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The Role of *Insights* in Becoming a Culturally Responsive Mathematics Teacher

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Abstract: This paper extends earlier research on prospective and practicing teachers' (PPTs') developing understandings of culturally responsive pedagogy (CRP) while enrolled in a teacher education course for CRP and mathematics. Here, we take as our starting point a framework we refer to as COFRI, which describes five integral components of PPTs' perspectives on CRP: Challenges, Opportunities, Fears, Resistance, and Insights. Viewing PPTs' reflective journal entries through the lens of this framework, we noticed interesting relationships between the five components that had not been evident in our initial analysis. Specifically, we observed that, as we coded participants' reflections according to C, O, F, R, and I, each I (insight) appeared to be related to one (or more) of the other components in quite different ways. Additionally, careful study of the insights expressed by PPTs lead to our categorization of insights according to one of three types: mathematical, pedagogical, or ideological. As a result, this paper offers a new way to interpret the five components, specifically their relationships to new insights into CRP and the corresponding types of insights that PPTs produce over the course of one semester. In closing, this paper discusses implications for mathematics teacher educators in understanding and processing PPTs' evolving understandings of CRP.

Keywords: culturally responsive pedagogy (CRP); mathematics teacher education; prospective and practicing teachers; course-based research; insights

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1. Introduction

In mathematics teacher education, culturally responsive pedagogy (CRP) is increasingly recognized as a critical approach toward realizing a vision of equitable and socially just mathematics classrooms [1,2]. Such an approach involves the concept of culture, a particularly complex concept that is loaded with different meanings [3,4]. Our work is aligned with Hofstede, who defines culture as "part of our conditioning that we share with other members of our nation, region, or group but not with members of other nations, regions, or groups" [5] (p. 76). We find this definition useful because it does not equate culture to nations. Quite the opposite, it acknowledges that culture has structural and dynamic dimensions [6]. Regarding the former, culture can be formed and expressed at different levels nested within one another: cultural representation within the individual person, groups (e.g., classrooms), organizations (e.g., schools, teacher education programs), nations, and the global culture. The dynamic dimension pertains to the interrelationships among the various levels of culture and how they impact each other.

Conceptualizations of CRP in mathematics education have included a focus on Indigenous education, in addition to social justice, critical mathematics, ethnomathematics, language diversity, and equity-based research [7]. In fact, even though the published literature on CRP is extensive, Young points out: "The void in scholarly research is not in the knowledge of theories but in the knowledge of how to implement them, particularly in a way that has a wide-reaching and sustainable impact on teacher education" [8] (p. 259). This paper aims to make that wide-reaching and sustainable impact on mathematics teacher

education through its focus on studying prospective and practicing teachers' (PPTs') perspectives on CRP as students enrolled in an undergraduate course on CRP in mathematics. The primary goal of that course-based research study was to document, through a reflective journal assignment, how PPTs' ideas, understandings, experiences, and knowledge of CRP in mathematics change/grow/evolve throughout the semester.

To begin, we describe this paper's important relationship with two previous research articles, both of which serve to set the stage for the key extension of what is presented here. In Nolan and Xenofontos [9], we used Ladson-Billings' [10,11] three elements of CRP (academic achievement, cultural competence, and sociopolitical consciousness) as a starting point and a lens to analyze course data provided by PPTs. Subsequently, we built upon those elements to develop a new framework, which we refer to as COFRI. The COFRI framework highlights five integral components of PPTs' perspectives on CRP: Challenges, Opportunities, Fears, Resistance, and Insights. Following this, in Nolan and Xenofontos [12], we utilized the COFRI framework to analyze five PPTs' first two journal entries, in the form of narrative case studies. As we sought to build upon the second paper's findings, and essentially "test" our COFRI framework on the remaining journal responses for these same five case study participants, we noticed interesting relationships between the five components that had not been evident in our initial analysis. Simply put, we observed that, as we coded PPTs' journal reflections according to C, O, F, R, and I, each I (insight) appeared to be related to one (or more) of the other components in quite different ways. As a result, we aim here to offer a new way to understand the five components and, in turn, a tool for mathematic teachers and teacher educators to understand and process their students' (PPTs') evolving understandings of CRP. Specifically, we aim to address the following research questions:

(1) In what ways are insights connected to challenges, opportunities, fears, and resistance in PPTs' reflections throughout a semester-long CRP course?
(2) What types of CRP-related insights do PPTs have as a result of their engagement with the course?

Before we attend to these questions, we present the theoretical considerations that frame our work. Subsequently, we turn to this study and its methods, followed by a presentation and discussion of our findings. In closing, we address important implications for mathematics teacher education.

2. Theoretical Considerations

The three key areas of scholarly research that provide the theoretical foundation for this paper are: meanings and intentions of CRP; the COFRI framework; and "aha" (insightful) moments in mathematical learning.

