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# Novice Middle Grades Science Teacher Perspectives on Culturally Responsive Teaching Practices

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This is to certify that the doctoral dissertation by

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and that any and all revisions required by
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Abstract

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## Abstract

Culturally responsive teaching (CRT) bridges students' cultural experiences with academic learning; however, novice science teachers often lack the preparation to apply it. This study addressed the problem that teachers without sufficient preparation to support culturally diverse learners are teaching middle grades science. Grounded in Freire's critical consciousness and informed by Gay's CRT principles, the purpose of this study was to explore the experiences and perspectives of middle grades science teachers in their first 5 years of teaching regarding their use of CRT to plan and implement science lessons. Data from 12 semistructured interviews with novice middle grades science teachers were analyzed through inductive thematic analysis using an open-coding approach. Findings showed that novice science teachers often enter the profession underprepared and without adequate institutional support at the study district. Despite this, science teachers developed cultural awareness, implemented CRT, built supportive classrooms, viewed science as a tool for equity, navigated structural challenges, and sought to bridge the gap between teacher preparation and classroom realities. Recommendations include integrating science-specific CRT training into teacher preparation programs and examining how these practices develop early in teachers' careers through coaching, learning communities, and equity-centered curricula. By illuminating instructional practices teachers can use to build confidence, identity, and opportunity for culturally diverse youth, students' science literacy may be strengthened, thereby supporting positive social change over time.

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# Dedication

This work is dedicated to my angels here on Earth and those watching from Heaven — the ones whose voices I heard with my ears and those I felt with my heart. To those who will see me walk across the stage and those I only see in my dreams, this is for you. To my forever educators, who gave me their time and wisdom — I now dedicate this work to you. While I hold this achievement in my hands, know that I always hold you in my heart. To my biggest supporters, my first teachers… this is for you.

To my Grandmother Ruth, my angel watching over me, thank you for showing me what unconditional love and care for others looked like from the very beginning. You are always with me. The love I have for people, a love I am proud to carry, comes from you. I promise, I'll keep seeing the ladybugs.

Finally, and most importantly, to my mother, my number one fan, supporter, and advocate, my angel here on Earth — thank you. This achievement is a reflection of the foundation you built within me. You are the reason I believed in myself enough to complete this doctoral degree. Thank you for being the model of what a loving educator looks like. You are the reason I am the change I wish to see in the world, and the reason I make sure my students know just how much I care before they care how much I know. Every step of this journey was taken with your strength beside me. If I am anything today, it is because you showed me the way. You are the reason I became the educator I am today and the woman I still strive to be. This is for you, Mom.

This journey was never mine alone, and this achievement belongs to both of you.

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To my girls, Beth, Emma, and Tanielle. Thank you for always reminding me of the gifts God gave me and the plans He has for my life. Thank you for praying for me when I could not pray for myself and for pushing me to rest when I wouldn't. You have been down for whatever, whenever, wherever, and you continue to help me walk boldly in my purpose.

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Finally, to all my children—my former students, my current students, and the future ones I haven't yet met. This is for you. I believe in you, and I believe in the power of your education. You matter.

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# Chapter 1: Introduction to the Study

The United States population of K-12 students has become increasingly diversified by culture, language, and socioeconomic background (Clark & Andreasen, 2021; Trumbull et al., 2020). However, even with this change in diversity, classrooms across the country are often still led by predominately White, middle-class teachers, many of them lacking the skills to effectively educate the diverse populations (Brodeur et al., 2020). While teachers may be proponents for adequately educating the diverse students in their classrooms, they often lack consistent and in-depth training from their previous education programs (Underwood & Mensah, 2018).

In order to ensure equity and inclusivity in all classrooms, teacher programs need to prepare preservice teachers with the necessary tools to use students' prior knowledge and strengths for effective education (Brodeur et al., 2020; Moore et al., 2021). This is referred to as culturally responsive teaching (Gay, 2010). By developing the culturally responsive mindsets and practices of in-service and preservice teachers, there will be greater chances of closing the gap in educational equity (Mensah et al., 2018).

This study explored the culturally responsive teaching practices of novice (individuals with 5 or fewer years of experience), middle grades (grades 6-8), science teachers. According to Evans et al. (2020), many preservice and in-service teachers lack adequate preparation in culturally responsive teaching (CRT) and a strong understanding of culturally relevant pedagogy (CRP), therefore weakening their effectiveness in educating diverse student populations. The findings of this study may benefit the education field by pinpointing specific areas of culturally responsive teaching that can

guide professional development and training to support more equitable science education. The results of this study may provide insight into novice teachers' authentic practices and perspectives of culturally responsive science education that can help create consistent standards for improvement and sustainable positive change in teacher education programs.

This chapter will include the background of the study. Following the background, Chapter 1 contains the problem statement, purpose, research questions, conceptual framework, nature of the study, and definitions of key terms and concepts. It will also include the study's assumptions, scope and delimitations, limitations, and significance.

## Background

Culturally responsive teaching (CRT) refers to the use of students' prior knowledge, cultural experiences, frames of reference, and performance styles to make learning more relevant and effective for diverse learners (Gay, 2010). Developed in response to persistent academic inequities among culturally diverse student populations, CRT emphasizes that students' languages, identities, and lived experiences should be acknowledged and incorporated into classroom instruction (Watson, 2021). Often associated with terms such as appropriate, congruent, compatible, and rooted (Pejaner & Mistades, 2020), culturally responsive teaching highlights the importance of valuing students' cultural assets as part of the learning process.

Although sometimes used interchangeably with culturally relevant pedagogy, CRT and CRP are distinct but connected. CRT represents the instructional practices teachers use in the classroom, whereas culturally relevant pedagogy (CRP) is the broader

theoretical framework that guides those practices. CRP emphasizes academic success, cultural competence, and critical consciousness as essential aims of teaching (Ladson-Billings, 1995; Thomas & Berry, 2019). Together, CRT and CRP support learning environments where students' cultural knowledge, strengths, and identities are central to instructional decision-making and equitable learning experiences.

For CRT to be effective, teachers must be trained with the skills and practices needed to apply it; however, many still lack adequate preparation from their education programs (Evans et al., 2020). Although teachers express interest in supporting culturally diverse students, a disconnect remains between their intent and their actual use of culturally responsive practices (Evans et al., 2020). According to Mensah et al. (2018), while some programs offer courses related to culturally responsive teaching, the coursework and resources are inconsistent, and many multicultural education courses are not required for certification.

Teacher education programs generally do not focus on multicultural education or culturally responsive teaching for distinct content areas (J. C. Brown et al., 2018). Furthermore, in-service teachers are not trained with subject-specific practices that could help address equity and diversity challenges new teachers commonly face (Lakhwani, 2019). Particularly for science teachers, education programs lack consistent resources for culturally responsive instructional and assessment practices. This lack of preparation has led to consistently underdeveloped science teachers missing critical elements of culturally responsive science teaching (J. C. Brown et al., 2018).

Although researchers have investigated the insufficient preparation of science teachers with culturally responsive teaching skills (J. C. Brown et al., 2018; Evans et al., 2020), there is still a lack of understanding of how novice science teachers use culturally responsive teaching practices and their perspectives regarding how to plan and execute instructional activities for culturally diverse students. Novice teachers, or teachers with five or fewer years of experience, reflect the practices and mindsets gained from their education programs (Moore et al., 2021) or alternative teacher certification programs (Toombs et al., 2021), and also their experiences from preservice to in-service teaching (Evans et al., 2020; Schauer, 2021). Novice teachers often have difficulties effectively teaching culturally diverse students due to the lack of preparation with culturally responsive teaching practices from their previous education programs (Underwood & Mensah, 2018). Due to challenges such as these, many novice teachers prematurely leave the profession (Lakhwani, 2019).

This study was necessary to support the retention of novice teachers. It provided insight into the current practices used by novice science teachers assessed through the lens of culturally relevant pedagogy (CRP). Through analyzing the authentic practices and perspectives of this group of teachers, this study provides researchers with foundational information to better prepare culturally responsive science teachers through education programs and in-service professional development. The results of this study may bring increased awareness regarding the needs of novice science teachers in terms of support and CRT/CRP-aligned professional development, potentially leading to decreases in the science achievement gap and increases in novice science teacher retention.

## Problem Statement

The problem that was addressed in this study was that teachers without sufficient preparation to support culturally diverse learners are teaching middle grades science (see Evans et al., 2020; Schauer, 2021). Though research, such as the seminal works of Gay (2010) and Ladson-Billings (1995), has long shown a need for culturally responsive teaching practices and the principles of culturally relevant pedagogy to support equitable education, teacher preparation programs provide inconsistent coursework and training for preservice and in-service teachers (Lomelí, 2021; Mensah et al., 2018). Importantly, these gaps in preparation become especially pronounced in the middle grades, where earlier emerging science achievement disparities often persist and widen; this is particularly true for students of color, making culturally responsive practices essential during this critical stage (Quinn & Cooc, 2015; Underwood & Mensah, 2018). Furthermore, this lack of preparation contributed to many middle grades science teachers being unaware of culturally responsive pedagogy and how to implement it in their instruction (Underwood & Mensah, 2018).

Although many studies have investigated the culturally responsive teaching preparation of preservice teachers (Mensah et al., 2018), in-service teachers (Lomelí, 2021), and even the incorporation of CRT into science education (Pejaner & Mistades, 2020), there has been little research on novice science teachers. There is a gap in the research base regarding how novice science teachers used culturally responsive teaching practices and their perspectives of cultural awareness to plan and execute instructional activities for diverse learners.

Research on these practices can provide information on the training and development science teachers receive in their preservice and early in-service learning experiences. Findings from this study may be used within teacher development programs to help create consistent standards for culturally responsive science education training. These standards may help to guide professional development and more adequate preparation in teacher education programs, ultimately leading to increases in equitable science education for all learners.

## Purpose of the Study

The purpose of this basic qualitative study was to explore the experiences and perspectives of middle grades (6–8) science teachers in their first 5 years of teaching regarding their use of culturally responsive teaching practices to plan and implement science lessons. CRT is sometimes used interchangeably with culturally responsive pedagogy; however, for the purpose of this study, it specifically referred to the instructional practices that draw upon students' cultural knowledge, prior experiences, and strengths to promote equity in their learning experiences (see Watson, 2021). The teachers of focus in this study worked in a Southeastern suburban school district. The findings of this study may contribute to a better understanding of the culturally responsive practices that novice science teachers use to educate their diverse student populations.

## Research Questions

This study addressed the following research questions (RQs):

RQ1: How do novice middle grades science teachers describe their experiences with using CRT to plan and implement science lessons?

RQ2: What are the perspectives of novice middle grades science teachers regarding the use of CRT to plan and implement science lessons?

## Conceptual Framework for the Study

This research study explored the culturally responsive teaching practices used by novice middle grades science teachers through the lens of Freire's (2017) theory of critical consciousness. Focusing on awareness in education, Freire described critical consciousness as being aware of social, political, and economic inequities and supporting the oppressed populations most affected by them. Awareness of these societal shortcomings provides more opportunities for action against them (Schauer, 2021). In education, teachers must develop critical consciousness to explore race at both personal levels and through their teaching (Ladson-Billings, 2014; Schauer, 2021). Aligning with culturally relevant and culturally responsive education, the theory of critical consciousness encourages awareness of students' cultural identities while challenging the oppressive systems within education (Ladson-Billings, 2014; Schauer, 2021). Teachers who are aware of the inequities affecting oppressed student populations often strive to include culturally responsive practices in their teaching to ensure equitable education for all students (Schauer, 2021).

Consisting of critical reflection, political efficacy, and critical action, also known as Freire's idea of "see, judge, act" (Schauer, 2021, p. 13), the theory of critical consciousness provided a supportive framework for the qualitative approach to this study.

Questions for the interviews explored teachers' perspectives on their culturally responsive practices as they related to their mindsets of reflection, sociopolitical consciousness, and action for oppressed student populations. Interview responses were analyzed based on cultural awareness and the perceived impact of race on planning and instructional practices. Through the analysis of their perspectives, novice middle grades science teachers may have increased their awareness of the generalized biases of their marginalized student groups. By studying participants' perspectives of cultural awareness based on their experiences and previous education programs, this study provided descriptions of participants' critical consciousness (Schauer, 2021).

## Nature of the Study

To address the RQs of this study, the research design included a basic qualitative approach. Qualitative methods, including interviews for data collection and coding for analysis, allowed for exposure to the experiences of teachers, as well as how they interpreted those experiences and used them to guide their teaching (Merriam & Tisdell, 2016). With this approach, middle grades science teachers within their first 5 years of teaching were interviewed using semistructured methods. Thematic analysis of the teachers' responses allowed for in-depth interpretations of their culturally responsive teaching practices (see Gay, 2010) and ideas of critical consciousness (see Freire, 2017) based on their authentic classroom experiences (see Ravitch & Carl, 2021).

For this research study, middle grades (Grades 6–8) science teachers with 5 years or less of experience participated in individual semistructured interviews. Interview questions addressed the study's problem and purpose regarding teachers' perspectives on

culturally responsive teaching practices and how their critical consciousness impacted their instructional planning and practice. Google Forms and Gmail were used to retrieve contact and basic demographic information from participants at 15 middle and K–8 schools in a Southeastern school district. A virtual conferencing platform was used to conduct the teacher interviews. The interview data were transcribed, analyzed, and formulated into codes, categories, and themes to support in-depth understanding and systematic organization following the approaches of Braun and Clarke (2006), as well as Ravitch and Carl (2021). Through the basic qualitative approach and the plans for data collection and analysis, this study yielded credible information based on the authentic experiences of the teachers.

## Definitions

*Alternative teacher certification*: Teaching licensure for individuals who already hold a bachelor's degree but did not complete a traditional teacher education program (J. J. West & Frey-Clark, 2019).

*Culturally relevant pedagogy*: Culturally relevant pedagogy (CRP) describes a theoretical approach to teaching that supports academic success, sustains students' cultural identities, and develops critical consciousness, enabling learners to examine and challenge social inequities through culturally meaningful instruction and empowered engagement with their world (Ladson-Billings, 2009).

*Culturally responsive teaching*: Culturally responsive teaching (CRT) describes an instructional approach that applies the principles of culturally relevant pedagogy by incorporating students' cultural knowledge, experiences, perspectives, and

communication styles into the learning process. This approach helps make instruction more meaningful and supports stronger academic outcomes for ethnically diverse students (Gay, 2010).

*In-service teachers:* In-service teachers are teachers currently employed in an educational setting (Mensah et al., 2018).

*Middle grades education:* Middle grades education describes an education grade level configuration designed to meet the needs of young adolescents (Hanover Research, 2015). For this study, middle grades levels 6-8 were studied.

*Novice teachers:* Novice teachers are teachers new to the profession with limited hours of teaching experience (Wolff et al., 2021). For this study, novice teachers were defined as teachers with 5 or less years of experience.

