Examining the practice of culturally responsive pedagogy in upper primary school mathematics: Perceptions and competencies of teachers in North Wollo zone, Ethiopia

Bihonegn Ayalew
Ph.D. Candidate, Department of Teacher Education and Curriculum Studies, College of Education, Bahir Dar University

Alemayehu Bishaw Tamiru (Ph.D.)
Professor, Department of Teacher Education and Curriculum Studies, College of Education, Bahir Dar University

Solomon Melese Mengistie (Ph.D.)
Professor, Department of Teacher Education and Curriculum Studies, College of Education, Bahir Dar University

Abstract

This study aimed to examine the status of culturally responsive pedagogy (CRP) practices among upper primary school mathematics teachers in North Wollo Zone, Ethiopia. To achieve this purpose, the researchers employed a mixed-methods convergent research design. The participants included teachers, students, principals, and department heads. Data were collected from these participants through questionnaires and interviews and analyzed using both quantitative and qualitative techniques. Results indicated that teachers employed CRP strategies in mathematics instruction on an occasional basis. Furthermore, the results revealed significant correlations between the independent variables—school location, teaching experience, CRP perception, and CRP competency—and the practice of CRP. Notably, teaching experience and CRP competencies were found to positively and significantly predict the dependent variable of CRP practices in mathematics education. These findings underscore the need for teachers to gain teaching experience, enhance their cultural competence, and exchange insights on implementing responsive teaching methods that integrate cultural elements and real-life contexts.

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Introduction

Ethiopia's education system, akin to those in other countries, has been largely shaped by a traditional pedagogy and a curriculum primarily influenced by European cultural perspectives. A curriculum revision undertaken between 2003 and 2005 highlighted significant shortcomings, notably a lack of emphasis on value development and insufficient relevance to the lives and needs of students (MoE, 2010). In a related study, Amare (2009) identified that issues of relevance originating from previous regimes continue to impact the current educational landscape. The Ethiopian Education Development Roadmap report (MoE,

CONTACT Bihonegn Ayalew tsionbihon@gmail.com

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2018) indicates that initiatives aimed at incorporating indigenous knowledge into the existing curriculum are still in their infancy, with minimal emphasis placed on this integration within the general education framework, including subjects such as mathematics. Furthermore, an analysis of basic education revealed that the academic performance of upper primary school students remains unsatisfactory (JICA, 2012).

From 2000 to 2012, mathematics emerged as the subject that experienced the most significant decline in student academic achievement, as evidenced by national learning assessment results for eighth grade. An analysis of national data from five national learning assessments conducted between 2000 and 2016 indicated that mathematics achievement among students in the Amhara region fell below the national standard (NEAEA, 2016). Furthermore, a detailed examination of regional mathematics exam scores for eighth-grade students in the North Wollo Zone, Amhara region, over the preceding five years (2013–2017) revealed that 58.6% of these students scored below the national benchmark (North Wollo Education Office, 2018).

Furthermore, in addition to the low achievement scores observed among students, significant disparities in mathematical performance between male and female students have been identified. For instance, a survey comparing the mathematical achievement of boys and girls at the upper primary education level in Addis Ababa revealed that female students' achievement was markedly lower than that of their male counterparts (Tilaye, 2004). On the other hand, local research examining the assessment of mathematics teaching and learning processes in secondary schools within the Benishangul-Gumuz and Amhara regions highlighted the ineffectiveness of traditional instructional methods in fostering a deep understanding of mathematical concepts among students (Asnakew, 2017). Collectively, these findings underscore the persistent issues of low academic performance and achievement gaps in school mathematics, indicating a pressing need for further investigation in these educational contexts.

The challenges facing mathematics education in Ethiopia can be attributed to several factors. The Ministry of Education has highlighted that traditional pedagogical approaches, which have dominated the field for an extended period, may significantly contribute to students' academic challenges (MoE, 2018). Tate (1995) characterizes traditional mathematics instruction as a form of “foreign pedagogy,” arguing that it undermines student motivation and, consequently, academic performance. This instructional model is based on the thinking, experiences, and values of foreign cultures, which do not resonate with the local students' contexts.