2.1. Meanings and Intentions of CRP

Gay proposes that CRP "is the behavioral expressions of knowledge, beliefs, and values that recognize the importance of racial and cultural diversity in learning" [13] (pp. 36–37). More specifically, Ladson-Billings [14] delineates three components of CRP: academic success (i.e., student learning), cultural competence, and sociopolitical consciousness. Ladson-Billings' work has been influential for CRP research in general. Yet, we observe that mathematics-specific CRP studies do not place as much emphasis on the third component, i.e., sociopolitical consciousness, as they do with the other two components. Of course, we do not claim that issues of sociopolitical nature are overlooked by colleagues in mathematics education; on the contrary, it appears that developing sociopolitical consciousness in mathematics has been typically associated with a different direction of research, that of *critical mathematics education* (e.g., [15,16]), or what other colleagues refer to as *teaching mathematics for social justice* (e.g., [17,18]). In our own work, we have found Ladson-Billings's three components to be highly informative and productive for our analysis and subsequent development of the COFRI framework [9,12].

Research focused on developing the culturally responsive practices and beliefs of PPTs ranges from addressing issues of equity and inclusion to challenging dominant narratives of teaching, learning, and curriculum [19]. Some of the published literature describes the actions and dispositions teachers should develop in their work with diverse students and cultures toward becoming culturally responsive, specifically toward developing critical consciousness [20,21]. Rychly and Graves offer four characteristics of teacher practice that, they believe, are essential to being and becoming a culturally responsive teacher: be empathetic and caring; be reflective about one's own beliefs and dispositions; be reflective about one's own worldview and potential cultural blind spots; and seek to grow in one's knowledge of culture and cultural practices [22] (p. 45).

While Rychly and Graves [22], and many others (see, for example, [14,23,24]), write more generally about CRP for teachers, there is also substantial research available which focuses specifically on developing as culturally responsive *mathematics* teachers [25–28]. Kelley, whose research explores the role of funds of knowledge in developing as a culturally responsive mathematics teacher, highlights how teacher education programs are called to address more complex issues to move the field toward challenging "what constitutes mathematical knowledge and who possesses this knowledge" [26] (p. 1). Some scholars have taken up this call by proposing critically reflective frameworks that can be used by PPTs as they develop mathematics lesson plans [29], as they revise existing curriculum materials [30], and as they conduct self-study into growing their own practices as culturally responsive mathematics teachers [31].

Research on CRP in mathematics teacher education points to the need to not only focus on the beliefs and actions of PPTs, but also on those of mathematics teacher educators (MTEs) as a productive way forward in developing PPTs' CRP. In other words, MTEs must grow and develop their own culturally responsive practices [32] so that they are better able to model these practices in their teacher education courses with PPTs. A recent literature review, which set out to identify, synthesize, and analyze key scholarly texts in the field of teacher educator CRP, not only identified a dearth of studies specifically focused on MTE practices, but it pointed to the absence of an explicit critical lens for examining the CRP practices of teacher educators in general [2]. As it turns out, research with/on MTEs has predominantly been conducted through self-study [33] where MTEs reflect on, for instance, how they model (or not) CRP in their own work with PPTs [32,34,35] as well as their efforts to design teacher education courses or field experience highlighting CRP, equity, and/or anti-racist practices [36–39]. These efforts on the part of MTEs are grounded in a belief that students from diverse cultural backgrounds will continue to suffer inequities and injustices within mathematics classrooms until teacher educators themselves take on the responsibility to grow and model their own CRP. Willey and Drake urge both mathematics teachers and teacher educators "to sharpen our sociopolitical lenses in order to notice and disrupt manifestations of privilege and oppression in mathematics education" [40] (p. 68).

Research studies in mathematics teacher education point to the slow development and lack of sustainable impact regarding CRP [8]. For example, when it comes to PPTs' ideas for implementing CRP, O'Keeffe et al. [41] report on PPTs' fear and apprehension that they will practice CRP in ways that are insensitive or even offensive to certain cultures. Castro [20] suggests that such views continue because there is a serious absence of complex thinking around issues of cultural diversity and equitable classrooms. He proposes that further research on teaching practices, curricular components, and intercultural relationships will hopefully prompt the necessary changes in PPTs' attitudes and beliefs toward deeper critical awareness about issues of inequity and injustice.

Returning to the characteristics of culturally responsive teachers (as stated earlier in this section), we highlight here the importance of the reflective piece, and support the belief that "teachers will be unable to fully do the work of culturally responsive pedagogy if they do not first investigate their own attitudes and beliefs" [22] (p. 46). In line with this, the research highlighted in this paper is grounded in a course-based study where the data were drawn from a reflective journal assignment. The primary goal of that assignment was

to provide PPTs with opportunities to reflect on their own beliefs and dispositions about mathematics and CRP, while also being reflective on their own worldviews and embedded ideologies that could be serving as barriers. Given this, we claim that the assignment reflections serve two very important roles: first, improving PPTs' own awareness of their growth as culturally responsive mathematics teachers and, second, informing MTEs about their own practices as CRP models/educators as they strive for better/richer/deeper course experiences for their PPT students.

