travel to the University of the Western Cape to collaborate with Dr. Govender, we requested $4,415

. Dr. Otten and Dr. Govender reviewed the structure and layout of the selected geometry textbooks, which included *Classroom Mathematics* (Grades 10, 12), *Via Afrika Mathematics* (Grade 11), *CAPS* (Grades 10, 12), *CAPS Platinum* (Grades 10, 11, 12), and *Mind Action Series Mathematics* (Grades 10, 11, 12). These textbooks were selected because they are commonly used in the province and the grade levels were selected based on the placement of geometry topics relevant to reasoning-and-proving opportunities. Dr. Govender also acclimated Dr. Otten to the official standards and expectations for secondary mathematics in the province. While on the campus of UWC, Dr. Otten began the textbook analysis to verify that the coding schemes, developed for use with U.S. geometry textbooks, were appropriate for use in the South African context. The types of reasoning-and-proving opportunities in the South African textbooks were similar to those found in other countries and the coding schemes were found to be appropriate.

fund to pay for interview transcript, completed within 3-4 days of audio file submission (using

. Dr. Otten was invited to give two presentations to faculty, students, and administrators at UWC. The first presentation was focused on his research related to reasoning-and-proving and was tailored for mathematics education faculty and mathematics faculty, who were invited over from the Faculty of Natural Science. The title of the first presentation was “Reasoning-and-Proving Opportunities in Secondary Textbooks: General and Particular Divisions.” Dr. Govender was especially pleased that several faculty from mathematics attended this presentation and actively engaged with the topic and with the mathematics education faculty.

The second presentation was broadly oriented toward the full Faculty of Education. It focused on flipped instruction and the NSF-funded study by Dr. Otten and Dr. de Araujo from Mizzou focused on secondary algebra. The attendance at this seminar was above average and Dr. Otten received a substantial amount of positive feedback, including some contacts with scholars

Dr. Otten was also able to use his visit to help disseminate scholarship from UWC to the U.S. and other

Dr. Otten was also pleased to make connections with practitioners, not only the teachers in the study but also an elementary school where he received a full tour. And Dr. Otten also reconvened with Dr. Corvell Cranfield, a former colleague from graduate school at Michigan State University, who now works at the National Education Collaboration Trust in South Africa. He is part of a team that works to revitalize mathematics instruction in the bottom-quintile schools in the townships around Cape Town. The visit also helped facilitate connections among others, aside from Dr. Otten. For example, Dr. Otten was able to introduce (via email) a literacy education scholar from UWC and Drs. Kuby and Zapata from Mizzou. He was also able to put Dr. Khuzwayo from UWC in touch with Dr. Munter from Mizzou because both scholars are interested in the presence of racism in mathematics education. In both of these instances of new connections, there is interest in possibly pursuing a future UMSAE faculty travel exchange.

Finally, another network-building activity was Dr. Otten joining Dr. Govender's weekend summit at Gordon's Bay of mathematics teacher educators from across South Africa. This two-day summit involved discussions of the curriculum for teacher preparation related to geometry. Dr. Otten was an active participant in the discussions and was able to share some of the curricular features of teacher education in the U.S. and also learned a great deal about teacher education in South Africa. Below is a photograph of the teacher educators in attendance.

Hunte, A. A. (2018). Opportunities for Reasoning and Proving in Geometry in Secondary School Textbooks from Trinidad and Tobago. *International Perspectives on the Teaching and Learning of Geometry in Secondary Schools*, 39-58.

Thank you. We are trying to learn about your experiences with teaching mathematics and your opinions on some issues in mathematics education. You are the experts on your particular students and on what it's like in your classrooms.

Your identities will be protected. But to get started,

- .

This is meant to be a conversation, so speak freely. And please respond, add on, or clarify at any time.

- Can you think of any particular students where you felt it was especially beneficial to them that they learned mathematics?
- Are there any students where you felt it was not especially important or not appropriate for them to learn mathematics? In other words, does *every* student need to learn Grade 10–12 maths?

We are curious about your perspectives on reasoning-and-proving, and by reasoning-and-proving we mean the broad process of determining the truth of mathematical results. So reasoning-and-proving includes conjecturing, attempting to justify claims, using logic, critiquing and refining arguments, and ultimately it includes formal proof.

- Does *every*eG(-)3 ents weed math(d)-3earn eesonin-aem tGdl r22 Tf 1 011 (g)10 bthe bo ial

Should students learn a particular format for writing proofs or should there be some flexibility in proof format?
Should students be held to mathematically rigorous standards of formal proof or should there be some leeway in terms of justifications and explanations that make sense to the students?

What do you remember about the changes in maths standards from 2006 to 2012?

- How many of you were teaching maths for at least a portion of that time between 2006 and 2012? (Record number.)
- For those of you who were teaching at that time, how did you teach reasoning-and-proving then? How does it compare or contrast with how you teach it now?

Should reasoning-and-proving be taught primarily in conjunction with geometry topics,

Name.
Tell me about your teacher preparation program. Your mathematical background.
How many years have you been teaching? In what contexts?

CLAIM:

If two angles of a triangle are congruent, then the triangle is isosceles.

This claim is (circle one)

ALWAYS TRUE

SOMETIMES TRUE

NEVER TRUE

Prove that your answer is correct.

CLAIM:

If a polynomial has $(x - k)$ *as a factor, then k is a root of the polynomial.*

This claim is (circle one)

ALWAYS TRUE

SOMETIMES TRUE

NEVER TRUE

Prove that your answer is correct.

Given: $3x^2 - 24x + 48 = 0$

Prove: $x = 4$