*Preservice teachers:* Also referred to as teacher candidates, preservice teachers are students within a teacher education program. These students are prepared with instruction, coursework, field experiences, and internships necessary to be a certified teacher (Moore et al., 2021).

*Teacher professional development.* Teacher professional development can be defined as training used to enhance the learning, pedagogical practices, and mindsets of current teachers (Ackah-Jnr, 2020).

## Assumptions

In a study, there are necessary factors that cannot be verified as true; therefore, it is essential to make assumptions (Merriam & Tisdell, 2016). For this qualitative research study, it was assumed that all participants were truthful in their interview responses.

Another assumption was that the participants provided accurate information for their background and demographic surveys. Additionally, it was assumed that the participants selected had adequate knowledge of their instructional practices and an awareness of their culturally diverse students. These assumptions were necessary to support the validity of participant responses and data saturation.

## Scope and Delimitations

The scope of this research study focused on the perspectives of novice middle grades science teachers in a Southeastern U.S. school district. The participants in the study taught at schools with culturally diverse students. It was important for these novice middle grades science teachers to teach at schools with culturally diverse students because the study focused on their culturally responsive teaching practices and perspectives. The study was limited to teachers who entered the field through a traditional teacher education program and had 5 or fewer years of certified classroom experience. All participants taught students in Grades 6–8.

Purposeful sampling was used to locate and select participants within the specific parameters of the study. This study did not address the perspectives of elementary or high school teachers, nor those of teachers in other subject areas or with more than 5 years of experience. By focusing on teachers from teacher education programs, the study may support the transferability of findings to teachers of other grade and experience levels.

## Limitations

This research study focused on the perspectives of novice middle grades science teachers; therefore, the results may not be applicable to teachers of other grade levels,

content areas, or experience levels. Due to this specific participant group and basic qualitative design, the sample size was limited to a small number. The richness of the findings may also have been influenced by the level of detail participants chose to share about their classroom practices, as well as by variation in teachers' educational backgrounds. Because this study focused on participants' perspectives in their planning and instruction, their responses may have been biased to present a favorable or supportive mindset of culturally responsive teaching. To address these limitations, the interview questions were organized to promote truthful, unbiased, and valid responses. Questions were directly aligned with the conceptual framework, particularly Freire's dimensions of critical consciousness which include awareness of inequities, reflection on teaching practices, and action toward equity, and were also explicitly connected to the RQs by focusing on participants' perspectives and how those perspectives impacted their planning and instruction.

## Significance

With the rising numbers of diverse students filling today's U.S. classrooms, teachers must be developed with skills and knowledge to teach all students (Mensah et al., 2018; Watson, 2021). Many teachers are currently in the education field, aspiring to teach their culturally diverse students effectively, but they are lacking the specific and necessary tools and mindsets from their previous programs and institutions (Lomelí, 2021; Moore et al., 2021).

This study was potentially significant in that its findings may contribute to a better understanding of the identified gap by providing insight into novice science

teachers' culturally responsive teaching practices. The study presented authentic practices and perspectives of culturally responsive science education that may help create consistent standards for improvement and support sustainable positive change in teacher preparation programs. By analyzing novice science teachers' culturally responsive teaching practices and perspectives through the lenses of CRT, CRP, and the theory of critical consciousness, the study may provide researchers with information foundational for preparing culturally responsive science teachers. This information may also pinpoint specific areas of culturally responsive teaching that can guide professional development and training for more equitable science education.

The findings of this study may lead to positive social change by enhancing teachers' and teacher educators' knowledge, skills, and attitudes about culturally responsive science education and embracing the diversity of their students. The findings may also contribute to reducing the science achievement gap through the proper preparation of culturally responsive science teachers and the promotion of more equitable science education. Lastly, this study may further contribute to positive social change by exploring the theory of critical consciousness and its role in CRT through authentic experiences. This exploration may bring awareness to the need for novice science teacher support and culturally responsive science teacher training. Through this deliberate process of improving science education for all students, teachers and teacher educators may gain the skills to empower the next generation of changemakers.

## Summary

This study was an exploration of the culturally responsive teaching practices used by novice middle grades science teachers as reported through semistructured qualitative interviews. Participants provided their experiences and perspectives framed by the theory of critical consciousness (Freire, 2017) and the principles of culturally responsive teaching (Gay, 2010). Through this study, participants shed light on the culturally responsive practices gained from teacher preparation programs, potentially informing improvements in training and professional development.

Chapter 1 presented the study's background, problem statement, purpose, RQs, conceptual framework, and nature of the study. It also included definitions of key terms, as well as the study's assumptions, scope and delimitations, limitations, and significance. Chapter 2 contains a review of literature addressing concepts and theories relevant to the study, including culturally responsive education, culturally responsive science education, novice teacher development, Freire's theory of critical consciousness, Ladson-Billings' culturally relevant pedagogy, and preservice teacher preparation.

# Chapter 2: Literature Review

## Introduction

The problem addressed in this study was the inadequate preparation of teachers leading the culturally diverse middle grades science classrooms. Many of these classroom teachers are lacking the culturally responsive teaching practices necessary for effective and equitable education (Gay, 2010; see also Ladson-Billings, 1995). Due to the inconsistent preparation of preservice and in-service teachers through their coursework and training, there is an ongoing achievement gap among students of color (Underwood & Mensah, 2018). Research has shown the effectiveness of culturally responsive teacher preparation of preservice teachers (Mensah et al., 2018), in-service teachers (Lomelí, 2021), as well as the incorporation of culturally responsive practices into science education (Pejaner & Mistades, 2020). However, there was a lack of research on the practices used by novice science teachers.

The purpose of this basic qualitative study was to explore the perspectives of middle grades (6-8) science teachers in their first 5 years of teaching regarding their use of CRT to plan and implement science lessons. Since being identified as theoretical frameworks informing culturally responsive teaching (Gay, 2002; Ladson-Billings, 1995), these approaches have been shown to be valuable for promoting equity in culturally diverse educational settings. However, the effectiveness of these culturally responsive teaching practices in closing the achievement gap is in jeopardy due to the lack of adequate teacher preparation, as noted by Mensah et al. (2018).

Wilcoxen et al. (2021) and Moore et al. (2021) identified the need for more purposed, meaningful, and structured preparation of preservice teachers in order to improve their awareness, knowledge, and skills in working with diverse populations. On the other hand, Tanguay et al. (2018) and Bottiani et al. (2018) emphasized the need for professional development of in-service teachers as it is critical to develop their skills and self-efficacy with teaching culturally diverse students. Furthermore, extensive research has been found on the incorporation of culturally responsive instruction into science education and its benefits in lessening the science achievement gap. Underwood and Mensah (2018) and J. C. Brown et al. (2018) identified the need for culturally responsive science education but found that many teachers lack the adequate preparation of effective culturally responsive teaching practices. Stepp and Brown (2021) determined that the teachers' lack of preparation led to low self-efficacy and flawed implementation of culturally responsive learning experiences. B. A. Brown et al. (2019) and J. C. Brown et al. (2018) proposed specific professional development training to increase the cultural awareness and culturally responsive instructional practices for in-service science teachers. Both studies were successful in improving self-efficacy and the knowledge and skills necessary to plan and implement culturally responsive science practices adequately.

Overall, this study examined the current perspectives and practices used by novice science teachers to determine their levels of cultural awareness and skills with culturally responsive planning and instruction. This chapter will feature a review of research on the conceptual framework of critical consciousness. The ideals of critical consciousness (Freire, 2017) will support the concepts explored in this study because they focus on the

awareness of inequities in education and how they affect the culturally diverse students within the classrooms. Through this framework, a direct relationship may be evident as the perspectives of novice teachers' cultural awareness are studied. Additionally, research on the theories of culturally relevant pedagogy (Ladson-Billings, 2009) and culturally responsive teaching (Gay, 2002) will be presented as supplemental frameworks for the study. The research on culturally responsive teaching allowed me to look at the practices used to retrieve and apply students' cultural knowledge, strengths, and experiences. By including the additional framework of culturally relevant pedagogy, there was the ability to delve into the higher-order thinking and development of the consciousness necessary to empower culturally diverse students, which was vital to the study. While it often preferable to have only one framework, in order to fully explore this topic and answer the RQs, the additional frameworks were both necessary and justified. The following review will continue with findings from current research on culturally responsive and culturally relevant education, culturally responsive science education, novice teacher development, and preservice teacher preparation.

## Literature Search Strategy

For this study, several library databases and search engines were used to retrieve information. These databases included Academic Search Complete, Education Source, ERIC, ERIC and Education Source Combined Search, SAGE Journals, Taylor and Francis Online, and the Teacher Reference Center. These databases were accessed using the Walden University Library.

In searching for current and relevant, peer-reviewed research articles, the following terms were used: *culturally responsive teaching, culturally responsive science education, culturally responsive professional development, culturally responsive novice teacher training, novice science teachers, novice teacher development, novice teacher training, culturally responsive preservice teacher preparation, preservice teacher training,* and *science teacher training.* Because most research pertaining to culturally responsive teaching practices also related to culturally relevant pedagogy, the term culturally relevant was used interchangeably with culturally responsive when searching for articles. Additionally, the term teaching was used interchangeably with pedagogy when searching for relevant articles, due to it generating similar results. To retrieve information necessary for the conceptual framework, other terms used included *cultural awareness, Freire's theory of critical consciousness, cultural awareness in education,* as well as *critical consciousness with culturally responsive teaching*. With all of the aforementioned terms used both individually and in combination with others, a plethora of research articles were located.

In narrowing down the results of the searches, settings for parameters such as being scholarly (peer-reviewed), academic journals, and from 2019-2023 were used. In some cases, research was limited by the time constraints because the articles were relevant but published prior to the year 2019. For these occurrences, Google Scholar was used to search for more current articles that cited the research within the study. These current articles were located using the features of searching by author, publishing date, and noting that it was cited by other articles. The other more current articles were then

retrieved for use in this study. Lastly, ProQuest Dissertations was used to locate dissertations useful in supporting the research for this study.

## Conceptual Framework

The conceptual framework for this study was Paulo Freire's (2017) theory of critical consciousness, or *conscientização*. Also referred to as the theory of the oppressed (Assante, 2020), the theory states that when people can recognize their unequal social conditions, they feel obligated to act to change them (Schauer, 2021). With this theory, there is a heavy emphasis on change through reflection and action. Freire believed that through learning to identify social, political, and economic contradictions, the oppressed could act against the oppressors. Also termed, “see, judge, act” (Schauer, 2021, p. 13), Freire's beliefs directly correlate with education reform due to both yielding a call to action against the injustice of the oppressed.

Developed in response to firsthand oppression and educational hardships, Freire's goal was to humanize the oppressed and liberate them through education (Diaz, 2018). Freire's philosophies were heavily influenced by the theories of Karl Marx, and many other international philosophers such as John Dewey, Erich Fromm, G.W.F. Hegel, and Albert Memmi (Diaz, 2018). With a commitment to eradicating illiteracy, Freire began his literacy efforts in the early 1960s after many years of researching the current state of Brazilian education. During his efforts for literacy, Freire focused on adult literacy, educating thousands of the Brazilian working class with skills to read and write. Through his literacy efforts, the oppressed were liberated through education (Diaz, 2018). Even

though Freire was exiled by the government due to his liberation philosophy, he continued to advocate for the oppressed through his writings and teachings (Diaz, 2018).

For over 50 years, Freire's theory has been used as an antidote to injustice (Assante, 2020) in education. With his theory, Freire rejected the traditional educational approach, transitioning to referring to it as the banking concept of education. This banking concept states that teachers merely deposit knowledge into students and that the students, as passive learners, have no ideas or skills of their own. Since the teachers are the all-knowing beings of the classroom, the students are the oppressed, lacking the knowledge and discipline of their oppressors. With this method, the students are solely collectors of information, lacking the opportunities for critical thinking, creativity, and inquiry (Assante, 2020).

Since its inception, researchers and theorists of varying fields have interpreted Freire's theories of critical consciousness into numerous models and practices (Jones & Donaldson, 2022). Though Freire presented the core elements as critical reflection, critical motivation, and critical action, over time, researchers have developed their own conceptualizations, with greater attention to the elements of reflection and action (Assante, 2020).

Early on, researchers found correlations between Freire's theory and Rappaport's (1981) empowerment theory since they both incorporated psychological and behavioral components, combating oppression (Christens et al., 2016). Gutierrez (1995) connected Freire (2017) and Rappaport (1981) due to Freire's core elements being interpreted as the

psychological factors of group identification, group consciousness, and self and collective efficacy.

Decades later, researchers continue to adopt new interpretations of Freire's elements. Instead of focusing on motivation, R. J. Watts et al. (2011) included the element of political efficacy. R. J. Watts and Hipolito-Delgado (2015) translated the elements into ideals of fostering awareness of sociopolitical circumstances, encouraging critical questioning, and fostering collective identity. On the other hand, Diemer et al. (2016) maintained the elements of reflection, motivation, and action, but included the condition of fostering collective identification. Overall, through the varying interpretations, the elemental theories of critical consciousness have maintained a collective focus on critical social analysis, collective identity development, political self-efficacy, and sociopolitical action (Assante, 2020; R. J. Watts & Hipolito-Delgado, 2015).

This study focused on the cultural awareness of novice science teachers. The framework was appropriate because it shed light on teaching practices and the teacher-student relationship through critical consciousness. Freire's core elements and theories are essential in developing critically conscious teachers (Schauer, 2021). When teachers become critically conscious, they gain awareness of social inequities within their student populations and strive to act through pedagogy and policy (Schauer, 2021). While critical reflection and action are cyclical processes (Freire, 2017), teachers can be empowered to support their students in developing critical consciousness through physical and psychological processes (Freire, 2017). Additionally, the element of critical motivation

encourages teachers of varied experiences and backgrounds to cultivate environments of active learning, therefore developing student skills of critical thinking, discovery, and engagement (Assante, 2020). Overall, as professionals with more significant levels and understanding of critical consciousness, teachers gain greater clarity and increased commitment to their careers (Assante, 2020).

Freire's theory of critical consciousness served as an appropriate lens for this study because its emphasis is on improving social injustices. Research has shown how increased awareness, identity development, political efficacy, and sociopolitical action have impacted and liberated the lives of the oppressed across varying fields (Assante, 2020; Schauer, 2021). In education, teachers must be critically conscious and willing to challenge the pedagogies and policies of the oppressed within and outside of their classrooms (Schauer, 2021). Through practices such as culturally responsive instruction, teachers can intervene and foster a collective identity within their diverse student populations (R. J. Watts & Hipolito-Delgado, 2015). With these interventions, teachers can gain the confidence to change inequitable societal structures through the students of their classrooms (Schauer, 2021). When teachers are prepared with mindsets of critical consciousness, students may exist authentically through relevant and meaningful education and liberation from oppressive societal systems (Freire, 2017).