2.2. The COFRI Framework

Table 1 presents our COFRI framework, as first introduced and implemented in Nolan and Xenofontos [9,12]. While the framework appears to neatly compartmentalize each of the five integral components, we note, however:

> . . . a key learning for us in this data analysis was around the idea that a best approach to analysis did not involve extracting evidence of individual COFRI components from the participants' journal responses. Instead, utilizing a case study approach to analysis meant that response narratives remained intact and illustrated to us something quite significant: that COFRI components could exist side by side and even overlap/intersect. In other words, in one journal response it was possible to see evidence of, for example, participants expressing fear and resistance, while also looking ahead to the opportunities that might be available to them as they learn more about CRP. This is significant for mathematics teacher education in providing an entry point for PPTs themselves to reflect on the juxta positioning of very different perspectives in their journey to becoming culturally responsive teachers. [12] (pp. 314–315)

Table 1. The COFRI components—brief descriptions.

Characteristic	Brief Description
Challenge	The idea of challenge involves awareness of one's lack or partial development of competence to address an issue. Challenge is based on a person's perception that new knowledge, dispositions, skills, or tools (KDST) are required, which they are inspired to move forward and acquire.
Opportunity	Opportunity refers to the identification of space for something "good" to happen. A person sees the space as already existing; things are in place to move forward (i.e., the person has the KDST to move forward) to make good things happen.
Fear	The feeling that attempting something might lead to failure. A person might be inclined to stop in their tracks (or even move backward), and to rationalize this (non)movement by saying they do not have (and cannot easily obtain) the KDST to achieve it.
Resistance	The expression of dispositions against or disbelief in the importance, feasibility, or possibility of specific ideas. Resistance can manifest itself through "rationalizing discourses" which have the property of projecting how *others* will act or respond to a situation—an "it's not me, it's them" approach to resisting an idea.
Insight	An understanding or realization of what is currently happening and/or how things could be. In addition to seeing what is currently happening, a person will generate new ideas for extending, adapting, and/or improving. Generally, when a person has "insight", this will affect the other four components. That is, an insight suggests a new direction which could create a new challenge, opportunity, or even fear or resistance depending on the "tools" one has. Consequently, an insight might lead to gaining new tools (challenge), moving forward with what one has (opportunity), halting/moving backwards (fear), or disbelief (resistance).

2.3. Insightful Moments and Mathematics Teacher Education Research

We now turn our attention to the academic literature on one of the COFRI components, the insight, as we seek to unpack this further and gain a deeper understanding of its relationships with the other four components. In doing so, we are fully aware of the variation in labels used by colleagues to discuss similar issues. For example, Brody and Hadar refer to "critical moments", defined as "significant events marking change in" one's "professional narrative" [42] (p. 53), whereas Rahmawati and Taylor [43] (2015) write about "moments of critical realisation". In turn, Yacek and Gary (2020) base their work on the concept of "epiphany. . . a special kind of transformational catalyst that calls us to become a better version of ourselves", adding that such epiphanic experiences "involve establishing contact with one or more substantive ethical goods or values that had previously remained out of our field of vision" [44] (p. 219). From a different perspective, Liljedahl introduces the concept of "AHA! experience", arguing that, "[a]lthough it defies logic and resists explanation, it requires neither logic nor explanation to define it. The AHA! experience is self-defining" [45] (p. 220). While we agree that all these labels are equally relevant, we decided to continue using the term insight, primarily for consistency with our previous work [9,12].

Despite the various labels that can be found in the literature, a relatively recent Delphi study involving academics working in this area [46] concludes that, in educational settings, these insightful moments typically result from reflections on real-life experiences, systematic questioning and reflective activities, the use of analogies, and team discussions and problem solving. Yet, our readings of the relevant literature suggest that various scholars exploring such moments within (mathematics) teacher education focus almost exclusively on a specific type of insight in their work. For instance, the work of Liljedahl [45] investigates insights from a subject-matter point of view, and specifically how prospective elementary teachers experience mathematical realizations during their undergraduate studies. Such insights, claims the author, typically come with expression of anxiety or pleasure, and a change in one's beliefs and attitudes. Drawing on the work of Liljedahl [45], Caniglia et al. [47] approach insightful moments with emphasis on pedagogy. In their study, opportunities to reflect on such moments allowed prospective mathematics and science teachers to develop greater awareness of the self as a teacher, the importance of knowing one's students, inconsistencies between one's own beliefs and students' beliefs, and the importance of anticipating students' misconceptions. Finally, reflecting on her own culturally diverse background, upbringing, schooling, and education, and experiences as a teacher and a teacher educator, Nieto [48] writes about a different type of insight, that of ideological, sociopolitical realizations that have had significant impact on her becoming and being an educator. In acknowledging these different types of insights, we do not wish to place emphasis on any specific type. On the contrary, we anticipate that all three of these types can be found in our work with PPTs and CRP. Therefore, we are particularly interested in understanding how insights related to CRP and mathematics may be channeled through mathematical, pedagogical, and/or ideological lenses.