Research suggests that teachers often fail to establish connections between mathematical concepts and their students' preexisting mental frameworks, prior knowledge, and cultural backgrounds, which can contribute to students' academic struggles (Irvine, 1995). Similarly, Gutiérrez (2000) posits that students' inadequacies in mathematics are not indicative of their intellectual limitations but rather stem from a lack of alignment between their home and community cultures and the classroom environment, curriculum, and educational practices.

Thus, teachers' inability to provide a mathematics curriculum and instructional methods that reflect students’ experiences, cultural backgrounds, and traditions poses a significant barrier to achieving equity in mathematics education (Tate, 1995). If teachers genuinely aspire to foster improved and equitable mathematics achievement, it is imperative that mathematics instruction begins to reflect pedagogies that meaningfully integrate cultural considerations into the classroom.

Nasir (2016) asserts that, despite the traditional perception of mathematics as a discipline detached from culture, it is, in fact, a rich repository of cultural knowledge and practices. Therefore, it is imperative that mathematics education should be designed and implemented within socio-cultural contexts, incorporating authentic tasks and activities that actively engage learners (Bishop, 2008; Ascher, 2002). Building on this premise, researchers such as Aguirre et al. (2017), Gutstein (2016), Bonner (2014), Gutierrez (2013), and Gay (2010) have proposed that culturally responsive pedagogical approaches in mathematics could substantially benefit learners identified as low performers, potentially mitigating the challenges they face.

Culturally responsive teaching is predicated on the premise that when educators contextualize content within the lived experiences and frames of reference of their students, academic knowledge and skills become more engaging, meaningful, and comprehensible (Gay, 2009). In this context, teachers' instructional practices can render standards-based content and curricula more accessible to students, facilitating understanding by integrating relatable aspects of students' daily lives into the curriculum (Rajagopal, 2011). Tate (1995) emphasizes that culturally responsive pedagogy in mathematics involves posing open-ended questions and representing real-world situations in various formats—verbal, numerical, or graphical. When effectively implemented, culturally responsive pedagogy not only enhances students' access to learning opportunities but also positively influences their academic achievement (Gay, 2002; Villegas & Lucas, 2002). In light of this study, the persistent underperformance of students in mathematics underscores the necessity of examining teachers' adoption of culturally responsive practices, as research demonstrates that these approaches can effectively mitigate disparities in mathematics achievement.

Recognizing the significance of culture-based pedagogy, Ethiopia has undertaken comprehensive reforms in general education at both institutional and instructional levels, aiming to render schooling more pertinent to the cultural backgrounds and experiences of its students (MoE, 1994). The revised curriculum for general education was strategically designed to prioritize science and mathematics while emphasizing the acquisition of relevant knowledge (MoE, 2002). The pedagogical initiatives and practices reflective of the cultural contexts of learners were incorporated into various educational strategies, including the 2010 National Curriculum Framework and subject-specific curriculum guides for mathematics (MoE, 2008).

Consequently, recent advancements in mathematics education aspire to transition teacher pedagogy from traditional didactic methods to approaches that connect mathematics with real-world scenarios and cultural contexts, thereby fostering students' critical thinking and problem-solving abilities (MoE, 1994). The 1994 education and training policy mandated that teachers emphasize the necessity of relevance and adapt their instruction to align with the diverse profiles of their students (MoE, 2010).

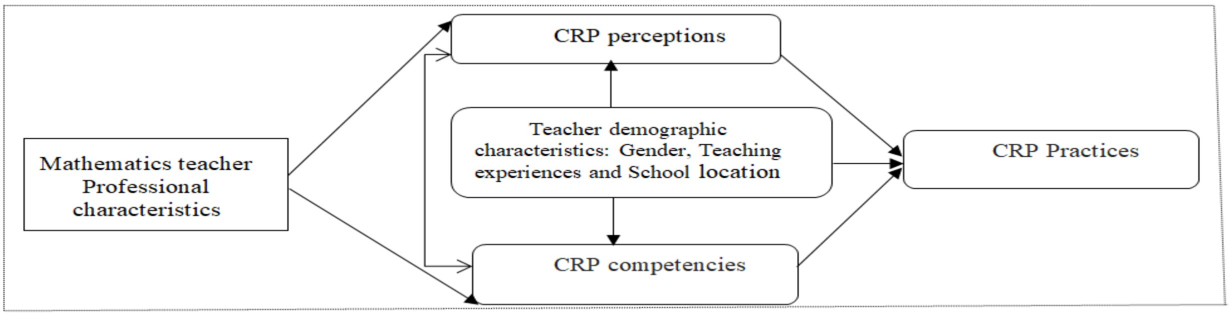
Furthermore, the country's education and training policy advocates for a constructive, problem-solving, and student-centered pedagogical approach, alongside the incorporation of indigenous knowledge. The integration of indigenous knowledge and cultural artifacts into the school curriculum and instructional practices is underscored as a vital strategy in policy documents and implementation frameworks.