## Literature Review Related to Key Concepts

The following literature review will present research related to the preparation and development of preservice and novice science teachers. The review will contain studies showing the effects of preparing preservice and novice teachers with culturally

responsive teaching practices. It will also consist of research on the constructs of culturally responsive and culturally relevant education and how these approaches are incorporated into science education. Research conducted through qualitative and case study methods will be used to support the scope of this study. The contents of this in-depth review will be used to synthesize the relevant and current research, validating the purpose and approach to this study.

## Preservice Teacher Development

### *Culturally Responsive Education Courses*

Teacher education programs (TEPs) are mandated to prepare educators with the tools and skills necessary to teach culturally and linguistically diverse students (Kondo, 2022; Moore et al., 2021). However, research has shown that many teachers enter the field still lacking the mindset and skills to be successful in today's academic environments (Brady & Esmail, 2019; Schauer, 2021). Across the country, TEP graduates continue to receive inconsistent preparation or experience inadequate curricula, leaving them ill-prepared to be effective in their classrooms (Carter Andrews, 2021; Kondo, 2022). Though teachers enter the education field with often simplified culturally responsive (CR) skills and awareness gained from university-level courses, they are still unable to connect effectively with their students through the culturally responsive teaching (Kondo, 2022).

Teacher education programs typically include multicultural education courses; however, many programs do not mandate that candidates enroll in and complete the courses (Moore et al., 2021). These courses fail to focus on the mindsets, practices, and

pedagogies imperative for teachers of diverse classrooms. Frequently, MCE courses, and others like them, are not adequately created, still including oppressive policies and practices unsupportive to the liberation of diverse groups (Carter Andrews, 2021). Courses within these TEPs lack clarity and coherence in their curriculum design and implementation. These occurrences potentially lead to inequitable learning and misunderstandings among their teacher candidates (Carter Andrews, 2021). While teacher education programs prepare candidates, they must receive consistent and beneficial learning experiences to meet all students' needs.

Comparable to the issues of unmatched populations of teachers and P-12 students, many teacher educators face challenges in instructing diversity and equitable education considering they are unmatched in their teacher candidate population (Kondo, 2022). Kondo stated that it is difficult for relatively homogeneous populations to teach heterogeneous populations how to further teach heterogeneous populations. Teacher educators are inadequately prepared to fully incorporate MCE content into their TEP courses. Additionally, many instructors lack the culturally responsive teaching knowledge to efficiently teach their own culturally and linguistically diverse students in TEPs (Kondo, 2022). Overall, educators within TEPs need training in the theory of culturally responsive pedagogy, as well as the practices culturally responsive teaching, not just teachers in P-12 learning environments.

In order to successfully prepare teachers of diverse learners, TEPs need to provide multiple MCE courses that occur throughout their program. However, these current singular MCE courses, or individual electives, have shown to be less effective in

preparing quality CR educators (Carter Andrews, 2021; Moore et al., 2021). In addition, while classrooms become increasingly diverse, there is a crucial need to explore other approaches to educating teachers (Kondo, 2022).

Courses must provide meaningful learning experiences through CR teaching practices and immersions to best prepare preservice teachers (PSTs) (Wilcoxen et al., 2021). Furthermore, courses must integrate diversity into all curriculum areas (Brady & Esmail, 2019). Additionally, courses need to be evaluated for appropriate CR teaching practices to ensure that teacher candidates achieve mastery of cultural awareness and critical consciousness (Kondo, 2022). Overall, to revolutionize TEPs, there must be an audit of the curricula used to determine their intentionality and effectiveness for preparing 21st-century teachers (Kondo, 2022; Wilcoxen et al., 2021).

### *A Need for Preservice Teacher Training*

Multicultural education in TEPs provides teacher candidates with the tools necessary to understand and reduce biases about race, ethnicity, class, and gender (Brady & Esmail, 2019). While the American population continues to diversify, the need for PST training becomes more relevant and vital (Schauer, 2021). However, considering the mono-cultural backgrounds of most preservice teachers, a persistent challenge arises with training them to teach culturally and linguistically diverse students (Brady & Esmail, 2019). Furthermore, due to the lack of adequate training, inequitable learning experiences occur, further leading to a gap between teachers and students and between students and the content (Brady & Esmail, 2019).

In preparing PSTs, there is a need to develop culturally-forward mindsets, methods, and educational practices (Carter Andrews, 2021). While these teacher candidates prepare to connect with diverse students, they need to be able to identify and reflect on their personal perspectives, assessing the adequacy of their cultural understanding (Brady & Esmail, 2019; Wilcoxen et al., 2021). Through these reflections, PSTs understand their impact on culturally and linguistically diverse students, leading to a deeper connection to culturally responsive teaching (Lindo & Lim, 2020; Wilcoxen et al., 2021).

Due to inadequate training, preservice teachers graduate from teacher education programs still unprepared to effectively educate their diverse students (Carter Andrews, 2021). As a result, these PSTs become in-service teachers without the necessary understanding of cultural awareness and culturally responsive teaching practices. Research by Brady and Esmail (2019) showed that new in-service teachers often struggle with building connections between the content and their diverse students because incorporating diversity concepts is a daily challenge. Furthermore, because they lacked adequate training in their previous TEPs, these teachers struggled with developing their own understanding of cultural differences and how to utilize them in culturally responsive teaching (Moore et al., 2021).

Due to discrepancies between high expectations and inadequate preparedness, many new teachers become overwhelmed because they are unsupported and challenged with building cultural connections (Moore et al., 2021). Through efficient preservice training, there will be an increase in teacher comfort levels, high-quality learning

experiences, and engagement with challenging issues like race and other ethnic biases (Brady & Esmail, 2019). If teacher education programs sufficiently prepare preservice teachers, they will be more effective and willing to continue as in-service teachers (Moore et al., 2021).

To be true change agents, PSTs must be equipped with proper pedagogies to reach students of all cultural and linguistic backgrounds (Kondo, 2022). Moreover, teachers must be able to bridge the gap between their students' academic content and their cultural backgrounds and lived experiences (Moore et al., 2021). Brady and Esmail (2019) showed that PSTs believe that changes in teacher education programs are necessary to increase and maintain their effectiveness in preparing for 21st-century classrooms. Through the proper training in TEPs, teachers should be able to identify and honor the diversity within their classrooms and utilize it to provide equitable education.

### *Best Practices for Implementation*

Studies by Brady and Esmail (2019) showed that preservice teachers benefit from adequate and meaningful MCE coursework, workshops, and field experiences. Though PSTs value these learning opportunities, they are offered inconsistently across teacher education programs (Brady & Esmail, 2019; Moore et al., 2021). In utilizing the best practices for implementation, teachers may receive the ongoing training, feedback, and support necessary for adequate preparation (Moore et al., 2021). Through quality teacher preparation, candidates gain opportunities to reflect and accept aspects of their own culture while acknowledging the differences in others (Wilcoxen et al., 2021).

In order to bridge the cultural gap within 21st-century classrooms, teachers must first understand the students and their individual backgrounds (Wilcoxen et al., 2021). Immersion activities such as field experiences allow PSTs to learn through first-hand education (Moore et al., 2021). Referred to as the most powerful experience in TEPs, field experiences provide teacher candidates exposure to incorporating culturally responsive teaching practices into their specific content classrooms (Wilcoxen et al., 2021). Furthermore, immersion experiences encourage candidate reflections on how teacher thought processes and actions impact student achievement and professional growth.

Through classroom immersions, preservice teachers may observe culturally responsive lessons provided by teacher mentors and teacher educators (Carter Andrews, 2021). Preservice teachers may learn that through CRT, their lessons can be more effective. This can lead to progressive confrontations of biases and misconceptions, as well as overall growth and a changed mindset (Wilcoxen et al., 2021). With a goal of increasing cultural competence, immersions allow preservice teachers the reflections and constructive conversations necessary to critically understand and appreciate the diversity within their classrooms.

Many teacher candidates are underprepared with culturally responsive components such as content, pedagogy, lesson design, and classroom management (Moore et al., 2021). Because of this, they need to reflect on and gauge their effectiveness and competencies through modeling and field experiences (Wilcoxen et al., 2021). Along with immersion experiences, PSTs must receive adequate feedback and support from

teacher education program instructors (Moore et al., 2021). By incorporating CRT into their coursework, observations, modeling, and field experiences, teacher education programs will be more adept at competently preparing teacher candidates to teach in diverse classrooms (Kondo, 2022).

### *Implementation of Best Practices in Teacher Education Programs*

Wilcoxen et al. (2021) studied 174 preservice teachers from a university to determine how the structure of their teacher education program affected their comfort with, understanding, and use of CRT in urban classrooms. Researchers collected qualitative data over five semesters by assessing participants through surveys conducted before the experience and after the exposure and immersion experiences. These surveys reported the preservice teachers' confidence levels and CRT competency at each experience stage. Based on the results, the PSTs, who initially lacked cultural connections to their urban students, gained success through classroom immersion, support from mentors, and meaningful dialogue with the school's stakeholders.

Researchers concluded that preservice teachers need to be exposed to their students' cultural backgrounds and learn about their communities and the neighborhoods from which they come (Wilcoxen et al., 2021). Furthermore, preservice teachers require engaging and in-depth field experiences to be immersed in their schools' cultures and gain the necessary skills to implement CRT and increase student learning (Moore et al., 2021; Wilcoxen et al., 2021). Lastly, through meaningful conversations, feedback, debriefs, and seminars, preservice teachers gain opportunities for critical reflection with support from mentors, faculty, and coaches in the field (Wilcoxen et al., 2021). In this

study, researchers provide sufficient data showing the need for authentic experiences, including exposure, immersion, and dialogue necessary to sufficiently prepare PSTs for their diverse classrooms.

In a similar study, Johnson et al. (2019) explored the impact of a specific field experience on preservice teachers' skills and understanding of CRT. Termed the Neighborhood Treasure Hunt, this experience exposed PSTs to cultural norms and social dynamics through neighborhood explorations and interviews with community stakeholders. With the community and district connections, preservice teachers acquired pertinent information such as the district's mission, demographics, and initiatives from interviews with district leaders. Additionally, PSTs received further school and student information from conversations with school-level leaders, specialists, and parent groups. Along with these experiences, preservice teachers completed weekly reflections, received support through weekly professional learning communities, and observed teachers capably implementing culturally responsive teaching practices. As a result of this mixed-method study, researchers demonstrated the effectiveness of their field experience activities through surveys, reflections, observations, and questionnaires. Through this implementation, preservice teachers showed changes in mindsets and increased levels of self-efficacy with CRT and overall cultural competency.

Authentic implementation occurs when there is an alignment between the teacher's beliefs and beneficial educational practices, such as CRT (Johnson et al., 2019). This section shows that in order to be effective educators in 21st-century classrooms, preservice teachers must develop culturally responsive teaching practices through quality

impact learning experiences. These authentic learning experiences promote the reflective cycle of self-study, knowledge obtainment, and application, leading to increased levels of cultural competence (Lindo & Lim, 2020). Experiences, such as field immersions, observations, and reflections (Johnson et al., 2019; Wilcoxen et al., 2021), as well as adequately designed CR teacher education program coursework (Brady & Esmail, 2019; Carter Andrews, 2021), prepare preservice teachers with best practices for equitable education. Overall, regardless of cultural upbringing, through competent preparation, all preservice teachers can connect with their future diverse student populations (Brady & Esmail, 2019).

## Novice Teacher Development

### *Impact of Novice Teacher Development on Teacher Retention*

Year after year, teachers transition from the status of preservice to in-service, still lacking skills to ensure student success (Chaney et al., 2020; Meadows, 2021). While these novice teachers enter the classroom, many fail to return in the following years due to unforeseen challenges with instructional implementation, classroom management, and reaching students of diverse backgrounds (Arroyo et al., 2020; Chaney et al., 2020). With the increase in classroom diversity, there is a critical need for novice teachers to be competent in their instructional practices (Meadows, 2021). However, novice teachers complete teacher education programs with rich content and pedagogical knowledge but lacking experience with implementation, especially with diverse learners (Chaney et al., 2020; Hayden & Gratteau-Zinnel, 2019).

Chaney et al. (2020) and Meadows (2021) showed that novice teachers' classrooms are typically more diverse than experienced ones, which often include higher-level, more capable, and lesser-diverse students. Because of their placements in more diverse classrooms and even schools, it is necessary to develop novice teachers' skills adequately (Hayden & Gratteau-Zinnel, 2019). Without proper preparation, novice teachers struggle with low cultural self-efficacy and competency with culturally responsive teaching practices (Gadsden Holliday, 2021; Lakhwani, 2019). When left unsupported, these struggles lead to mental and physical anguish and increase teacher attrition (Donahue-Keegan et al., 2019; Lakhwani, 2019). In order to retain and sustain novice teachers as competent career teachers, educational stakeholders need to provide support through mentoring, professional development, quality feedback, and the overall transition from theory to practice (Arroyo et al., 2020; Borrero et al., 2018). Through adequate and ongoing support, novice teachers may continue in the education field and increase their trajectory for positive, professional growth (Arroyo et al., 2020; B. Brown et al., 2020).

### *Transitioning From Preservice to In-Service Teachers*

When preservice teachers transition to in-service teachers, they must receive effective and growth-oriented support (B. Brown et al., 2020; Chaney et al., 2020). Coming from teacher education programs, new teachers discover the vast discrepancies between their candidacy knowledge and experiences and what occurs in their in-service classrooms (Borrero et al., 2018). New teachers are often forced to learn and develop practices through immersion in their classrooms because TEPs provide limited and

inadequate experiences (Arroyo et al., 2020; Chaney et al., 2020). While new teachers are in the beginning stages of culturally responsive teaching implementation (Borrero et al., 2018), they lack confidence in creating a learning environment suitable for culturally and linguistically diverse students (Meadows, 2021).

Though they may feel competent with their content, novice teachers struggle with culturally responsive practices, including classroom management and teaching (Arroyo et al., 2020; Chaney et al., 2020). With this feeling of incompetence due to being ill-prepared, novice teachers are often overwhelmed and discouraged, struggling to meet the needs of students and the expectations of their administrators and parents (Aronson, 2020; Meadows, 2021). To address the gap between theoretical and practical knowledge, novice teachers need support developing their culturally responsive teaching implementation skills, supplementing the theories gained in their teacher education programs (Aronson, 2020).

Adequate skill development in teacher education programs provides a foundation that supports new teachers with developing competencies to equitably use CRT (Donahue-Keegan et al., 2019; Gadsden Holliday, 2021). This development requires teacher candidates to assess personal biases and assumptions in preparation for culturally responsive teaching as in-service teachers (Donahue-Keegan et al., 2019). Additionally, through this skill development, preservice teachers gain a resilient growth mindset, leading to progressive craft development as in-service teachers (Gadsden Holliday, 2021).