3. Methods

This study was conceptualized around a course entitled Culturally Responsive Pedagogy (CRP) in the Mathematics Classroom, offered as part of a Teaching Elementary School Mathematics (TESM) certificate program at a Canadian university. The course, designed and taught by one of the authors (Nolan), has an overarching goal of deepening understanding of mathematics concepts while developing a critical cultural consciousness. Nolan designed the course to reflect the many intersecting fields of research that can be seen to shape CRP, such as ethnomathematics [EM], language diversity [LD], equity-based [E-b], social justice [SJ], Indigenous education [IE], and critical mathematics education [CM].

One of the course assignments asked students (PPTs) to maintain a reflective journal where they would respond to questions designed to stimulate their growth and development of CRP. The questions were assigned by the instructor at the end of each class. The

reflective journal assignment was used in each of three offerings of the course, from 2017 to 2021, and consisted of 10–13 reflective questions (depending on the offering). The course was designed to be "responsive" to the specific students enrolled in the course and their experiences/interests, in addition to the selected readings assigned in each offering. Hence, the journal questions posed each day over each offering varied considerably. That said, several questions did not change significantly between offerings and are presented below to provide a sense of what PPTs were asked to reflect on:

- What concerns you the most about today's discussions on bringing culture, responsiveness, and mathematics together? Is this the start of something different for you, as a mathematics teacher and learner?
- As culturally responsive mathematics teachers, how do you promote culturally inclusive and culturally appropriate mathematics in your classroom? How do you tell the difference between culturally *appropriate* and cultural *appropriation*?
- With the individual student seminars now complete, take a few moments to reflect on the seven topics/issues used to structure this course (EM, LD, E-b, SJ, IE, CM, and CRP). What have you noticed regarding overlaps and intersections between the seven topics?

As offered by Rychly and Graves, "the work of becoming 'culturally responsive' is quite personal, and may best begin with individuals engaging in reflection as a process" [22] (p. 48), which necessarily includes digging deeply into one's own beliefs, preconceived ideas, and expectations around students from diverse cultures and their engagement with mathematics.

This paper draws on that reflective journal assignment as data for the study. Specifically, this paper draws on the data from the same five case study participants as focused on in [12]: Cindy, Olive, Felix, Raymond, and Iris. For this paper, however, the analysis has been extended to include all journal entries for each of these five cases. As alluded to above, these five participants were selected for our COFRI-driven analysis due to the way in which their data illustrated how expressions of challenges, opportunities, fears, resistance, and/or insights could exist side by side, potentially even overlapping/intersecting with each other within one journal response. In fact, this side-by-side positioning of the COFRI components is what led us, in our analysis, to discovering the significant role played by I—insights.

4. Analysis and Results

Following from the two research questions presented earlier, our analysis is divided into two sections.

4.1. Connections between COFRI Components

Our first research question asks: In what ways are insights connected to challenges, opportunities, fears, and resistance in PPTs' reflections throughout a semester-long CRP course? Our aim here is to begin with our COFRI framework, specifically the definition for the Insight component, and to zoom in on the accuracy and completeness of this definition in light of our continuing analysis of PPTs' journal entries.

We draw attention to the way in which we defined an insight in our initial conceptualization (see Table 1). We not only describe the strong potential for an insight to be closely connected to at least one other COFRI component, but we also include that an insight might "lead to" one (or more) of the other components. In other words, in our initial data analysis and COFRI conceptualization, we noticed that the expression of an insight seemed to appear first, followed by the expression of what this insight might mean in terms of a future challenge, opportunity, fear, or resistance. This definition seemed clearly reflective of our initial data analysis (the first two journal entries). However, as we analyzed additional journal entries for each of these five participants, we began to notice the positioning of insights relative to the other components. As the data are extensive (10–13 journal entries, averaging 250 words each, for five participants), Table 2 presents only selected exemplars to illustrate the diversity of ways in which insights are connected to the

other four components. Even though we use colour coding to give readers a sense of how different COFRI components are positioned in relation to one another, we should note that the boundaries between components are frequently blurred. Aiming to distinguish between the components by drawing clear lines is, we believe, neither desirable nor productive.

Table 2. The relative positioning of Insights.