Despite considerable efforts, the existing literature on the implementation of CRP by mathematics teachers within Ethiopian upper primary schools—particularly in the study area—remains limited. Particularly, students' academic performance has been unsatisfactory, largely due to instructional methods that do not align with learners' prior experiences (MoE, 2018; Asnakew, 2017; Weldeana, 2016). Furthermore, CRP has not received adequate attention in the Ethiopian educational landscape, and the available research has often failed to address the specific CRP practices in mathematics education. For instance, Abrha et al. (2019) investigated gender-responsive pedagogy in science education, Tilaye (2004) focused on girls' achievement in upper primary school mathematics, and Weldeana (2016) explored ethnomathematics in Ethiopia. Likewise, Girma (2019) studied "the practice of culturally responsive pedagogy as a nexus to enhancing female students' academic performance in the college of teacher education." The findings of these studies generally do not center on teachers' implementation of CRP in mathematics. Consequently, there is a pressing need to explore the practice of CRP within the context of upper primary school mathematics, as well as to examine the extent to which teachers' perceptions of CRP, their competencies in CRP, and specific demographic characteristics correlate with their implementation of CRP in mathematics education.

Hence, this study aimed to explore mathematics teachers' practice of CRP in the upper primary school setting. It specifically examined how the demographic characteristics of math teachers—such as gender, teaching experience, and school location—as well as their professional attributes—such as CRP perceptions and CRP competencies—influenced their CRP implementation in mathematics. To achieve this purpose, the researchers formulated the following basic research questions: (1) how do upper primary school teachers practice CRP in mathematics, and to what extent is CRP practiced among these teachers' CRP? (2) Is there a significant relationship between upper primary mathematics teachers' demographic variables—such as school location, teaching experience, and gender—and their perceptions of CRP and competencies in relation to their practices of CRP? (3) To what extent do the demographic characteristics, CRP perceptions, and competencies of mathematics teachers serve as predictors of their CRP practices in mathematics education? In line with the aforementioned research purposes and basic research questions, the researchers employed the following conceptual framework to guide the study (see Figure 1).

Figure 1

Conceptual Framework for the Study



Methods

Research Approach and Design

To achieve the purposes of this study, the researchers employed a mixed-methods research approach. Specifically, they adopted a convergent parallel design, which enabled a comprehensive examination of the research problem by integrating both quantitative and qualitative data (Creswell, 2014). This methodological choice facilitated simultaneous data collection through the use of both questionnaires and interviews, thereby enhancing the richness of the analysis and the robustness of the overall findings (Creswell, 2014).

Sampling Techniques

To collect data for this study, the researchers targeted mathematics teachers, department heads, and school principals within the North Wollo Zone as key informants. A total of 609 mathematics teachers employed across 449 government schools within 14 Woredas of the zone were identified as study participants. Among these Woredas, seven were selected for inclusion: Woldia, Kobo Town, Raya Kobo, Gazo, Gubalafto, Habiru, and Angot, which together encompass 239 upper primary schools. From this group, 60 schools were randomly chosen as research sites. The study involved all 250 mathematics teachers (153 males and 97 females) located in these schools, selected through comprehensive sampling due to the manageable number of teachers at each institution. Additionally, six school principals and six department heads from the seven selected districts were purposively included as study participants.