Novice teachers necessitate in-depth training on theoretical concepts and application with instructional practices (Gadsden Holliday, 2021). Since teacher education programs continue to prepare teachers insufficiently, novice teachers need skill development through observations, practice, and mentorship (Aronson, 2020; Arroyo et al., 2020). This support, and opportunities for focused feedback and reflection, are crucial for teachers in their first years of field experience (Arroyo et al., 2020). Professional development through active learning, collaborative activities, and partnerships with mentors and coaches, provides novice teachers with skills and mindsets for 21st-century learning (Arroyo et al., 2020; Chaney et al., 2020). Overall, in transitioning from teacher candidates to professional teachers, it is essential for schools, districts, and other stakeholders to provide adequate support, ensuring proper classroom preparation and avoiding teacher anguish and attrition (Donahue-Keegan et al., 2019; Gadsden Holliday, 2021).

### *Supporting Novice Teachers with CR Pedagogy through Mentorship and Coaching*

Chaney et al. (2020) showed that novice teachers with consistent mentors remain in the education field much longer than teachers with inconsistent or no mentorship. Mentoring is essential for new teacher development because they learn while immersed in a complex educational environment (Hayden & Gratteau-Zinnel, 2019). Adequate and efficient mentorship supports new teachers with the pressures of adjusting to career teaching, especially when utilized with intentional collaboration (Borrero et al., 2018).

Mentors help to nurture and guide new teachers' skills in equitably educating diverse populations (Hayden & Gratteau-Zinnel, 2019). In addition, mentors

exemplifying CRT are vital to new teacher growth (Borrero et al., 2018). Serving as models for observations, mentors also act as resources for culturally responsive teaching and managing classroom and instructional responsibilities (Chaney et al., 2020).

When conducted with fidelity and intentionality, mentoring is vital for developing teacher effectiveness (Chaney et al., 2020). Across the nation, states are required to provide adequate support to novice teachers; However, researchers found that programs are often implemented inefficiently, even failing to ensure mandated mentors to the teachers (Chaney et al., 2020). To ensure the highest levels of support, new teachers need frequent face-to-face mentoring, focusing on the culturally responsive teaching skills required for effective 21st-century education (Chaney et al., 2020; Hayden & Gratteau-Zinnel, 2019).

According to Borrero et al. (2018), an effective peer network of coaches, mentors, and administrators helps new teachers balance school requirements, CRT, and also complements the lack of resources available for diverse students. Furthermore, to enhance professional growth, novice teachers need opportunities to practice their skills while receiving feedback from observations by trained instructional coaches (Arroyo et al., 2020). In a recent study, Gadsden Holliday (2021) created and implemented a culturally responsive coaching framework focusing on novice teachers building community, building knowledge, and building change. From the study, researchers discovered that in order to ensure an equitable learning environment, it is essential for stakeholders to develop novice teachers' culturally responsive teaching skills through effective coaching. Adequate and efficient coaching requires the coaching educators to be

well-versed in culturally responsive teaching practices, culturally relevant pedagogy, and content-specific knowledge, as well as the social impact each of these has on the learning environment. Moreover, as it is beneficial for professional development, meaningful and intentional coaching also promotes the self-reflection skills vital for proper CRT integration. In short, a positive and effective relationship with a coach or mentor can improve novice teachers' self-efficacy, culturally responsive teaching knowledge, and general instructional practices (Arroyo et al., 2020; Borrero et al., 2018).

### *Transitioning From Novice to Career Teachers*

As classroom diversity continues to increase, the professional development of novice teachers is imperative to meet increasing expectations for teacher performance (Lakhwani, 2019). To transition into career teachers, novice teachers must engage in ongoing and intentional professional development (Lakhwani, 2019). According to Gadsden Holliday (2021), effective and continuous professional development is essential to ensure novice teachers properly implement culturally responsive teaching (CRT) and related practices. However, many school systems still provide insufficient professional development for CRT. Because of this, teachers continue to lack the skills to teach diverse students, solely relying on their beliefs and biases.

When novice teachers shift to career teachers, there is still a continual need for feedback and evaluations from observations, as well as opportunities for mentorship and professional learning communities (PLCs; Lakhwani, 2019; Meadows, 2021). Developing teachers call for assessments through surveys, focus groups, and interviews to evaluate the effectiveness of professional development and support from school and

district professionals (Lakhwani, 2019). Adequate professional development is crucial for teacher growth and effectiveness in 21st-century classrooms. Quality experiences, including professional development, mentoring, and PLCs, can improve teacher practice and connect culturally responsive theory to culturally responsive practice (B. Brown et al., 2020; Lakhwani, 2019).

In B. Brown et al. (2020) researchers created their design-based professional learning (DBL) to meet and strengthen the competencies for teachers' professional standards. In this DBL, teachers experienced a framework for inquiry through facilitated activities that supported their ongoing teacher growth. Unlike traditional development sessions, where professionals deliver information without the necessary ongoing support, this DBL provided continuous activities through supportive collaborations with experts. As a result, novice teachers mastered competencies of CRT, including fostering effective relationships, management, and content knowledge for diverse learners. Furthermore, they gained skills for career-long learning, such as inquiry, reflection, and collaborative decision-making.

In shifting to career teachers, these novice teachers gained feedback and support from other teachers, facilitators, and coaches beneficial for professional growth and improving practice. Teachers strengthened their competencies and pedagogical knowledge while learning the necessity of designing meaningful tasks, engaging in critical reflection, and building a supportive network. This study concluded that all teachers require continuous support through ongoing professional learning (B. Brown et al., 2020). Through information and application-rich professional learning, novice

teachers can connect culturally responsive theory to practice (B. Brown et al., 2020; Gadsden Holliday, 2021). When teachers continuously engage in learning and critically reflective practices, they will improve their culturally responsive teaching skills and overall student learning (B. Brown et al., 2020; Lakhwani, 2019).

Career teachers must continue developing and strengthening skills with CRT (Donahue-Keegan et al., 2019). In addition, teachers must be able to acknowledge and honor the diversity of skills, knowledge, and background experiences coming from their diverse student populations (Borrero et al., 2018; Donahue-Keegan et al., 2019). Through professional development, teachers gain support in CRT, as well as critical reflection, critical consciousness, and adaptability, all of which are foundational in effective teaching (Borrero et al., 2018; Hayden & Gratteau-Zinnel, 2019). Overall, while there is a correlation between teacher practices and student academic success, proper culturally responsive instructional practices and experiences are essential for diverse student success (Meadows, 2021).

This section shows that there is a relationship between the preparedness of novice teachers, the quality of their classroom environment, and their retention in the field (Chaney et al., 2020). Novice teachers are expected to display levels of practice and instruction similar to experienced teachers but lack adequate support and training (Arroyo et al., 2020; Meadows, 2021). To be effective change agents, novice teachers have to develop the critical consciousness that leads to authentic learning for teachers and students in the classroom (Borrero et al., 2018). With an emphasis on highlighting students' cultural differences as assets to the classroom experience, novice teachers can

adequately prepare for the 21st-century learning environment (Gay, 2010; Ladson-Billings, 2009).

Striving for educational equity through culturally responsive teaching practices, novice teachers often stray from the traditional norms of academic success, like assimilation and test-taking skills (Borrero et al., 2018). However, B. Brown et al. (2020) and Gadsden Holliday (2021) have found evidence of the need for novice teachers to receive ongoing support to develop their theoretical understanding of CRP into practical application of CRT. To guide novice teachers into career educators, support through collaborations, observations, mentoring, and meaningful professional development is vital (Gadsden Holliday, 2021; Lakhwani, 2019). Additionally, novice teachers need opportunities for feedback and reflection to promote their professional growth (Arroyo et al., 2020; B. Brown et al., 2020). When novice teachers are coached and developed to greater competency levels, there will be higher retention of quality teachers (Chaney et al., 2020). With adequate support and preparation, novice teachers can promote significant change with today's diverse students, leading to more consistent and equitable education (Borrero et al., 2018).

## Culture-Based Science Education

### *Culturally Responsive Science Education*

In science education, culture is often unacknowledged (Dodo Seriki, 2018; Pejaner & Mistades, 2020). Past educational researchers shared the belief that the sciences, as well as the other STEM fields, were factual and acultural (J. C. Brown & Livstrom, 2020) and that culture was only relevant in the humanities subjects (i.e.,

English Language Arts and Social Studies; Dodo Seriki, 2018; Kim et al., 2021). Because of this, science classrooms continue to lack the inclusion of culture and the cultural assets of its students (Barron et al., 2021; Kim et al., 2021). Currently, science education fails to prioritize the learning experiences of diverse students (Barron et al., 2021). Its Eurocentric and westernized content, activities, and assessments do not reflect the steadily increasing diverse student population (Garvin-Hudson & Jackson, 2018; Kayser et al., 2020). These acultural, teacher-centered science classrooms perpetuate the inequity of science education through inconsistent learning opportunities and inadequate instruction, resulting in overall low academic achievement (Dodo Seriki, 2018; Garvin-Hudson & Jackson, 2018).

The Next Generation Science Standards (NGSS) were created for equitable science learning for all students (McGlynn & Kelly, 2018). With these standards, teachers provide students with opportunities to connect their communities to the content, making it more relevant (B. A. Brown et al., 2019; McGlynn & Kelly, 2018). However, B. A. Brown et al. (2019) showed that the NGSS lack explicit examples and tasks, challenging the idea of equitable science for all learners. Furthermore, these standards and the continuing lack of access to high-quality learning opportunities contribute to a persistent achievement gap for minority students in science (D. R. Williams et al., 2018). Additionally, school systems' strict pacing guides, standardized testing, and norm-referenced grading perpetuate the science achievement gap for diverse students, rejecting opportunities for equity in science education (J. C. Brown & Livstrom, 2020; Madkins & McKinney de Royston, 2019).

The disconnect between the races and cultures of students and teachers, as well as the school curricula, causes the gap in science and other STEM fields (Kayser et al., 2020; Kim et al., 2021). Because of the increasing achievement gap and increased classroom diversity, education reform requires the implementation of culture-based initiatives that can reflect the populations served in these educational environments (J. C. Brown & Livstrom, 2020; Garvin-Hudson & Jackson, 2018). These culture-based initiatives address the "cultural mismatch (Kayser et al., 2020)" within today's classrooms, bridging the home and school experiences of the students within them (Tanase, 2022)

With culture-based educational practices, like culturally relevant pedagogy (CRP), educators must focus on students' academic success, cultural competency, and the development of their critical consciousness. This focus must occur while incorporating the students' cultures and backgrounds into their learning experiences (Kayser et al., 2020; Wallace et al., 2022). With these practices, students' home lives and communities are valued and validated as assets to the classroom environment (Barron et al., 2021; Dodo Seriki, 2018).

According to Garvin-Hudson and Jackson (2018) and Ladson-Billings (2009), CRP does not solely focus on diversity. It also focuses on understanding culture, assessment of social injustices, and acts of liberation through education. Though educators have a general understanding of CRP and its connection of students' culture to the content (Garvin-Hudson & Jackson, 2018), research on culturally responsive science

education implementation is minimal (Barron et al., 2021; Madkins & McKinney de Royston, 2019).

Research on culturally responsive learning in science and other STEM fields is inconsistent and not a priority for educational researchers (Barron et al., 2021; J. C. Brown & Livstrom, 2020). Additionally, there is limited research on the professional development, training, and teaching practices for culturally responsive science educators, including preservice and in-service teachers (B. A. Brown et al., 2019; Wallace et al., 2022). This lack of research directly impacts the culturally responsive teaching preparation of teachers because it causes challenges with instructional strategies and the development of materials (Pejaner & Mistades, 2020).

Overall, researchers and educational stakeholders must redesign science education to be equitable for all students (Madkins & McKinney de Royston, 2019). This revision requires culturally responsive teaching practices that connect students' home and school experiences through relevant and meaningful learning (Garvin-Hudson & Jackson, 2018; Gay, 2010). In addition, content must be culturally informed, valuing the assets contributed by the diverse student populations (Barron et al., 2021; Madkins & McKinney de Royston, 2019). Furthermore, educators must be prepared to combat the school's systemic marginalization of students by implementing culturally responsive teaching practices (Wallace et al., 2022). Educators can support all cultures through CRT, and all students can receive high-quality, equitable science education (Barron et al., 2021).

### *Evidence of Implementation of Culturally Responsive Science Practices*

When educators implement culturally responsive teaching practices in their classrooms, there is a necessary shift from teacher-centered to student-centered learning (Tanase, 2022; D. R. Williams et al., 2018). Students gain opportunities to actively engage in science and not just learn the content (D. R. Williams et al., 2018). In culturally responsive science environments, students connect the science content to real-world issues, their communities, and personal interests (Tanase, 2022; D. R. Williams et al., 2018). While students work collaboratively, they increase their engagement, accountability, and concept retention (Barron et al., 2021; Tanase, 2022).

With the proper implementation of culturally responsive science, learning is intentional because it anchors students to their communities through the content (Tanase, 2022). Utilizing their funds of knowledge, the students bring authentic experiences and backgrounds to the collaborative learning environment (McGlynn & Kelly, 2018). In the culturally responsive science classroom, students receive differentiated learning experiences, learning how their funds of knowledge connect to science practices and concepts (Tanase, 2022; D. R. Williams et al., 2018). These experiences develop students into inquirers with higher self-efficacy in their grade-level science concepts (Barron et al., 2021; Pejaner & Mistades, 2020).

While students engage in culturally responsive science education, their teachers hold them to high expectations of success and content mastery (Pejaner & Mistades, 2020; Tanase, 2022). Beginning with creating a safe and supportive learning environment, culturally responsive science teachers strive to foster positive relationships

with their students, families, and communities (O'Leary et al., 2020; D. R. Williams et al., 2018). In implementing culturally responsive science practices, teachers acknowledge and embed students' cultures and interests into content, leading to improvements in students' attitudes, cultural pride, and science achievement (Madkins & McKinney de Royston, 2019; Wallace et al., 2022).

Through activities, surveys, and discussions, teachers learn about students' backgrounds and make science relevant and cultural for their diverse learner population (Tanase, 2022; D. R. Williams et al., 2018). Teachers incorporate the students' prior knowledge and experiences as learning resources into their daily classroom activities, instruction, and assessments (Barron et al., 2021; Madkins & McKinney de Royston, 2019). With the implementation of culturally responsive science education, teachers directly aid students' transformations into scientists, forming their science identity, and also, their critical consciousness and sociopolitical awareness (Barron et al., 2021; Wallace et al., 2022).

In Kim et al. (2021), researchers implemented a culturally relevant, invention-based learning approach to middle grades science students. Students connected the science content to their home cultures by inventing a heating device using objects specific to their homes and cultures. While students planned and designed their devices, they were able to bridge the concepts of heat transfer to items from their own cultures. In focusing on six bicultural students in the classroom, researchers found that students increased their heat transfer conceptual knowledge, the value of their learning experience, and pride in their family and culture.