Challenge	Opportunity	Fear	Resistance	Insight
Participant	**Sample Quote**			**Component**
Cindy	Math really isn't just math anymore. Math is everywhere and I think we need to show students that. [The presenter] gave a good example of this when she brought up the topic of measurement. Students went home and were asked to find out who measures things, what are they measuring, how are they measuring, and then they had to draw a picture. This is something I immediately latched onto as this is something I would love to try in a classroom. I am interested to see what students come back with and to have some really authentic class discussions about their findings.			Insight → Opportunity
Olive	I have felt the content of the course to be "heavy" and felt guilt as an educator grasping at ways to apply this to my own classroom. I felt fear, of being culturally inappropriate within my own eurocentric bias. Our conversation with [presenter] created a real-life connection and put a face to the research. I understand that becoming a culturally responsive teacher is a process that will not happen overnight, and requires baby steps. My biggest take away from [presenter], aside from her sharing of her depth of knowledge, was her openness and passion for the subject matter. In saying this, I feel more confident in pushing myself away from my fears of making mistakes and embrace the learning challenges that appear.			Challenge → Fear → Insight → Opportunity
Felix	I think my concerns weigh heavily on me and make it difficult to get excited. I try to be reflective of my privilege and place in addressing social inequity as a white man in modern society. I have often struggled with my place in this narrative, and how I can appropriately uplift the voices of those who need to be heard without overstepping or filling the cliché "nice white person" role. Concisely, I am concerned about doing a poor job of bringing culture, responsiveness, and mathematics together and similarly concerned not doing ANY job out of fear of doing it poorly. My excitement is that there are many knowledgeable and caring voices out there who seem to have tread this ground with my same fears and have wisdom to share. I hope that I can learn actionable skills that are realistic within my context. I am excited to get to dig into the idea of "tokenism" and cultural appropriation and to hone my critical evaluation skills for what is or is not appropriate. I also hope to open new discussions to increase engagement and fulfillment for my students. When these ideas are brought together it does not seem easy to distinguish appropriate from appropriation as a cultural outsider. I have often struggled with this idea of being an outsider told to tell someone else's story—it feels wrong to me on a very personal level. These stories are not mine, and I do not follow or necessarily believe in them. I also believe they are important, worthwhile, and deserve full acknowledgement of their richness and importance to the people who do hold those cultural values and stories. When culture appears to be "tacked on" I tend to judge it appropriation. But today we also learned about the danger of mathemetizing/personalizing too. This sparked some riveting ideas in how to approach the role of western and other cultural math processes.			Fear → Opportunity → Challenge → Insight

Table 2. *Cont.*

Challenge	Opportunity	Fear	Resistance	Insight
Participant	**Sample Quote**			**Component**
Raymond	Specifically, as I hope (in my project) to help students explore the math behind wealth and income inequality, I first have to help them see that a) such inequality exists, and b) this existing inequality is somehow inherently bad. In my research, I've found that "socialists" (like me!) argue this inequality not only exists, but is growing, and that both the existence and the growth are inherently problematic. They use a wide range of data to make these points. But how do we define *income*? Or *wealth*? Employment, tax transfers, property, capital investments, debt, inheritance make these more difficult to define than I'd expected. And how much inequality should we expect in a "fair" country? Should a 21-year-old university student have already accumulated as much wealth as a 65-year-old who is preparing to retire?			Opportunity → Insight → Challenge
Iris	I certainly found some of the suggestions overwhelming. It's funny, a lot of the feedback from some of the seminars have been that people would like to see some sort of template or framework for helping develop us as CRP teachers. Yet, we've been provided a framework along with the reflective questions and here I am, feeling overwhelmed! I have this sense (not sure if it's grounded in any knowledge outside of my participation in this class), that CRP will not come as "naturally" to educators until the educators who experience CRP as students, are in the classroom in the teacher role. I see teachers teach exactly how they learned in school (which makes sense, you know what you know!). However, I do recognize that this cycle requires intervention. I think the best advice I've heard so far this course it to just start somewhere, to start small. I do believe there were some very [good] questions in the Tool for Reflection we saw tonight, that I would genuinely like to consider when teaching CRP. I valued questions encouraging me to ask if I genuinely connected to students' contexts and funds of knowledge, and assessing if students are engaged in higher-order thinking and critical analysis. Although I know this framework was considered "incomplete", however I do not devalue the types of questions I could be using to reflect after my introduction to CRP. Again, I need to start somewhere and I am no expert at CRP (yet!), so I think these reflective questions actually will only assist my progress.			Resistance → Insight → Opportunity → Insight → Challenge

In these examples, we see very different ways in which insights are linked to other components. The extract from Cindy's journal entry is, indeed, a case aligned with our initial working definition; an insight is expressed leading to a perceived opportunity. Yet, things appear to be a bit more complicated in other cases. In the journal entry of Felix, for instance, an expression of fear leads to the expression of an opportunity, leading to a challenge, which in turn points towards an insight. In other words, Felix had to pass through three other components in his reflection to reach, what was for him, an insightful moment. In the case of Iris, things become even more intertwined: An expression of resistance leads to an insight; yet that specific insight points to an opportunity, which in turn leads to another insight, only to conclude this chain with an expression of a challenge.