Instruments

The researchers employed both questionnaires and interviews as instruments for data collection. A questionnaire incorporating both closed and open-ended items was specifically designed to evaluate teachers' perceptions, competencies, and the frequency of their implementation of CRP practices. The questionnaire consisted of 153 items on a 5-point Likert scale, divided into three categories: 64 items related to practice, 40 items related to competence, and 49 items related to perception, targeted at upper primary mathematics teachers. To ensure the face, construct, and content validity of the questionnaire, the researchers sought feedback from education professors and colleagues, as well as conducted a pilot test. Following this pilot test, the reliability of the questionnaire was established, yielding a Cronbach's alpha coefficient of 0.93, indicating a high level of internal consistency.

A semi-structured interview was also developed for school principals and heads of mathematics departments in order to gather insights into their personal experiences regarding teachers' competencies and the implementation of CRP in mathematics education. The interview protocol underwent validation through the employment of bracketing and member-checking techniques.

Data Analysis Techniques

The data collected through the questionnaires were analyzed quantitatively using both descriptive and inferential statistics. The statistical analysis was conducted using SPSS software (version 23). Specifically, a one-sample t-test was performed to assess the CRP practices of mathematics teachers. Additionally, Pearson correlation analysis was utilized to determine the strength and direction of the relationship between independent variables and the CRP practice status of mathematics teachers. Multiple regression analysis was also employed to examine the predictive influence of teachers' demographic and professional characteristics on their CRP implementation in mathematics. Lastly, the qualitative data obtained from interview respondents were analyzed thematically, with narratives developed around key themes related to the practice of CRP in mathematics.

Results

The Status of Upper Primary School Mathematics Teachers' CRP Practice

The findings presented in Table 1 indicate that the expected mean (3.0) was slightly over weighted by the calculated mean value (3.08). This result suggests that most of the mathematics teachers practiced CRP on an occasional basis. The one sample t-test results further revealed that the teachers differ significantly in their practice of CRP in mathematics instructional processes (t (249) =2.237, p = 0.026, Cohen's d=.14, as $p < 0.05$).

Table 1

One Sample T-test Results on Mathematics Teachers' CRP Practice (Test Value=3)

Variable	Participants categories	N	Mean	SD	t	df	p-value	Cohen'sd
Practice of CRP	Teachers'	250	3.08	.600	2.237	249	.026*	.14

Note. *P<0.05

However, the effect size observed in this study regarding the practice of CRP in mathematics was small (see Table 1), indicating minimal variation between the calculated and expected mean scores. Although the differences in mean scores were statistically significant, the effect size was indeed small. This suggests that teachers infrequently implemented CRP in their mathematics classrooms. As Cohen (1988) indicated, when the difference between two means corresponds to a value of d = .0 to .19 in standard deviations, the effect is considered "trivial," even if statistically significant.

To triangulate the data, the researchers conducted qualitative interviews with school principals and of mathematics department heads. The results indicate that teachers in the observed setting endeavored to implement CRP in their classrooms. Specifically, the department heads noted that some teachers were motivated to consider students' background experiences into their teaching and learning activities by utilizing locally produced and readily available instructional materials. For example, one informant noted that, to help students conceptualize a circle and its components, teachers employed SEFIED, a traditional material made from grass that is typically used to hold bread.

Furthermore, the teacher respondents shared their experiences as mathematics educators, illustrating how they introduced the concepts of circles and the methods of drawing them by relating these topics to local house construction processes. Similarly, some respondents described how they taught the concept of fractions through the activity of sharing bread during the celebration of students' birthdays. This approach demonstrates the efforts of classroom teachers to integrate mathematical content with the lived experiences of their students.

The Relationship between Teachers' Demographic Variables, CRP Perceptions, Competencies, and Their Practice of CRP in Mathematics

This study has analyzed the correlation between various demographic or professional characteristics within the participant mathematics and their self-reported implementation of CRP strategies in mathematics instruction. To this end, a Pearson Product-Moment correlation analysis was conducted to explore the relationships between several factors: the gender of mathematics teachers, the location of their schools, their years of teaching experience, the mean perceived importance of CRP, and the mean level of CRP competencies. The results were then compared with the mean scores of self-reported CRP practices in mathematics (see Table 2).