In another study, D. R. Williams et al. (2018) implemented a science in the learning gardens (SciLG) program in two urban middle school science programs. Based on principles of CRT, SciLG used hands-on, experiential, holistic science to support and improve the inadequate learning experiences of minority students. In this program, students were able to develop their science identities, engaging in real-world, authentic science education. In addition, this garden-based program taught students how their specific science practices and gardening experiences connected to their personal lives and the real world, increasing their scientific interests.

In both studies, researchers determined the need for culturally responsive science implementation based on the widening achievement gap of diverse students in the science content (Kim et al., 2021; D. R. Williams et al., 2018). As a result of these student-centered, culturally responsive implementations, students showed gains in their engagement and motivation within the science content. In addition, these culturally responsive science implementations allowed students to connect the content to their cultures and backgrounds, increasing their competency and interest in the concepts. From these studies, researchers showed the benefit of implementing culturally responsive science practices in increasing student motivation, engagement, value in science learning, and overall science achievement (Kim et al., 2021; D. R. Williams et al., 2018).

By implementing culturally responsive science practices, teachers provide more effective science learning opportunities and increase students' engagement and achievement in science (Kim et al., 2021; Tanase, 2022). In a culturally responsive science classroom, students connect abstract science concepts with real and concrete life

experiences (Kim et al., 2021). Students are provided with differentiated learning opportunities and choices within their activities, cultivating ownership in their learning (Barron et al., 2021; Tanase, 2022). Culturally responsive science teachers explore students' interests and backgrounds, incorporating their funds of knowledge into the content to provide more meaningful science learning (Kim et al., 2021; McGlynn & Kelly, 2018). When students gain inquiry, critical thinking, and collaboration skills, they learn to use their prior knowledge to construct new conceptual understandings and develop their science identity (J. C. Brown & Livstrom, 2020; Tanase, 2022).

### *Impact of Culturally Responsive Science Education on Student Achievement*

Culturally responsive science pedagogy positively impacts minority student achievement because students gain a deeper understanding of the content through rigorous and relevant instruction (B. A. Brown et al., 2019) and aligns with the broader goals of culturally relevant pedagogy (Ladson-Billings, 1995). While learning experiences connect the science content with students' cultures and backgrounds, educators create a classroom sense of community that is vital for positive student progress (Barron et al., 2021; Tanase, 2022). Studies by Kayser et al. (2020) and D. R. Williams et al. (2018) showed that properly implemented culturally responsive science increases student motivation, interest, engagement, content mastery, and test scores. When students experience science through their cultures and personal interests, they develop pride and empowerment, improving overall confidence (Barron et al., 2021; Pejaner & Mistades, 2020). Additionally, through culturally responsive science, students understand the content beyond the classroom, being cognizant of their abilities to use

science to address inequities and injustices for social change (Madkins & McKinney de Royston, 2019; Pejaner & Mistades, 2020). Furthermore, culturally responsive science provides students with opportunities to see themselves as scientists, increasing their science self-efficacy and overall science achievement (Barron et al., 2021; D. R. Williams et al., 2018).

In Garvin-Hudson and Jackson (2018), researchers implemented a culturally responsive summer enrichment program for minority high school students. The program's goal was to provide equitable learning experiences for the marginalized populations of students while combating the excessive summertime learning loss. Through culturally responsive science learning experiences and activities, students were eager to learn more about the content, aspiring to become scientists and other STEM professions. Educators empowered the students, validating their cultures and backgrounds through instructional practices. Furthermore, students' mindsets and science self-efficacies transformed throughout the program, showing improvements in motivation and achievement. Following the program, students were more prepared and anticipating the return to school, including their upcoming science classes. Through this culturally responsive science experience, students gained the mindset that they became scientists and were not just able to do science work. From this study, culturally responsive science was shown to positively benefit diverse students with science because they increased in motivation, engagement, and content retention.

In another study, students displayed similar results when researchers implemented culturally responsive teaching in their middle school science classrooms. Pejaner and

Mistades (2020) studied 8th-grade physics students challenged with inequitable science experiences due to the increasing cultural mismatch in their classroom environments. In the study, culturally responsive science teachers explored students' cultural assets, such as backgrounds and interests, to embed them into the science content. With this incorporation, teachers could provide meaningful learning experiences connected to their students' personal lives and cultures. Through culturally responsive science instruction, students showed improvements in participation, sociopolitical awareness, and science achievement. From this study, researchers conveyed the benefits and processes necessary for equitable science education. With the implementation of culturally responsive science, teachers and students benefitted from their engagement and academic success.

Overall, culturally responsive science positively impacts student achievement because it bridges cultures and content, increasing participation and comprehension for diverse students (Dodo Seriki, 2018; Madkins & McKinney de Royston, 2019). Culturally responsive science helps students develop science interests and confidence, allowing students to see themselves as scientists or with future careers in STEM fields (Garvin-Hudson & Jackson, 2018). Without the proper implementation of culturally responsive science, diverse students will lack the content connections necessary for engagement and motivation, potentially decreasing academic achievement (Tanase, 2022). Furthermore, without culturally responsive science, students may lack awareness of the societal biases within and outside the classroom, missing opportunities for change (Madkins & McKinney de Royston, 2019; D. R. Williams et al., 2018). Proper

implementation of culturally responsive science is essential to transform antiquated science learning practices into learning for 21st-century classrooms (Tanase, 2022).

### *Impact Of Culturally Responsive Science Training on Teacher Instruction and Self-Efficacy*

While educators strive to bridge students' content with their cultures, there must be an alignment of instructional practices and the ideals of CRT (Austin et al., 2019; Garvin-Hudson & Jackson, 2018). To ensure high-quality education, the mindsets and development of teachers are essential because they directly support the academic success of all students (Austin et al., 2019; O'Leary et al., 2020). While teachers aspire to improve their science practices and content engagement, they are motivated to expand their pedagogy by developing the skills needed to include culturally responsive teaching practices (B. A. Brown et al., 2019). However, teachers who lack preparation in culturally responsive teaching practices fail to fully embrace the asset-based mindset and cultural connections necessary for culturally responsive and equitable science learning (Dodo Seriki, 2018; Madkins & McKinney de Royston, 2019). To provide more inclusive and equitable science instruction, teachers must learn skills and practices from specific and relevant training through quality professional development and pedagogical support (J. C. Brown & Livstrom, 2020; O'Leary et al., 2020).

In order to develop the skills and competencies necessary for culturally responsive science teaching, educators must critically self-reflect, assess biases and connect with their own backgrounds before learning about others' cultures (Kayser et al., 2020). When culturally responsive teachers learn to incorporate cultures into their

classrooms, they improve their mindsets and expectations of the students (Kim et al., 2021; Madkins & McKinney de Royston, 2019). Additionally, when these teachers learn to integrate critical thinking and reflections into their culturally responsive content, they aid in developing students' critical consciousness and sociopolitical awareness (Gay, 2010; Kim et al., 2021). Through these competencies, teachers can be academically and culturally inclusive for all students (Kayser et al., 2020).

Developing culturally responsive science teachers requires changes in mindsets, active planning, critical reflections, and an awareness of students as assets (Madkins & McKinney de Royston, 2019). Professional development is critical in producing the skills and competencies necessary for teachers to be culturally responsive (J. C. Brown & Livstrom, 2020; O'Leary et al., 2020). Since science lessons rarely include multicultural concepts, teachers must learn how to develop culturally responsive science lessons- a task often daunting for novice teachers with limited culturally responsive science resources (J. C. Brown & Livstrom, 2020; J. C. Brown et al., 2018). Furthermore, even though culturally responsive competencies tend to improve with time and experience, novice teachers lack both factors and are still held to equal expectations similar to experienced teachers (Kim et al., 2021). Without proper support and development, these novice science teachers struggle with designing and implementing effective culturally responsive science curricula, often leading to teacher attrition (J. C. Brown & Livstrom, 2020; Gadsden Holliday, 2021).

In order to adequately incorporate culturally responsive practices into science classrooms, teachers must have an in-depth understanding of their content and the diverse

students they teach (B. A. Brown et al., 2019; Kim et al., 2021). According to research, science teachers often struggle to address diverse students through the content due to insufficient preparation (Kim et al., 2021). Ideally, teacher education programs provide resources and training to prepare these science teachers to be culturally responsive curriculum designers (J. C. Brown & Livstrom, 2020; Madkins & McKinney de Royston, 2019); However, J. C. Brown and Livstrom (2020) and Dodo Seriki (2018) showed that science teachers often finish teacher education programs without adequate training on culturally responsive teaching practices.

To best prepare these science teachers, education programs must implement culturally responsive lessons, training, and resources into their curricula (B. A. Brown et al., 2019; Madkins & McKinney de Royston, 2019). In addition, educators within these programs must acknowledge and develop the science teachers' mindsets to cultivate and value the asset-based approach of culturally responsive science teaching (Barron et al., 2021). Through this development, there will be increases in science teacher self-efficacy with culturally responsive teaching, leading to more effective lessons and higher student engagement (Barron et al., 2021; Madkins & McKinney de Royston, 2019). The following section highlights and provides evidence of the positive impact of adequate culturally responsive training on novice in-service science teachers.

### *Evidence of Culturally Responsive Professional Development for Novice Science Teachers*

In J. C. Brown and Livstrom (2020), researchers studied the relationship between critical self-reflection and culturally responsive instruction when 17 novice science

teachers engaged in a graduate-level course on culturally responsive teaching. Researchers discovered ongoing inconsistencies in their participants' culturally responsive science implementation linked to a lack of multicultural science education resources. In this case study, the participants built their instructional design capacity while they created culturally responsive science materials suitable to be integrated into their curricula. Focusing on concepts including the influence of culture on science learning, home and community sources of knowledge, and raising sociopolitical consciousness, educators instructed the participants to use reflection to analyze and adapt their instructional design work to the principles of CRT. Following the course, participants gained skills to create competently and ultimately transform their science instructional materials from acultural to culturally responsive.

In another study, participants engaged in a faculty diversity and inclusion curriculum development program (Austin et al., 2019). During the year-long program, faculty members learned how to plan and implement culturally responsive teaching through peer support, training, and feedback. Intending to improve student achievement through the principles of culturally relevant pedagogy and critical consciousness, researchers focused on supporting faculty members with competency and mindset development. Following the program, surveys showed positive growth in the participants' competencies with culturally responsive teaching, including instructional practices, planning, and curriculum reform. Researchers concluded the program's success because there were improvements in teacher effectiveness, teacher self-efficacy, student motivation, and ultimately, student achievement (Austin et al., 2019).

O'Leary et al. (2020) immersed university faculty member participants in a two-day inclusive pedagogy workshop. In this training, participants explored culturally responsive teaching practices through critical reflection, as well as acknowledging and understanding their own implicit biases. Intending to navigate through equitable education barriers such as stereotypes and microaggressions, researchers aimed to improve the mindsets and skills of educating diverse students through culturally responsive teaching. From the training, participants gained reflective practices beneficial in understanding themselves and their students. As a result, participants were eager to further develop their culturally responsive teaching practices, exhibiting their newly gained growth mindset, confidence, and asset-based approaches. Following the study, researchers proved the necessity of the training for all education programs due to its effectiveness in teacher professional development.

With each of these studies, researchers implemented culturally responsive professional development that proved effective with their respective participant groups. As shown through surveys (Austin et al., 2019), interviews (O'Leary et al., 2020), and written reflections (J. C. Brown & Livstrom, 2020), participants gained competencies and confidence to implement CRT into their diverse learning environments effectively. Furthermore, from these training experiences, teachers also gained opportunities for peer support (Austin et al., 2019; Wallace et al., 2022) and skills necessary to reflect critically, assess biases, and ensure equitable education (O'Leary et al., 2020). Overall, these studies show the value and imperativeness of adequate CRT-focused professional development to improve teacher effectiveness and, conclusively, student achievement.

Instructional practices must change to incorporate CRT to address the complex discrepancy between the cultures of students and teachers (Kim et al., 2021). Teachers must consider their students' backgrounds, cultures, and experiences in differentiating their classroom learning experiences (Barron et al., 2021; McGlynn & Kelly, 2018). The research of this section shows the benefits of sufficient CRT-focused teacher training and classroom implementation in addressing the inequities of today's science classrooms (B. A. Brown et al., 2019; Madkins & McKinney de Royston, 2019). Properly implementing culturally responsive science education conducted by trained teachers gives students more opportunities to be engaged and see themselves as scientists (Barron et al., 2021; Garvin-Hudson & Jackson, 2018). Adequately prepared culturally responsive science teachers have increased levels of self-efficacy and are more capable of building students' self-efficacy through high expectations and empowerment from a challenging and relevant learning environment (Austin et al., 2019; Garvin-Hudson & Jackson, 2018). To ensure the proper alignment of students' cultures with science content and competent culturally responsive instructional strategies, the professional development of science teachers is vital (O'Leary et al., 2020).

## Summary and Conclusions

This chapter provided existing and relevant literature supporting the current study on the culturally responsive teaching practices of novice science teachers. The studies within this review focused on significant themes, including preservice and novice teacher development, as well as culture-based science education. These studies are essential because they expound on the critical components of the present study, shedding light on

what is known and the need for further research. Furthermore, studies exploring these themes showed a gap in the literature that was addressed in this study.

With the continuing achievement gap of minority learners in science, research shows the need for culturally responsive teaching. Contrary to antiquated beliefs, science content and its practices are deeply rooted in culture and continue to evolve (Kim et al., 2021; Pejaner & Mistades, 2020). With the proper implementation of culturally responsive science education, teachers can provide equitable learning opportunities for all students by incorporating their cultures and backgrounds into the content (Pejaner & Mistades, 2020). Various studies have shown that culturally responsive science benefits students' critical consciousness, sociopolitical awareness, motivation, and science self-efficacy (J. C. Brown & Livstrom, 2020; Madkins & McKinney de Royston, 2019). In addition, culturally responsive science aids in connecting abstract science concepts to real-life, relevant experiences (Kim et al., 2021).

Though research has shown the desire of teachers to incorporate CRT into their science classrooms (Wallace et al., 2022), it has also shown the need for support with developing curricula and competencies amongst novice teachers (J. C. Brown & Livstrom, 2020; Madkins & McKinney de Royston, 2019). Furthermore, there is limited research on the culturally responsive competencies of novice middle grades science teachers and the specific dispositions toward connecting students' cultural backgrounds and the content. With proper training, teachers can gain skills necessary for effective culturally responsive teaching implementation, improving their self-awareness, mindset, and expectations of diverse students (O'Leary et al., 2020; Stepp & Brown, 2021).