We wish to draw attention to several aspects of the data presented in Table 2. Firstly, while our original definition of an insight clearly pointed to relationships between insights and the other four components, this first conceptualization suggested a limited understanding of those relationships when we stated "an insight *might lead to* gaining new tools (challenge), moving forward with what one has (opportunity), halting/moving backwards (fear), or disbelief (resistance)" [emphasis not in original]. It is true that insights can be expressed first, and then lead into the expression of challenges, opportunities, fears, or resistance associated with that insight; however, it can be seen in the data above that, in some cases, the insights *emerge from* or are even introduced *between* PPTs' expressions of challenges, opportunities, fears, or resistance. Also, while insights are shown to be

connected to at least one of the other components, in some instances, insights are connected to several components at once. This is an important finding as it can provide MTEs with key information about PPTs' progress/development/growth or, as the situation may entail, regression or feelings of being overwhelmed. For example, it might be a positive sign of growth in CRP for a PPT to express more fear or resistance early on in the course reflections while showing more expressions of opportunities and insights further into the course. For the purposes of this paper, however, we have not traced the developmental aspects of the journal entries; we leave that for another time.

4.2. Types of CRP-Related Insights

Our second research question asks: What types of CRP-related insights do PPTs have as a result of their engagement with the course?

Given our revised definition/description for Insight in our COFRI framework, we now return to our review of the literature on insights. We identified three different types of insights discussed in the research: those associated with mathematics concepts or the subject matter content as outlined in curriculum [45]; those associated with different ways of teaching, learning, and pedagogical approaches [47]; and those associated with ideological or sociopolitical realizations [48]. In this paper, we name these three types of insights mathematical, pedagogical, and ideological. We observed in the literature that most scholars focus primarily on only one of these types in their research. In our research, however, we have noticed the presence of all three types of insights in our data. Thus, in response to this research question, we note here examples within the five-participant case study data that serve to illustrate the presence of the three types of insights.

4.3. Mathematics Subject-Matter Insights

The five participants expressed mathematics subject-matter insights, along the lines of what Liljedahl [45] describes as mathematical realizations. Due to the focus of the course on CRP, the PPTs' subject-matter insightful comments underlined the links between mathematics and culture, acknowledging how mathematical knowledge "lies on the borderline between the history of mathematics and cultural anthropology" [49] (p. 44). One such example comes from Felix, who admitted that "I have rarely considered myself as part of any 'ethnic group' other than Canadian (which is [a] whole other discussion of identity for another time), so the idea of supporting people with a focus on promoting culture in, as, and for learning has so far felt fairly detached from my own experience". Likewise, Raymond commented on the underappreciated role of various forms of Indigenous mathematical knowledge, as opposed to "Western" mathematics: "My sense at the moment is that the 'western' math I teach is largely about developing general tools to apply in a variety of situations, while the intersections of culture and math that I hope to explore in my classes is very specialized (igloos, tipis, woven baskets, and so on)". Olive, in turn, expressed her personal disconnection between culture and mathematics as experienced during her own schooling. As she wrote, "[p]rior to these discussions, I can honestly admit, I had a disconnect between culture and math. I wondered how such a traditionally concrete subject such as math, could be connected to being culturally responsive". Olive later commented that her prior perceptions of mathematics as an inflexible subject with one and only right answer had a negative impact on her attitudes towards its learning:

> I traditionally have seen math as a 1 + 1 = 2, step-by-step, sequential, one-way-to-get-the-answer, kind of subject. I am excited to shift my mindset and open up my lens to a wider horizon. From experience as a learner, I frequently found math difficult and withdrew from the subject as it was deemed to be something, "I'm just not good at". I am curious to know if the approach had been shifted, if I may have found meaning and connection to deepen my understanding and approach.

In a similar vein, Iris presented her current "understanding of the word 'mathematize'" as "to treat activities or opportunities with a mathematical approach". In her reflections,

she commented on how course readings provided her with opportunities to challenge her prior views of mathematics being a discipline independent of the real world:

> When reading the Culture-Based School Mathematics report, we were introduced to the very powerful effect of Indigenous mathematizing. Because this article was my first understanding of the word, and because it was discussed in such a positive light, I generally feel it conveys a favourable image for me. It brings to light the idea that we use activities or everyday opportunities in a way to conduct mathematical exploration. It also helps create a verb sense of the word "mathematics". (. . .) I was reading a book out loud and I paused for a think-aloud moment where I quickly did some math (I think I was calculating the difference in pay between white American males and non-white American females). After calculating verbally and on the board I returned to my book and said something along the lines of "so there is some math for ya". Immediately after that I was shaking my head, asking myself why I would say that. This again supports the notion that math is a subject, not a part of everyday thinking or opportunities (which it was, it was a natural moment where I thought out loud some information regarding important facts supporting my understanding of the text).

4.4. Mathematics Pedagogy Insights

Several journal entries from all five PPTs included insights about mathematics pedagogy. In line with Caniglia et al. [47], insights of this type mainly regarded the self as a mathematics teacher, the importance of knowing the students in one's class, knowing and being critical of the curriculum, as well as knowing appropriate teaching strategies, the same way Loewenberg Ball et al. [50] talk about pedagogical content knowledge. In one of his journal entries, Raymond, for instance, emphasized the importance of knowing one's students and utilizing their funds of knowledge. He reflected on some of the course readings, arguing that the articles "remind me to be looking for ways to draw on the funds of knowledge of not just my students, but of the families and communities they come from".