Table 2

Pearson Correlation Coefficients in Teachers' Demographic and Professional Characteristics

Variables	Gender	School location	Teaching experience	CRP Perceptions	CRP Competence	Practice of CRP
Gender	1					
School location	-129*	1				
Teaching experience	-.087	.387**	1			
CRP Perceptions	.126*	.103	.296**	1		
CRP Competence	.072	.135*	.575**	.576**	1	
Practice of CRP	.055	.207**	.734**	.472**	.801**	1

Note. * Significant at the 0.05 level (2-tailed), ** Significant at the 0.01 level (2-tailed).
Key: gender(Male=1, female=2), School location (rural=1, urban=2); Teaching experience(0-5 years, 5-10, years, 10-15 years, and15 or above years)

As presented in Table 2, a significant positive correlation was observed between certain demographic characteristics of teachers, including school location ($r = 0.207$, $p < 0.01$) and years of teaching experience ($r = 0.734$, $p < 0.01$), in relation to their practice of CRP strategies. Furthermore, the results of the correlation analysis indicated that mathematics teachers' self-reported practices of CRP exhibited both moderate and strong significant positive correlations with their perceived importance of CRP ($r = 0.472$, $p < 0.01$) and their overall level of perceived CRP competencies ($r = 0.801$, $p < 0.01$), respectively. In contrast, no statistically significant relationship was found between mathematics teachers' self-reported CRP practices and their gender ($r = 0.055$, $p = 0.387$), as this p-value exceeds the threshold of 0.05.

The Predictive Status of Teachers' Demographic Characteristics, CRP Perceptions, and Competencies in Their Practice of CRP in Mathematics

To ascertain the influence of independent variables on the dependent variable—namely, overall self-reported practices of CRP in mathematics—multiple regression analysis was employed (see Table 5). Prior to conducting this analysis, the researchers meticulously assessed all variables for any violations of statistical assumptions and confirmed that none were present.

Following this validation, the researchers utilized multiple regression to examine the predictive power of mathematics teachers' demographic characteristics (such as school location and teaching experience) and professional attributes (including CRP perception and CRP competence) on their self-reported practices of CRP in school mathematics. The results are presented in Tables 3, 4, and 5.

The summary of the model (see Table 3) encompasses the R, R^2, adjusted R^2, and the standard error of the estimate (SE), which can be used to determine how well a regression model, fits the data. Consequently, the multiple correlation coefficient (R = 0.869) indicates that the prediction power of the demographic and professional characteristics of teachers is strong to predict teachers' self-reported practice of CRP strategies in mathematics instructional activities.

Table 3

Combined Effect of all Variables on Teachers' Self-reported Practices of CRP in Mathematics

Model	Sum of Squares	df	Mean Square	F	Sig.	R	R^2	Adj.R^2	SE	Durbin-Watson
Regression	67.747	4	16.937	188.666	.001[b]	.869[a]	.755	.751	.300	1.656
Residual	21.994	245	.090							
Total	89.741	249								

Note. a. Predictors: (Constant), CRP competency, School location, CRP Perception, Teaching experience;
b. Dependent Variable: CRP Practice

The coefficient of determination (R^2 = 0.755) explained 75.5% of the variability of the dependent variable, CRP practice in school mathematics. The adjusted R^2 value of 0.751 (the "R Square" column) indicates how much of the total variation in the dependent variable (practice of CRP in school mathematics), can be explained by the four independent variables: school location, teaching experience, CRP perception, and CRP competencies. In this case, 75.1% can be explained as strong.

Moreover, the F ratio in Table 3 checked whether the overall regression model was a good fit for the data. So, the results indicated that taken collectively the independent variables significantly predicted the dependent variable as evidenced by the ($F (4,245) = 188.666, p < 0.05$), which revealed the regression model was a good fit for the data. This result suggested that at least one of the four independent variables had a significant effect on the dependent variable of teachers' self-reported practice of CRP in mathematics.

Then, the researchers examined the effect size of each independent variable—school location, teaching experience, perceived importance of CRP, and perceived level of CRP competencies—predict teachers' overall self-reported practice of CRP strategies. The results of the preliminary multiple regression models demonstrated that school location and teacher perceived importance of CRP strategies were not statistically significant predictors of teachers self-reported CRP practice scores, as evidenced by ($\beta = -.034, t = -0.991, p = .373, P > .05$) and ($\beta = .039, t = 1.005, p = .316, P > .05$), respectively (refer Table 4).