The aim of this study was to address the gap in understanding regarding novice science teachers' culturally responsive teaching practices. The findings from this study may contribute to the literature on the preparation and development of novice science teachers. Furthermore, this research identified specific areas of CRT that may lead to higher teacher self-efficacy, lower teacher attrition, more asset-based mindsets, and, ultimately, more equitable science education. Chapter 3 will outline the methodology used in this study and describe how it connects the existing research base with the exploration of teacher perspectives.

# Chapter 3: Research Method

## Introduction

The aim of this study was to explore the perspectives of novice middle grades science teachers regarding their cultural awareness and use of culturally responsive teaching practices to plan and execute science instruction. Through semistructured interviews, the practices of novice middle grades science teachers were analyzed as they relate to Freire's (2017) theory of critical consciousness and Gay's (2010) principles of culturally responsive teaching. This chapter will include the study's research design and rationale, the role of the researcher, and its methodology, including details of the study's target population selection, instrumentation, and data collection. The conclusion of this section will include information on issues of trustworthiness, including ethical procedures, as well as a summary and transition to Chapter 4.

## Research Design and Rationale

The RQs guiding this study were as follows:

RQ1: How do novice middle grades science teachers describe their experiences with using CRT to plan and implement science lessons?

RQ2: What are the perspectives of novice middle grades science teachers regarding the use of CRT to plan and implement science lessons?

This study explored the culturally responsive teaching practices used by novice middle grades science teachers through the lens of Freire's (2017) theory of critical consciousness and Gay's (2010) principles of culturally responsive teaching. Freire defined critical consciousness as awareness of social, political, and economic inequities

experienced by the oppressed. With this awareness in the education field, teachers can explore factors including race, ethnicity, language, and socioeconomic background at personal levels and through their teaching (Ladson-Billings, 2014; Schauer, 2021). Freire's theory of critical consciousness aligns with the principles of culturally responsive teaching and culturally relevant pedagogy, as both promote the awareness and understanding of students' cultural identities while challenging oppressive educational systems (Ladson-Billings, 2014; Schauer, 2021). As teachers are conscious of the inequities of the oppressed student populations, they may seek culturally responsive teaching practices to ensure equitable learning environments (Schauer, 2021). Through semistructured interviews, teacher participants shared their views and educational practices related to culturally responsive teaching and critical consciousness. These central concepts provided a supportive framework for this study.

A qualitative approach was used to conduct this study. This research tradition provided a naturalistic, subjective approach that may acquire deeper insight and perspective into specific phenomena (Denzin, 2017; Ravitch & Carl, 2021). Qualitative methods, such as interviews and coding, allow for an authentic exploration of views and experiences, leading to opportunities for varied interpretations and constructed explanations (Ravitch & Carl, 2021). This social constructivist approach makes discoveries and justifications for certain behaviors, responses, and occurrences obtainable (Creswell & Creswell, 2018).

Unlike quantitative or mixed methods approaches, qualitative data does not have to fit within specific parameters or scales. Qualitative responses allow flexibility, the

induction of theory, and the incorporation of thoughts and behaviors compared to the rigid quantification of numerical responses (Ravitch & Carl, 2021). This study's responses varied based on the perspectives and experiences of the participants. With this collection of diverse responses, a sufficient number of interviews provided adequate data saturation, consistent with guidance from Ravitch and Carl (2021).

A basic qualitative design provided rich, interpretive, descriptive data. This study focused on participant perspectives of experiences and phenomena without intending to build on specific theories or understand common phenomena like in the grounded or phenomenological approaches (see Merriam & Tisdell, 2016). Additionally, because the exploratory study did not focus on a distinct unit of analysis or its impact of a single bounded system, a case study was not appropriate. Since this study lacked a sociocultural focus, an ethnography approach was also not suitable. Interviews were conducted to gain various, authentic, and detailed responses focusing on how participants made sense of their experiences (see Merriam & Tisdell, 2016). These interviews did not require participants to share their experiences through narratives but as descriptive responses to the semistructured questions. This study's basic qualitative design allowed for discovering and understanding perspectives, identifying common themes, and analyzing authentic, information-rich data (see Merriam & Tisdell, 2016).

## Role of the Researcher

For this study, I collected data and analyzed the perspectives of the participants. As a novice researcher, my attentiveness, precision, and preparedness assured data saturation. Participants were engaged critically and reflexively to produce rich qualitative

data through the study's semistructured interviews (see Yoon & Uliassi, 2022). As an observer, I capitalized on listening and interpreting visual cues to interpret participant responses efficiently (see Smit & Onwuegbuzie, 2018). Lavee and Itzchakov (2023) showed that adequate listening skills were essential, leading to higher rapport, authenticity, trust, and insight in an interview. Because of potentially shared experiences with the participants as a former middle grades science educator, conducting the interviews with an open mind and an impartial yet attentive stance was essential.

There were no prior personal or professional relationships with the participants in this study. Though the participants may have shared similar work settings or associates, no other connections or potential ethical issues existed. To establish trustworthiness and credibility, I remained as unbiased as possible, limiting the sharing of personal information with the participants, as recommended by Collins and Stockton (2022). In cases where shared positionality existed between the participants and me, it contributed to developing more profound levels of trust, as noted by Merriam and Tisdell (2016). Confidentiality ensured through consent forms and verbal confirmation. To ensure data accuracy, participants also validated their own responses by reviewing them as collected after the interview (see Nassaji, 2020). After the interview process was completed, participants received a $10 Amazon gift card as a thank-you for their time.

## Methodology

This basic qualitative study focused on the perspectives of novice (first 5 years of teaching), middle grades (6-8) science teachers. The study presented the participants' views and experiences of cultural awareness and how they used culturally responsive

teaching practices to plan and execute science instruction. Information-rich insight and opportunities for in-depth interpretations were gained based on the authentic classroom experiences of the participants.

**Participant Selection Logic**

The population for this study was middle grades science teachers with 5 years or less of classroom experience throughout the United States. The target population consisted of novice middle grades science teachers employed at urban or suburban middle or K-8 schools in a Southeastern United States school district. The sample included teachers educated through traditional education programs who were drawn from the target population.

Participants were selected using a purposive sampling strategy. In a qualitative study, a purposively selected sample is logical for increasing the in-depth understanding of a conceptual framework (Campbell et al., 2020). Purposive sampling requires selecting participants based on their alignment with the study's purpose and objectives (Bhardwaj, 2019; Campbell et al., 2020). In this study, participants were required to be middle grades science teachers in their first five years of teaching and currently employed in a Southeastern school district. Through purposive sampling, the selected participants were equipped with the knowledge and experiences necessary to provide rich data for analysis, supporting the achievement of data saturation through ongoing interpretation (Bhardwaj, 2019; Merriam & Tisdell, 2016).

The purposive sampling for this study occurred within one Southeastern school district, which provided an adequate sample size in the desired range of 10–15

participants. The primary method for obtaining participants was through contacting the principals within the study's district, and sending email invitations to qualified teachers, defined as middle grades science teachers within their first 5 years of teaching. Participants were also recruited through flyers posted in the teacher workrooms of participating schools, as well as through social media posts on Facebook. To ensure adequate data saturation, a snowball sampling strategy was additionally employed within the district, utilizing the purposively sampled participants. Also referred to as chain or referral sampling, the snowball sampling method recruits new participants based on the referrals of current participants (Merriam & Tisdell, 2016; Ungvarsky, 2020). With the snowball sampling strategy, participants were asked to recommend colleagues within the district who met the inclusion criteria of being middle grades science teachers in their first five years of teaching. Teachers outside of these parameters were excluded from the study. The new participants were contacted and interviewed, and the process was repeated until data saturation was achieved, consistent with snowball sampling descriptions in both Merriam and Tisdell (2016) and Ungvarsky (2020). This strategy was beneficial as it provided another way to find participants. Because it was based on connections, it readily established trust and rapport with new participants (see Ungvarsky, 2020).

As the snowball strategy can create bias due to shared experiences and ideas of connected participants (Parker et al., 2019; Ungvarsky, 2020), it was important to remain cognizant and thorough with the collected data. Additionally, with the snowball strategy, the participants may homogenize due to common associations (Parker et al., 2019). To

address this concern, the sample's diversity was strategically maintained by selecting participants who represented a balance across grade levels (6-8), school settings (middle and K-8), and teaching backgrounds. Referrals who did not meet the inclusion criteria of being novice middle grades science teachers within their first 5 years of teaching were not selected for the study. When additional participants were needed, the purposive sampling strategy was continued within the district until data saturation was reached.

The study was conducted within one Southeastern school district. The study's school district was led by the local board of education, including the district's superintendent and administrative staff. This organization controls all public K-12 schools located within this Southeastern school district. In order to conduct the study within the district, an agreement with the superintendent and administrative staff was obtained. Following the receipt of the signed partner organization agreement with the district's administration and Walden University Institutional Review Board Approval, I sent principals within the study's district an email invitation for participants best fit for the study. The principals' email addresses were retrieved from their schools' informational websites.

Additionally, participants were invited to the study directly via a recruitment flyer and an approved social media post. As a member of the social media group, recruitment posts were permitted. These correspondences included information regarding the study and the inclusion criteria desired; however, no data were collected prior to consent being received. Interested participants who met the criteria were encouraged to respond to the invitation via email.

After participants responded about participating in the study through email, they received a follow-up email that included the informed consent document, scheduling information, as well as a link and corresponding QR code to a preliminary contact form. Upon clicking the link, the potential participant was taken to the brief contact form that collected the participant's name, email address, phone number to allow for the scheduling of an interview. For this preliminary contact form, it was assumed that the participants would provide accurate information in their responses since the participants self-selected.

If the surveyed educators met the criteria of being middle grades science teachers in their first 5 years of teaching, they were enlisted to join the study. If multiple participants met the criteria, the sample was selected based on the educators' years of experience, with newer teachers having priority. Because this study presents the perspectives of novice science teachers based on their preparations from teacher preparation programs, teachers with less certified classroom experience were prioritized. The teachers most recently removed from the preparation programs had more detailed perspectives about the programs' courses compared to teachers who had been working in certified classroom longer periods of time. All qualified teachers were not invited to participate in the study.

### *Sample Size and Data Saturation*

Compared to the designs of phenomenology, narrative inquiry, and case study forms of qualitative studies for which fewer than 10 participants are sufficient (Subedi, 2021), this basic qualitative research study targeted 10-15 participants, with data saturation determined through ongoing analysis when no new themes emerged. Based on

the anticipated saturation of quality and information-rich interview responses, a minimum sample size of 10 participants is sufficient (see Merriam & Tisdell, 2016; Patton, 2015). This sample size can allow for in-depth interpretation of the participants' perspectives within the scope and feasibility of the study.

While larger sample sizes can yield valuable data, they are not typically needed in basic qualitative studies where the focus is on depth of understanding (Subedi, 2021). In this study, a smaller sample size allowed for thorough exploration of responses and the time needed to build participant trust for honest and open sharing. A sample of 12 participants was established as sufficient; however, data saturation was determined through ongoing analysis and was considered reached when no new information emerged.

### *Participant Selection Procedures*

For this study, participants were middle grades (grades 6-8) science educators within their first 5 years of teaching who were currently employed in the study district. Teachers outside these parameters were excluded from the study. Before identifying and selecting participants, the necessary documentation to obtain approval from the Walden University Institutional Review Board was completed and submitted. The participant selection process began following IRB approval (Approval No. 06-21-24-0241635) and the receipt of site authorization from the study's district through its signed partner organization agreement. To identify potential participants for the study, the principals and assistant principals of the 15 middle and K-8 grade schools within the study school district received an email invitation. This email correspondence included an introduction

of the researcher, a description of the study, and a request for connection to potential participants based on specified criteria. The correspondence also included the request to forward the researcher-produced recruitment flyer to all eligible participants. The recruitment flyer included a brief description of the study, participant eligibility criteria, and contact information for potential participants to respond if interested.

Additionally, the social media platform, Facebook, was used simultaneously to locate potential study participants within the target population. Participants within the Southeastern school district were recruited and contacted through an approved Facebook post to the local district educator groups, as well as through direct messaging. As a member of the social media groups, recruitment posts were permitted. Personal networks of associates from local university systems were also leveraged for other connections to potential participants. Approximately 2 weeks after the initial recruitment efforts, as there were insufficient potential participant responses, the snowball sampling method previously described was employed through social media platforms and personal networks.

When potential participants responded through email expressing their interest in participating in the study, they received a follow-up email with the informed consent document and information for scheduling. The informed consent document included the study's purpose and disclosed the participant's right to be fully informed with details of the study and their liberty to withdraw from the study at any time. It also confirmed the confidentiality of the participant and their responses, as well as established the expectations of the participant in the study (see Purna Singh et al., 2023).

The follow-up email correspondence also included a link and QR code for a brief contact form, which collected participants' names, email addresses, and phone numbers to allow for scheduling interviews. Potential participants were given approximately two weeks to complete this form. After receiving informed consent, participant eligibility was confirmed during email follow-ups, where teachers shared information about their teaching roles and years of experience. Based on this information, newer teachers were given priority for participation. Any further contact occurred using the email addresses and telephone numbers from the initial form. All respondents to the form received an email of appreciation for their time and responses. However, not all respondents were selected to participate in the study.

Once the participant pool was finalized, the selected participants were contacted via telephone or email. Participants received an email signifying their official acceptance to participate in the study. The email also included verification of the participant's willingness to participate and their scheduled time and date for the interview.

**Instrumentation**

Data were gathered for this study through the use of a researcher-developed interview protocol (see Appendix) to explore participants' perspectives through semistructured interview questions. Interviews were conducted on the video conferencing platform, Microsoft Teams. The interviews were recorded and transcribed through the conferencing platform's video recording tool, and stored on a personal computer in a secure, password-protected file. As the sole collector of data, executing the interview

protocol, recording interviews, correctly transcribing responses, and establishing the credibility of responses through member checking was vital.

In qualitative studies, interviews promote versatility and flexibility in the data collection process. However, interview protocols aim to establish quality and consistency in the process (Billups, 2021; Braaten et al., 2020). Interview protocols are essential in guiding the interview process, standardizing anticipated responses, and ensuring interview questions' validity (Billups, 2021). Adequate interview protocols provide participants with the support necessary to correctly interpret and respond to interview questions with detailed and specific information (Braaten et al., 2020). For this study, participant clarity of the interview questions was necessary to promote quality, information-rich responses.

Semistructured interviews were used to collect data in this study. Semistructured interviews are often described as organized or purposed conversations, commonly used to collect rich, qualitative data (Ahlin, 2019; Bearman, 2019). Semistructured interviews allow the participants to engage with meaningful questions and prompts that activate deeper, distinct, and intricate thoughts and experiences relative to a specific phenomenon (Bearman, 2019). This authentic interaction with participants is flexible, guided by the natural yet structured flow of questions, prompts, and new findings (Ahlin, 2019).