Like Raymond, Olive also highlighted the importance of teachers knowing their students. She expressed insights into the role of language in mathematics teaching.

> With that, it is important we are digging deeper into the importance of knowing all of our students and expanding our knowledge by developing connections between their world and the impacts it has on them when they come to school. I reflected on how the language I use in the classroom can have an impact on my students and my teaching of mathematics. In class, a discussion arose about the difference between more and less, does this look the same for every student? It appears we cannot assume students have specific language and vocabulary that is the same for each student. This helped me to critically reflect on my own teaching. . . By looking at my teaching practices through this critical lens, I can make adaptations and be aware of how the language I am using can impact my students learning.

For Felix, teachers need to become aware of personal bias and how specific teaching practices may be pushing some children to the margins:

> It is important to recognize and have awareness of our own personal biases and how this is reflected in the curriculum and many current teaching practices. One thing I noticed is the language being used at times is still "othering" a group or groups of people without using the appropriate language. I think it is important to observe the language we are using and to not further marginalize groups of people. It is important to be aware of our personal biases and consciously challenge this in our reflections and sharing. At times this is challenging as it is deeply ingrained into our societal westernized ideas.

From a different perspective, Cindy underlined the need for teachers to be critical of resources and tasks found in mathematics textbooks during lesson planning. She wrote the following:

> This course has made me aware of the different content that we should be incorporating into our mathematics lessons. The textbook activity with [presenter], in which we analyzed various questions in the textbooks, was just one eye-opening experience. A lot of those questions were very surface level and very tokenistic. In my opinion, they were just including them to say that they have checked off the box of including First Nations content. This same idea appeared in [classmates'] final project presentation, in the Big Math Book from the grade 2 Math Makes Sense resource. We need to be more aware of what we are teaching our students. Both of the above examples are very surface level and do not dive any deeper. In order to make these lessons deeper, we need to provide some more information. It may take more time to discuss this background knowledge but it is needed so students can not only appreciate the culture but understand the meaning and significance of the activity. However, this idea of lessons being surface level is something I have struggled with a tad and I probably still will in the future. [One class presenter] talked about how lessons need to dive deeper; however, [another class presenter] said that even a surface level lesson is better than not touching on the subject at all. So where do we draw the line? Surface level lessons can still be beneficial, but are students really getting that deeper understanding I mentioned earlier?

4.5. Ideological Insights

A third type of insight expressed by all five PPTs concerns ideological/sociopolitical realizations in relation to themselves as teachers [48], which are significant first steps towards supporting communities in vulnerable positions [51]. Olive wrote the following:

> I believe the first step to becoming a culturally responsive mathematics teacher is to make a conscious decision to become one. I do not believe it is something that is always instinctual based on the societal pressures and ideologies that are persistent in our communities. It takes a conscious step back from ethnonormative perspectives to open yourself to the understanding that this is not a reality for our learners in our classrooms.

For Felix, his sociopolitical realizations were expressed in the context of his learning about mathematizing, an action which he defines as "applying structured mathematics to a thing and/or the contexts surrounding it in an attempt to observe a fundamental principle of mathematics within that given 'thing'" He warned that this kind of general approach can "become a problem when we mathematize those contexts which are humanizing to people, especially marginalized groups". On reflecting, he added: "I don't see anything wrong with mathematizing a soda can, a public park space, the classroom itself, etc. But I do see the issues with mathematizing cultural artifacts, processes, and traditions".

Raymond, who described himself as a person with socialist dispositions, commented that his own project for the course aimed at helping students develop an awareness of social inequalities. With his course project, he aimed "to help them see that a) such inequality exists, and b) this existing inequality is somehow inherently bad" (see Table 2 for full quote from Raymond).

Another example comes from Iris, who raised some interesting points about when it is age-appropriate to introduce children to issues of social justice:

> I can understand why people would argue that critical consciousness and social agency would be more appropriately geared towards older grades. The subject matter often pertains to more mature learners, as often topics can require extensive knowledge of socio-economic issues which students may not full understand until they have more in-depth knowledge of economic relations. Having said that,

> I think the concepts of “right and wrong”, “standing up for what’s right”, and “fighting injustices” are concepts that can be taught, explored, and elaborated at any age. Now obviously fighting social inequalities and injustices are a little different than standing up to the playground bully in kindergarten, but these are still concepts that are understood from a very, very young age. I believe that, in order to build empathy in our future community learners, it is not only possible but critical to instill a sense of critical awareness at a young age. I often think about a quote I’ve seen pop up a few times in the past year; “If my child is old enough to experience racism, your child is old enough to learn about it”.