Table 4

Regression Analysis Summary for teacher Characteristics Predicting Practice of CRP Strategies in Mathematics Instructional Activities

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
Constant	.687	.142		4.833	.001		
School location	-.042	.043	-.034	-.991	.373	.837	.195
Teaching experience	.258	.025	.426	10.155	.001	.570	.756
CRP perception	.043	.042	.039	1.005	.316	.664	.505
CRP Competence	.521	.044	.539	11.812	.001	.481	.078

Note. Dependent variable: Practice of CRP; R^2 = .755(Adjusted R^2 = .751) (N = 250, p < .05)

Two of the independent variables had a significant and positive effect on teachers' self-reported practice of CRP strategies (refer Table 4). Specifically, teachers' years of experience was statistically significant in predicting teachers' self-reported practice of CRP scores as evidenced by (β =.426, t = 10.155, p<.001). This result revealed that the more experienced the respondents' had, the more they implemented CRP.

To triangulate the quantitative findings, the researchers conducted a semi-structured interview with heads of the mathematics department and the respective school principals. To do so, the researchers asked the respondents, '*How do you evaluate the CRP practice of mathematics teachers in relation to their teaching experience?* Considering this question, the participants responded that teachers who have more years of teaching experience reflected the practice of CRP in their classroom instructional activities more than those who had less experience. Specifically, the mathematics department head (HMD1) reported, '… as I have seen during teachers appraisal observation schedule, some mathematics teachers (who taught for more years) used locally made teaching aids, considered the background experiences of the students before conducting actual lessons, and also tried to connect mathematics content with local contexts' (HMD1, 22 May 2022). The principal of the school (SCP1) reaffirmed this.

The data presented reveals that teachers who had more years of teaching experience showed greater consideration of CRP practices in their instructional activities. Therefore, it is possible to say that there is consistency between the quantitative and qualitative findings on the issue of teachers with higher teaching experiences influencing their CRP practices positively.

In addition, as seen in Table 4, the teachers' perception of their CRP competencies was statistically significant in predicting their self-reported practice of CRP, as supported by (β =.539, t = 11.812, p<.001). The results indicate that math teachers who perceived themselves as competent in aspects of CRP could implement such pedagogy in their actual mathematics instructional processes.

Table 5

Final Regression Model for Predicting Self-reported Practice of CRP Strategies in Mathematics

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. E.	Beta			Tolerance	VIF
Constant	.729	.100		7.286	.000		
Teaching experience	.247	.023	.408	10.551	.000	.670	1.494
CRP Competence	.548	.037	.567	14.663	.000	.670	1.494

Note. R=.868, R^2 = .753 (Adjusted R^2 = .751), (N = 250, $p < .05$); Std. E. =standard error

As displayed in Table 5, the final multiple linear regression was performed based on the two independent variables (demographic characteristics) to examine their level of significance and effect size for each. These independent variables significantly predicted the dependent variable- practice of CRP in mathematics (F (2,247) = 376.556, p=.000, $p < 0.05$, $R^2 = 0.753$). The result reveals that when mathematics teachers' CRP strategies were regressed on their years of teaching experience and perceived CRP competence, 75.3% (R^2 = .753) of the total variance in math teachers' self-reported practice of CRP in mathematics was accounted for by their years of teaching experience and level of perceived CRP competencies. The R^2 value, which was higher than three-fourths (75.3 percent) of the 100% coefficient of determination, showed a strong effect of the combination of the two variables that accounted for the total variance in teachers' practice of CRP in mathematics.

Of the two independent variables, level of teachers' perceived CRP competence had a higher effect (beta =.548, p=.000), and teachers' years of teaching experience had also a statistically significant contribution (beta =.408, p=.000) on predicting their overall self-reported practice of CRP scores (see Table 5). This means, the teachers' CRP competencies and years of teaching experience contributed significantly and positively to their practicing status of CRP strategies in school mathematics.

Discussion

This study examined the correlation and predictive significance of demographic and professional characteristics of teachers in relation to their implementation of CRP in mathematics education. The results were thoroughly analyzed and revealed findings that both support and contradict previously published research projects. To present these findings comprehensively, the researchers organized the discussion thematically as follows.