Semistructured interviews allowed for in-depth, nuanced information directly from respondents connected to the study's phenomenon and framework (Adeoye-Olatunde & Olenik, 2021; Ahlin, 2019). These interviews provided more profound insight into participants' perspectives and experiences. The adaptability of semistructured

interviews is ideal for exploratory studies as interview's direction can develop to dive deeper into complex discoveries, retrieving higher levels of rich, quality data (Adeoye-Olatunde & Olenik, 2021). However, because semistructured interviews allow participants to explore different relevant areas, consistency across responses may be reduced, which is a common consideration in this method (Ahlin, 2019).

Professionals currently in the field were interviewed to allow sharing of complex and detailed data specific to the study phenomenon. When these data were retrieved directly from sources in the field, the study's trustworthiness increased significantly. Trustworthiness is strengthened when participants with direct experience of the phenomenon share detailed accounts during the interview process (Adeoye-Olatunde & Olenik, 2021; Ahlin, 2019). Using the structured interview protocol, which included consistent question wording and procedures across all interviews, supported the collection of adequate data while maintaining consistency, trustworthiness, and reliability.

To prepare for data collection, an interview protocol was developed (see Appendix) specific to the study's frameworks, purpose, and RQs. Focusing on the ideals of culturally responsive teaching (Gay, 2010) and critical consciousness (Freire, 2017), 16 questions and follow-up prompts were formulated for the semistructured interviews. These questions and prompts were directly derived from this study's problem, purpose, and framework to allow the RQs to be answered. The main goal of these qualitative interviews was to fully understand the meaning of the participant's responses (Billups, 2021). The participant responses were validated considering the interview questions were

appropriate and focused on the study's framework. Information was gathered through participants' verbal responses during interviews. The exploratory semistructured interview process yielded sufficient data that were clearly applicable to answering the study's RQs.

**Procedures for Data Collection**

Once participants agreed to the study, they received a reminder of the informed consent document previously emailed and the steps necessary to provide consent within the interview. With this document, participants were able to understand their rights within the study and determine if they would continue through the process. Approximately 3-5 days before the interview process, participants received the study's interview logistics to adequately prepare for a sufficient time and the appropriate location. Participants received the option of a video conferencing platform to allow for user preference and accessibility. Participants engaged virtually through Microsoft Teams. Once the interview date and time were established, participants received an email with their scheduled interview information and corresponding meeting link.

The interview protocol was used for all interviews, beginning with the introduction script (see Appendix). Participants were reminded of the study's purpose, the previously agreed upon informed consent document, and an approximate time for the interview, which was expected to take approximately 45-60 minutes. Participants were informed that the interview would be audio and video recorded for comprehensive data collection and transcription, although only the audio portion was used for data collection. A back-up audio recorder was a secondary tool to the video conferencing platform's

video recording feature in case of technology failure. Participants' identities and responses were linked to alternate alphanumeric aliases to ensure the confidentiality of their specific profiles. Participants received insight into the roles of particular Walden University faculty that would have access to responses from the study. Participants received a description of the semistructured interview process and had the opportunity to ask any questions before beginning the interview. Once the participant was ready, the interview commenced.

This study collected data from audio and video recordings of the semistructured interviews of 12 participants. The responses gathered in this study provided direct insight to the participants' descriptions of the phenomenon (Roberts, 2020). The semistructured interview questions were developed using the study frameworks of critical consciousness (Freire, 2017) and culturally responsive teaching (Gay, 2010). The follow-up prompts were guided by specific discussion points outlined in the interview protocol and were necessary for probing, clarification, and deeper insight into the participants' responses (see Ahlin, 2019).

Following the semistructured interviews, the Microsoft Teams recordings were transcribed using Otter.ai, and the transcripts were reviewed to ensure that all questions, prompts, and responses were captured entirely and accurately. Following the review of the transcribed interview and the removal of obviously spurious comments and words like "ah" and "um," participants received a copy to member check their own responses' accuracy and ensure that their responses truly reflected their answers. Member checking promotes an increase in the credibility and validity of the participant data (Adeoye-

Olatunde & Olenik, 2021; Ahlin, 2019). Participants were emailed their transcripts and asked to make any corrections and return them within 5 business days. No changes were made during this member-checking process, and all transcripts were therefore considered accurate as transcribed.

Data collected from the transcriptions were verified through member checking to ensure the validity and credibility of the participants' responses (see Ravitch & Carl, 2021). No changes were made during this process. After the interviews, participants were reminded of the confidentiality procedures used throughout and after the process. Participants' information was securely stored in a password-protected file on a personal computer and will be securely destroyed 5 years after the conclusion of the study. Participants received verbal and written expression of gratitude for their participation in the study, as well as $10 Amazon gift cards virtually, as a thank-you for their time and efforts. Participants were given contact information should any questions, concerns, or supplementary insights arise following the interview process, although follow-up data were not collected.

**Data Analysis Plan**

For this study, data were collected from semistructured interviews. These semistructured interviews yielded data to explore the perspectives of novice middle grades science teachers regarding their cultural awareness and use of culturally responsive teaching practices to plan and execute science instruction. Through the analysis of responses from multiple participants, there was an increase the quality and credibility of the collected data (see Megheirkouni & Moir, 2023).

Semistructured interview questions were employed to explore participants' perspectives in a natural, conversational approach that would produce complex and nuanced data (see Bearman, 2019). The questions of the semistructured interview directly connected to the study's RQs:

RQ1: How do novice middle grades science teachers describe their experiences with using CRT to plan and implement science lessons?

RQ2: What are the perspectives of novice middle grades science teachers regarding the use of CRT to plan and implement science lessons?

Specific interview questions were developed to reflect the framework and purpose of the study through distinct terminology, formatting, and concepts. All interview questions connected to the frameworks of CRT or critical consciousness to ensure adequate and rich data from the participants' responses. The study's interview protocol contained the full set of interview questions and follow-up prompts (see Appendix).

After the interviews, the audio recordings were transcribed using the video conferencing platform’s transcription software, then analyzed. The collected data were disaggregated using the transcribed interviews and online software. Participants were also able to member-check their particular interview responses to ensure accuracy. As the data set was abundant yet detailed, codes, themes, and categories were employed for organization and enhanced interpretation (Ravitch & Carl, 2021).

The data were coded using the work of Saldaña (2021) and analyzed following Braun and Clarke's (2006) six-phase process of inductive thematic analysis. This process

was used to derive relevant themes that aligned with my RQ and the study's literature. The following six phases were used to guide the study's data analysis.

***Phase 1- Familiarization With the Data***

In this phase, I immersed myself into the data. Reviewing the data analytically and without bias, I gained deeper levels of understanding with the data. I took supplemental notes while reading and examining all facets of the interview process data.

***Phase 2- Generating Initial Codes***

In this second phase, I used my preliminary interpretations of the data to form codes. These initial codes were gathered from the interview responses. Following the identification of initial pieces of data (Saldaña, 2021), the initial codes were grouped into secondary codes, which were derived from common words, ideas, and phrases identified from the initial codes. These acquired secondary codes specifically connected to the study's RQ and were organized appropriately by main ideas and similarities into initial themes in the following phases.

***Phase 3: Constructing Themes***

In this phase, I inductively searched for themes from the data's codes and categories. These secondary codes and categories delved deeper into the data, organizing the data into more significant ideas. Using visual organizers, I coordinated clusters of categories derived from the initial codes. Then, I developed themes relative to my RQ based on the correlations of the categories.

***Phase 4: Reviewing Themes***

In this phase, I reviewed and finalized the study's themes and subthemes with the development of a thematic map. The themes were assessed to ensure that they are standalone and not overlapping. Additionally, they were assessed for their appropriateness, and usefulness. I reviewed each theme independently to confirm that it is supported by sufficient data and relevant to the RQs.

***Phase 5: Defining and Naming Themes***

I generated clear names of the study's themes for feasible organization and identification. The finalized themes contributed to the development of detailed descriptions that defined clear meanings and connections to the data. Each theme was specifically designated, defined, and supported with evidence from the responses of the study's participants.

***Phase 6: Producing the Report***

In this final phase, I drafted the report of my findings in Chapter 4. This report presented themes, provided supporting data, and explicitly aligned the themes to the study's RQs. The report included quotes from participants that aided in addressing the RQs guiding this study.

The distinct themes derived from the data's codes and categories were used to address the study's RQs and explain the study's overall phenomenon (see Ravitch & Carl, 2021; M. Williams & Moser, 2019). In addition, outlier responses and discrepant data were reviewed against the framework to determine whether they should be included as their own theme or excluded if not aligned with the study.

## Issues of Trustworthiness

Qualitative research provides a naturalistic opportunity for researchers to make meaning of human experiences (Adeoye-Olatunde & Olenik, 2021; Megheirkouni & Moir, 2023). The use of semistructured interviews is beneficial to ensure rigor and thick, rich data while demonstrating the trustworthiness of the findings (Stahl & King, 2020). Trustworthiness is essential in qualitative research. For this study, Lincoln et al.'s (1985) criteria for trustworthiness was applied. These criteria include credibility, transferability, dependability, and confirmability (Megheirkouni & Moir, 2023).

Credibility refers to the assurance of findings as truthful or valid (Ahlin, 2019). The credibility of qualitative findings is fundamental because it supports the interpretation of the collected data. The semistructured interviews increased the validity of this study by providing in-depth, rich data from sources directly connected to the phenomenon (see Ahlin, 2019). Credibility of participant responses was enhanced through prolonged engagement, building trust with participants throughout the study, which aligns with the literature (Megheirkouni & Moir, 2023; Stahl & King, 2020). Participants received relevant, open-ended questions, with the use of probes as necessary, to highlight and clarify details, promote a deeper exploration of content, and ensure the accuracy of findings (see Roberts, 2020). Higher levels of credibility were established by checking notes, video and audio recordings, and informal conversations before the interview, a strategy noted in the literature (Megheirkouni & Moir, 2023).

In qualitative studies, exact replication is unlikely. However, the ability to transfer findings from one context to another is essential in expanding the understanding of a

phenomenon (Ahlin, 2019; Megheirkouni & Moir, 2023). Transferability requires sufficient detailed information to be applied to other settings and with other respondents (Adeoye-Olatunde & Olenik, 2021). For this study, transferability was supported with the appropriate selection of participants and the use of questions designed to provide rich, usable data, consistent with the literature (see Megheirkouni & Moir, 2023). The participants varied in cultural and educational backgrounds but shared common experiences. Additionally, participants were asked thought-provoking, open-ended interview questions to ensure rich, detailed descriptions that may apply to other contexts (see Stahl & King, 2020).

Dependability refers to the data's consistency or reliability (Ahlin, 2019). Due to the format of semistructured interviews, dependability may be inconsistent as all participants' responses vary, leading to distinct follow-up questions and prompts (Ahlin, 2019). Dependability for this study was established with the use of the planned, organized interview protocol, asking of the same questions in each interview, and noting any modifications (see Ahlin, 2019; Roberts, 2020). The dependability of the findings was ensured through the use of consistent processes in the interview protocol

Confirmability legitimizes the research data acquired from the participant's responses (Adeoye-Olatunde & Olenik, 2021; Megheirkouni & Moir, 2023). Confirmability is imperative to reflect objectivity to the data, eliminating bias and misinterpreting findings. Potential biases were acknowledged in order to intentionally remain objective with the collected data, therefore ensuring confirmability. Leading questions were omitted in the interview in order to remain objective in questioning.

Additionally, following the interview, participants were enlisted to member-check responses and support accuracy (see Megheirkouni & Moir, 2023). Being critically self-reflexive in assessing personal biases ensured proper, objective data interpretation for this study, as discussed in the literature (Megheirkouni & Moir, 2023).

## Ethical Procedures

To ensure initial ethical access to participants and data collection, proper documentation was submitted for site authorization by the study district and approval by the Walden University Institutional Review Board (IRB). Following the IRB approval (Approval No. 06-21-24-0241635), participants were recruited through email correspondence to administrators in the study's school district. Additionally, participants were recruited through posts in educator groups on social media. There was no prior contact with the participants; however, there may have been common associates within the field. In this case, the participant's identity and responses were kept confidential.

The assurance of participant privacy was critical throughout the study to build trust and ensure honest, open responses. Because I did not have a direct association with the school district, the participants were more willing to share openly and truthfully, with confidentiality assured. Rapport was established with the participants while maintaining confidentiality by using aliases in the study's documentation. Participants were aware of the specific Walden University faculty that would have access to their identity and responses. After the study, participants' data were securely stored in a password-protected file on a computer. Any paper documentation was stored in a lockbox. All data and

documentation will be appropriately disposed of 5 years after the study's conclusion, following Walden University's policy for data collection.

Since time is valuable yet limited for the education professionals in the study, participants received compensation as a display of gratitude. Participants who completed the study received an Amazon gift card. Gift cards were valued at $10 and sent virtually to the participants.

## Summary

This chapter consisted of the study's overall research design and rationale. This study used a basic qualitative approach to explore the perspectives of novice middle grades science teachers regarding their cultural awareness and use of culturally responsive teaching practices to plan and execute science instruction. The chapter also presented my role as an observer, omitting any personal connections or biases to the participants and data of the study. Furthermore, this chapter contained the in-depth recruitment procedures and criteria that was used to engage and select participants for the study.

Chapter 3 also presented insight into the specific methodology used to collect and analyze data in this study. A researcher-developed interview protocol was used to ensure the study's trustworthiness. Semistructured interviews were used as the primary source of data collection for this study. Semistructured interviews were employed because they provide a natural, conversational approach to gathering information (see Ravitch & Carl, 2021). This chapter concluded with the specific data analysis procedures, methods of

ensuring a proper and ethical qualitative study, and a summary. The contents of Chapter 4 will present the collection and analysis of the data, and the results of the study.

# Chapter 4: Results

## Introduction

This chapter presents the study findings, based on data collected from semistructured interviews with novice middle grades science teachers. The findings from this basic qualitative study address the experiences and perspectives of middle grades (6–8) science teachers in their first five years regarding their use of CRT to plan and execute science lessons. The problem that was addressed in this study was that teachers without sufficient preparation to support culturally diverse learners are teaching middle grades science (Evans et al., 2020; Schauer, 2021). This study addressed the following RQs:

RQ1**:** How do novice middle grades science teachers describe their experiences with using CRT to plan and implement science lessons?

RQ2: What are the perspectives of novice middle grades science teachers regarding the use of CRT to plan and implement science lessons?

This chapter will include brief descriptions of participants' educational backgrounds and current teaching experiences, followed by a review of the data collection and analysis processes used to uncover the study's themes. Next, the chapter will include evidence of the data's trustworthiness, followed by the presentation of the results with tables and participant responses. The chapter will conclude with a summary of the findings, setting the stage for the recommendations, implications, and conclusions in Chapter 5.