5. Discussion

In this paper, we set out to understand the ways in which insights are connected to challenges, opportunities, fears, and resistance in PPTs’ reflections throughout a semester-long CRP course. We also aimed to explore the types of CRP-related insights PPTs have as a result of their engagement with the course. Based on our analysis of all journal entries for five case study participants, we observed that our initial working definition of *insight* was limited, and missing a full portrayal of how the COFRI components can be related to each other. As noted earlier in this paper, in our initial data analysis and COFRI conceptualization, we noticed that the expression of an insight seemed to follow an expression of a challenge, opportunity, fear, or resistance. Although this "order" was reflective of our initial data analysis (the first two journal entries), as we delved into additional journal entries for each of these five participants, we began to notice the positioning of insights relative to the other components. Table 2 shows that there is no fixed positioning for expressing insights. PPTs, in their journal entries, may show how they first think through challenges or fears in their reflection before expressing a related insight, and vice versa. Given this, the first consideration in our revised definition was relative positioning of insights. Also, given that we were successful in categorizing PPTs insights into one of the three types of insights as found in the literature, we can see benefits in incorporating these three types into our revised definition.

With these two key findings in mind, we offer the following revised definition of insight:

> An understanding or realization of what is currently happening and/or how things could be. In addition to seeing what is currently happening, a person will generate new ideas for extending, adapting, and/or improving. In general, insights can be (1) connected to one or more of the other four components (challenge, opportunity, fear, or resistance) and (2) classified as a specific type (mathematical, pedagogical, or ideological). That is, an insight suggests a new direction which either emerges from or leads into a challenge, opportunity, or even fear or resistance depending on the "tools" one has. Consequently, an insight might connect to gaining new tools (challenge), moving forward with what one has (opportunity), halting/moving backwards (fear), or disbelief (resistance) and, in each case, typically highlights aspects of mathematics subject matter, mathematics pedagogy, or one’s ideological/sociopolitical perspectives on mathematics.

Having a tool to help clarify the connections between PPTs’ insights and the other four components, as well as the type of insight being expressed, carries significant implications for mathematics teacher education and for culturally responsive mathematics classrooms. First, it is important to note that the course, which served as the context for this study’s data collection, was designed and taught (by Nolan) prior to the existence of this COFRI framework and our explicit classification of insights; yet we can see that the course provided opportunities for participants to experience all three types of insights: mathematical, pedagogical, and ideological insights. We have already noted that previous studies generally focus on one type exclusively. Our work confirms that all these types can happen in the same course, one specifically focused on CRP.

A second significant implication of the findings presented here relates more generally to the practices of MTEs. In designing course experiences for PPTs, MTEs can draw on this

COFRI framework and our expanded conceptualization of insights to build a course that acknowledges the presence of each of these components and types of insights at various stages of the PPTs' learning while, at the same time, providing opportunities for growth and diversity of perspectives within. As MTEs ourselves who teach courses in CRP, we welcome this tool to help us explicitly aim for PPTs' development and expression of all three types of insights as they progress through the course.

In the course associated with this study, the instructor was not as intentional about these aspects of PPTs' learning about CRP. As a result, and as we observed through our analysis, PPTs tended heavily toward expressing the first two types of insights (mathematical and pedagogical) while ideological/sociopolitical insights were either absent or underdeveloped. Elsewhere, we (and others) have acknowledged an unfortunate lack of attention to the sociopolitical and critical dimensions of CRP [12,14,21]. We now believe, however, that the tool developed through this research will encourage us, and other MTEs, to be more deliberate in our course design so that richer, more diverse learning opportunities in/for CRP are made available for PPTs. In other words, it can be claimed that, through this research, *our* insight is that we can analyze *their* insights to understand what directions their learning takes them: Toward challenge, opportunity, fear, or resistance?

6. Concluding Thoughts

As analysis beyond the five-participant case study continues, we are paying closer attention to the timeline for PPTs' expression of challenges, opportunities, fears, resistance, and insights, with an aim to track both the connections and the types of insights being expressed as the course progresses. This information is valuable for MTEs to inform their course design. Furthermore, we claim that PPTs themselves would benefit greatly from reflecting on their own COFRI timeline. For example, understanding when an insight occurs, how (or if) it is connected to other components, and what type of insight it is holds promise for PPTs as they move forward to make a conscious decision to become a culturally responsive mathematics teacher. Unpacking her own advice about making "a conscious decision" to become a culturally responsive mathematics teacher, Olive offered some general direction for how to do this:

> This can be done by taking courses such as this, by doing topic-related readings, getting to know our learners' unique family backgrounds and worldviews; by doing these things [we] begin to open our perspectives and deepen our knowledge to become more culturally inclusive, and we can find ways to integrate these into our classrooms. I do not believe a person is one day just going to become culturally responsive, as discussed, like a checklist. This, like many things, is a conscious, ongoing journey that will have ups and downs and learnings disguised as failures. Through this journey, a teacher becomes culturally responsive.

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