The Status of Upper Primary School Mathematics Teachers' CRP Practice

The results of this study indicated that teachers in the research area occasionally implemented CRP in mathematics, with a mean score of 3.08 (SD = 0.600). Furthermore, qualitative data revealed that some teachers integrated local building practices into their instruction on the concepts of circles and their representations. Additionally, the teaching of fractions was contextualized through the cultural practice of sharing bread during children's birth date ceremonies.

In this context, Morrison et al. (2008) argued that students enhance their learning by building upon their prior experiences and knowledge, thereby linking their background experiences to the current content and activities within the classroom. Such connections can significantly improve students' academic achievement through meaningful instructional practices. However, the findings of the current study indicate that mathematics teachers occasionally consider culturally responsive pedagogy practices in their classrooms. A one-sample t-test revealed a small but significant effect ($t(249) = 2.237$, $p = .026$, Cohen's $d = .14$). This observation aligns with existing literature. For example, (Umutlu & Kim, 2020) reported that while many teachers acknowledge the need to address the challenges faced by their students and recognize that culturally responsive teaching could effectively meet these challenges, they note that such approaches are seldom implemented in a meaningful manner.

When considering the different factors that influence student achievement in mathematics, the chosen pedagogy of teachers appears to be a leading factor. In their studies, Aronson and Laughter (2016) reported that to narrow down the contextual problems faced in the classroom, teaching and learning mathematics in schools should be culturally relevant and responsive to students. When teachers contextualize mathematics based on student interests, experiences, and communities and then scaffold instruction, positive inclusive learning processes can be created, and the subject can be used as a tool to critique social order (Klinger & Gonzalez, 2009; Martin et al., 2010). These pedagogical approaches set goals for mathematics education that include helping students achieve high standards as well as using mathematics to shape their identities and improve their living situations (Gutstein, 2006).

The Relationship between Mathematics Teachers' Demographic Variables, CRP Perceptions, Competencies and Their Practices of CRP

The CRP competence, teaching experience, CRP perception, and school location were positively and significantly correlated with practices of CRP in mathematics. Specifically, teachers' level of perceived CRP competencies correlated with their self-reported practice of CRP as evidenced by ($r = .801$, $p < .01$). The results suggest that if mathematics teachers are competent in aspects of CRP, they will be able to demonstrate the practices in mathematics classrooms. Multiple research studies confirm this finding. That is, as mathematics teachers feel competent, specifically in their ability to implement culturally responsive teaching, this contributes to their practice of CRP strategies in upper primary school mathematics contexts (Edwards, 2014; Gay, 2010; Ladson-Billings, 2009).

Similarly, with regard to teaching experience, mathematics teachers who have more years of teaching experience considered CRP practices in their classroom instructional activities more than those who have less experience ($r = .734$, $p < 0.01$). Similarly, Lucas and Villegas (2013) reported that to teach various learners professionally, teachers require many more years to be competent because CRP involves extensive knowledge, skills, and orientations. This means that teacher-teaching experience is one of the numerous foundations from which they derive their knowledge.

The result of the correlation analyses also revealed a positive relationship between scores on mathematics teachers school location variables and their self-reported practice of CRP ($r = .207$, $p < 0.01$). Based on established benchmarks, this effect size is considered small and medium. As a result, a teacher's location seems to slightly influence whether a teacher implements CRP in mathematics. Thus, as a demographic variable, the school location positively impacts the practice of CRP in mathematics in favor of urban school teachers. Likewise, Cogan et al. (2001) findings suggested that rural schools may be more likely than other schools to practice a conservative form of mathematics education. This result contradicts the Silva (2017) study, which revealed that none of the teacher demographics (e.g., teaching experience, location of the current teaching position) seem to significantly impact CRT practices. The reason for this significant association might be that in urban schools, more experienced teachers have exposure to and practical experience in every aspect of education and cultural contexts that help them become knowledgeable, skilled, and competent.

However, there was no statistically significant relationship between mathematics teachers' self-reported practice of CRP scores and their gender variable at ($r = .055$, $p = .387$, $p > .05$). This implies that being a male or female teacher has no effect on the practice of CRP strategies in mathematics instructional activities. This result also agreed with the previous findings. For example, Heitner and Jennings (2016) reported that there are no significant differences in CRT knowledge and practices among teachers in terms of gender.

Teachers' Demographic and professional characteristics predictive status of CRP Practice in Mathematics

The independent variables such as teaching experience and perceived level of CRP competencies among math teachers predicated positively and significantly their self-reported practice of CRP. However, school location and perceived importance of CRP did not predict significantly their practice of CRP. Thus, the positive association between years of experience and self-reported practice of CRP scores suggested that an increase in teachers' years of teaching experience in mathematics is associated with an increase in their self-reported practice of CRP scores.

This study's findings agreed with prior researchers outputs. For example, Tschannen-Moran, and Woolfolk (2001) reported that as teachers become more experienced, their perceived competence increases, leading to improved pedagogical practices, student-teacher relationships, and student outcomes. Managing the mathematics classroom environment in a responsive way is vital for teacher practice. Put in differently, culturally responsive classroom management was rarely implemented in meaningful ways by less experienced teachers. This is because gaining the opportunity to teach diverse students in different localities over a long period of time helps math teachers develop cultural knowledge, skills, and experiences and bring them into the classroom to use them in instructional processes.

Concerning the level of perceived CRP competencies of math teachers, Bills and Hunter (2015); Rockoff (2004) noted that the success of applications related to culturally responsive pedagogical practices is directly proportional to the knowledge, skills, experience, and competencies of teachers. Likewise, Goddard and Skrla (2006) state that teachers' sense of culturally responsive teaching competencies exert a significant influence on student achievement by promoting teaching that enhances learning.

Conclusions and Recommendations

Based on the data analysis and discussion, it is possible to conclude that upper primary school mathematics teachers practice culturally responsive pedagogy at a moderate level. Teachers who do not implement this pedagogy may possess only a superficial understanding of how CRP can be integrated into mathematics instruction, which may result in a lack of confidence in their ability to apply it effectively. Additionally, novice mathematics teachers are less likely to have facilitated culturally responsive pedagogical practices in their classrooms compared to their more experienced counterparts.

Furthermore, the results revealed that some demographic characteristics of teacher — specifically, school location, years of teaching experience, and professional attributes (including culturally relevant pedagogy competencies and perceptions)—exhibit significant positive correlations with the practice of culturally relevant pedagogy in mathematics. Notably, among these four predictor variables, the perceived levels of CRP competencies and the extent of teaching experience were the only significant predictors of CRP implementation in mathematics instruction. This suggests that mathematics teachers should prioritize the integration of CRP to foster more relevant and effective learning environments for their students.

Based on the findings of this study, the researchers suggest the following recommendations. First, to facilitate effective mathematics education, it is essential for teachers to develop cultural competencies and to consistently implement culturally relevant teaching methods that incorporate local culture and real-life contexts. Accordingly, the Amhara Regional Education Bureau, along with the Zonal Education Department and Woreda Education Offices, should provide professional development training for mathematics teachers on the integration of culturally responsive pedagogical strategies into their instructional practices.

Secondly, it is crucial for teachers to understand and promote culture-based instructional practices in mathematics classrooms; as such practices have been shown to positively impact student performance. Recognizing this impact, school principals should implement strategies aimed at enhancing the awareness and competencies of mathematics teachers, thereby enabling them to effectively integrate cultural contexts into the school’s mathematics curriculum and teaching methodologies.

Third, the findings of this study indicate that the teaching experience of teachers positively influences the implementation of culturally relevant pedagogy in mathematics education. Therefore, it is imperative for schools to develop strategies that facilitate collaboration between more experienced and less experienced teachers, particularly through the establishment of lesson study programs. Such programs provide a constructive platform for teachers to practice, exchange ideas, and seek assistance in a supportive, non-judgmental, and professional environment.

Limitation of the Study

This study faced several significant challenges that imped its progress. Notably, the COVID-19 pandemic posed a major obstacle, severely restricting the mobility of researchers. Furthermore, the ongoing civil war in Ethiopia, particularly in the northern regions, coupled with recurrent states of emergency, not only disrupted internet access but also physically obstructed direct communication among researchers.

Ethical Approval

To meet the objectives of this study, the materials utilized in the research were carefully identified, and participants were ensured anonymity throughout the study to enhance their sense of confidentiality.

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