## Setting

Participants of this study taught in various areas within a Southeastern U.S. school district. Due to the vast size of the school district, teachers had varying experiences with district leadership and support received within their school and content area. Additionally, with the time taken to retrieve and interview participants across the large school district area, teachers were at various points within their school year. As the teachers varied in their pacing and benchmark points within their content, their emotions also varied as they prepared for standardized testing, managed seasonal behavioral challenges, and dealt with changes within their school administration.

## Demographics

There were 12 participants interviewed for this research study. All participants were middle grades (6-8) science teachers at Title I public schools within a Southeastern U.S. school district. All of the teachers taught at schools with high populations of English Language Learners/Multilingual Learners and varying socioeconomic statuses of students. There were 10 female and two male participants. Additionally, seven of the participants identified as Black/African American, one as Asian, one as White/Caucasian, one as Latinx/Hispanic, and two as of mixed race. This demographic information was collected during email follow-ups while scheduling interviews. As only novice teachers qualified for the study, all participants were within their first 5 years of teaching. Participants' ages varied as teaching was a first career for some, and a second for others.

Of the participants, five held a master's degree, and the remaining seven had at least one bachelor's degree. Many individuals held noneducational degrees and entered

the field through various methods, including lateral entry programs. Specifically, three of the participants obtained certification through a traditional college or university-level education program. Four of the participants earned certification through the Teach for America lateral entry program, four completed a district-led residency academy, and one was certified through their master's program. Each participant received a code for the study's interview. Table 1 details demographic information of the study's participants and their schools.

**Table 1**

*Participant Demographics*

| Participant code | Certification program | Years exp. | Grade level | School description |
|---|---|---|---|---|
| A | Traditional | 5 | 6th | Low SES, urban |
| B | Teach for America | <1 | 8th | Varying SES, world language school, suburban |
| C | District Teacher Residency | 1 | 6th, 8th | Low SES, high transient population, urban |
| D | Master of Arts in Teaching | 2 | 7th | Low SES, IB school, rural |
| E | District Teacher Residency | 2 | 6th | Low SES, urban |
| F | District Teacher Residency | 2 | 6th | Low SES, urban |
| G | Teach for America | 2.5 | 7th | Varying SES, suburban |
| H | Teach for America | 2 | 6th | Varying SES, suburban |
| I | Teach for America | 2 | 8th | Low SES, urban |
| J | Traditional | 5 | 8th | Varying SES, global magnet school, Suburban |
| K | Traditional | 5 | 6th | Low SES, urban |
| L | District Teacher Residency | 5 | 6th | Low SES, urban |

## Data Collection

After IRB approval, the recruitment process involved using social media platforms and contacting school administrators and district personnel. Because teachers were out of school for summer break, it was challenging to locate participants directly through the school systems. Digital recruitment flyers were posted in multiple educator groups on social media. From the social media groups, there were a surprisingly high number of responses from potential participants. However, upon further investigation, it became evident that these individuals did not meet the study's eligibility criteria of being middle grades (6-8) science teachers within their first 5 years of teaching in the study district, and they were therefore not qualified to participate. Four participants from social media qualified for the study after expressing interest, completing the informed consent document, and the preliminary contact form.

Outreach to district principals, along with snowball sampling, proved effective in identifying additional participants. Many principals and school administrators were willing to share contact information for novice teachers, expressing hope that participation in the study would offer support or opportunities to connect with others. In total, 12 teachers met the study qualifications, completed the informed consent and preliminary contact form, and participated in interviews.

Participants received Microsoft Teams links upon scheduling their appointments. Interviews were arranged across various days and times, including weekday evenings and weekend mornings, to accommodate availability. Conducting the interviews virtually provided greater flexibility in scheduling. Each participant was interviewed only once,

and the semistructured interviews lasted between 40 minutes and 90 minutes. Table 2 displays the data collected from participants.

**Table 2**

*Data Collection from Participants*

| Participant | Date interviewed | Duration | Pages of transcript |
|---|---|---|---|
| A | 10/23/2024 | 32:20 | 12 |
| B | 11/11/2024 | 54:32 | 26 |
| C | 10/23/2024 | 32:26 | 19 |
| D | 10/28/2024 | 47:53 | 23 |
| E | 12/19/2024 | 34:21 | 13 |
| F | 12/13/2024 | 56:46 | 35 |
| G | 12/18/2024 | 21:57 | 13 |
| H | 12/16/2024 | 43:07 | 26 |
| I | 03/31/2025 | 1:16:16 | 35 |
| J | 03/31/2025 | 56:42 | 21 |
| K | 04/06/2025 | 23:56 | 17 |
| L | 04/10/2025 | 1:11:57 | 56 |

The virtual interviews were video- and audio- recorded using the Microsoft Teams software, as well as transcribed through Otter.ai. Additionally, participant eligibility had already been screened prior to scheduling, based on their responses during the email follow-ups, where they confirmed after consenting their years of experience, grade levels taught, and subject area. During the interviews, background information and observational notes to assist in analysis were also documented and included along with

each participant's data. All interview materials were securely stored on a password-protected computer.

Compared to the original plans presented in Chapter 3, there were few variations in the data collection process. The initial search for participants focused exclusively on middle grades (6-8) science teachers within their first 5 years of teaching in the school district, who were certified through traditional teacher education programs. However, a lack of qualified participants in the district led to a minor revision of the specific qualifications for the participant pool. To ensure adequate participation and data saturation, the criteria were broadened to also include teachers who entered the field through other state and district-wide avenues traditionally used in the area. By including participants certified through other traditional teaching programs (i.e., Teach for America, district-led teacher residencies, and master's programs), sufficient data were collected from 12 qualified participants.

Lastly, following an unusual interview with an impostor participant, I began screening participants' background information and email addresses more carefully during the preliminary email exchanges and prior to scheduling subsequent interviews. Potential participants initially contacted me by email after viewing my recruitment posts on Facebook, and this became the first point of screening. For my first interview, the participant completed all of the necessary preliminary tasks, including the informed consent document and contact form. During the interview, however, the participant's responses were exceptional, yet they could not elaborate further. Their responses were atypical for a novice teacher. The participant provided false statements about their work

environment, educational background, and their experiences as a teacher in the United States. After the participant's unexpectedly disconnected from the interview, revisions to the screening process were implemented. The emails and preliminary contact form responses of the participants identified through social media were further screened for inconsistencies, such as mismatches between names and email addresses, overly embellished descriptions, and errors in spelling, grammar, and formatting. As further potential participants applied to join the study, most failed to qualify through the additional screening process. No additional information was gathered prior to receiving the informed consent document.

My dissertation chair was alerted of the encounter. Following the revisions, there were no longer any unqualified participants attempting to join the study. The responses of the unqualified participant were excluded from the study's data. All qualified participants received their specific interview transcripts to member check their responses and provide any further feedback as necessary. Following the member checks of the data, no further responses were retrieved from participants. All interview recordings, notes, and transcripts were saved in participant folders on a password-protected computer.

## Data Analysis

The data were coded using Saldaña's (2021) qualitative coding methods and analyzed through Braun and Clarke's (2006) six-phase process of inductive thematic analysis. This approach supported the identification of relevant themes aligned with the study's RQs and conceptual framework. The following six phases guided the analysis.

**Phase 1: Familiarization With the Data**

I began data familiarization with multiple close readings of the transcribed interviews generated through Otter.ai. I recorded analytical notes to capture early patterns, key ideas, and researcher reflections. This step established a strong foundation for inductive analysis and the subsequent open-coding approach used to generate the initial codes.

**Phase 2: Generating Initial Codes**

In this second phase, I uploaded interview transcripts to the Delve (2024) software for coding. A total of 645 initial codes were created using Saldaña's (2021) guidance to identify meaningful segments of text. These codes reflected a range of participant experiences, values, and concerns related to culturally responsive science teaching. Many codes directly captured teacher sentiment and reflective statements. For instance, one teacher expressed, “I feel like I am doing this alone,” reflecting a common sense of isolation. Others revealed how teachers prioritized relationship-building and adapted instruction, as seen in the statement, “The first week of school, no content... I took that week to go through trust and accountability.” Initial codes such as building student relationships before academic content, adapting lessons for diversity, and acknowledging demographic disparities exemplified the data's breadth and depth.

In this second phase, I organized the initial codes into 61 secondary codes based on recurring patterns and language that aligned with the research focus. The 61 secondary codes, represent recurring ideas and conceptual patterns identified across participant responses. Secondary codes, such as peer collaboration, linguistic accessibility, real-

world connections, and representation in curriculum, highlighted standard practices and challenges. From these secondary codes, broader categories emerged, including cultural self-awareness, differentiated instruction, and mentorship and support systems, representing key components of culturally responsive science instruction. These were used to identify the initial themes.

**Phase 3: Constructing Themes**

In this phase, I clustered secondary codes into broader categories to reflect deeper ideas emerging from the data. I used Delve's (2024) organizational tools to support the development of 13 initial themes grounded in commonalities across participant responses. These themes were conceptually linked to CRT and novice teaching experiences. The 13 initial themes, along with the supporting secondary codes, are presented in Table 3.

**Table 3**

*Initial Themes with Sample Supporting Secondary Code*

| Theme | Secondary codes supporting theme |
|---|---|
| Navigating teacher identity through cultural awareness | Cultural self-awareness, teacher Identity development, reflective teaching practice, teaching through identity |
| Designing inclusive and differentiated science instruction | Inclusive science instruction, differentiated instruction, differentiating by cultural background, linguistic accessibility |
| Incorporating students' cultural and linguistic funds of knowledge | Valuing multilingualism, utilizing student language funds, honoring students' lived experiences |
| Fostering relationships and classroom community | Building relationships with students, classroom culture of belonging, classroom management through relationships, peer collaboration |
| Empowering student voice and agency in science | Student voice and agency, student empowerment, integrating student interest |
| Making science culturally relevant and real-world connected | Culturally relevant examples, real-world connections, culturally responsive labs, student-created science projects |
| Representation and role models in science curriculum | Representation in curriculum, representation in STEM role models, real-life science role models |
| Planning and assessment practices with a CRT lens | Culturally-aware lesson planning, responsive assessment practices, CRT in project-based learning |
| Professional growth, support, and collaboration | Mentorship and support systems, collaborative planning for CRT, learning from diverse colleagues, CRT professional development |
| Systemic challenges and barriers to culturally responsive teaching | Lack of CRT training, challenges with standardized curricula, navigating institutional barriers, addressing the opportunity gap |
| Emotional realities of novice science teachers | Emotional toll of insufficient preparedness, emotional resilience as a teacher, coping with pressure in tested subjects, professional isolation |
| Equity-driven motivation and teacher advocacy | Promoting equity through science, culturally rooted motivation, teacher advocacy for equity |
| Teacher preparation and the need for culturally responsive training and support | Lack of CRT training, learning from diverse colleagues, CRT professional development, mentorship and support systems, professional development for culturally responsive teaching, building cultural |

**Phase 4: Reviewing Themes**

In this phase, I assessed the preliminary themes for clarity, distinctiveness, and relevance to the study's RQs. Each theme was compared with supporting participant data and reviewed through the lens of the conceptual framework to determine whether further refinement or consolidation was necessary (see Braun & Clarke, 2006). This process helped ensure that the final themes were well-organized, accurate, and aligned with the study's aims.

While the majority of cases reflected shared experiences and perspectives, a few presented as discrepant. Discrepant cases in this study were characterized by teachers who expressed confidence in implementing CRT despite having minimal formal training, prioritizing academic content over cultural connections, or viewing the standardized curriculum as sufficient for diverse learners. These perspectives diverged from the dominant themes of insufficient preparedness, systemic challenges, and the need for culturally responsive support. While these cases were not representative of the majority, they were considered during analysis to ensure the themes remained inclusive and accounted for the diversity of teacher experiences.

**Phase 5: Defining and Naming Themes**

In this phase, I developed final themes through iterative analysis, grounded in the study's conceptual frameworks and guided by the central RQs on how novice science teachers understand and apply CRT. Seven themes were named and defined to capture their core meanings and relevance to culturally responsive science instruction. Themes

were evaluated for coherence, consistency, and alignment with the RQs, with a focus on naming that emphasized clarity and conceptual accuracy. The final themes are as follows:

1. Reflecting on their cultural awareness and developing an identity that values culturally responsive pedagogy
2. Strategically designing and implementing inclusive, differentiated, and culturally responsive science instruction
3. Intentionally fostering relationships and building a supportive classroom culture
4. Viewing science instruction as a tool for equity and empowerment
5. Navigating structural challenges and barriers while finding support in CRT implementation
6. Valuing cultural responsiveness as essential to effective science teaching
7. Bridging the gap between teacher preparation and real-world classroom needs

Each theme was supported by multiple examples and aligned with the theoretical constructs of equity, identity, agency, and responsiveness. These themes synthesized participant experiences in ways that illuminated not only their instructional choices but also the emotional and institutional realities they navigated while attempting to implement culturally responsive science teaching.

The seven themes identified in this study were not only grounded in participant experiences but also aligned with the theoretical constructs guiding the research. Freire's theory of critical consciousness emphasized teachers' awareness of inequities, self-reflection, and the need to challenge systemic oppression, while Gay's framework of

CRT highlighted cultural awareness, instructional strategies, and equity in practice. Together, these constructs provided the lens through which participant perspectives were interpreted. Table 4 presents the alignment of each theme with the theoretical constructs, demonstrating how teachers' experiences and practices reflected the principles of both Freire and Gay.

**Table 4**

*Alignment of Final Themes to Theoretical Constructs*

| Final theme | Theoretical constructs |
|---|---|
| Reflecting on their cultural awareness and developing an identity that values CRT | Freire's critical consciousness (awareness of inequities, self-reflection); Gay's CRT (cultural awareness) |
| Designing and implementing inclusive, differentiated, and culturally responsive science instruction | Gay's CRT (instructional strategies, equity in curriculum) |
| Fostering relationships and supportive classroom culture | Gay's CRT (building caring classroom communities) |
| Viewing science instruction as a tool for equity and empowerment | Freire's critical consciousness (science as liberation); Gay's CRT (equity focus) |
| Navigating structural challenges/barriers | Freire's critical consciousness (systemic inequities, oppression awareness) |
| Valuing cultural responsiveness as essential to effective science teaching | Gay's CRT (CRT as foundation of good teaching practice) |
| Bridging the gap between teacher preparation and classroom needs | Freire (critical reflection on systems); Gay (teacher preparation for CRT practices) |

As shown in Table 4, these themes demonstrated how participants' perspectives and practices reflected the study's theoretical framework. Themes 1 and 6 emphasized

the role of cultural awareness and identity, consistent with both Freire's call for critical reflection and Gay's emphasis on valuing cultural responsiveness as central to teaching. Themes 2 and 3 highlighted responsiveness through inclusive instruction and the development of supportive classroom communities. Themes 4 and 5 connected directly to equity and agency, illustrating how participants viewed science as a tool for empowerment while also acknowledging systemic barriers. Finally, Theme 7 bridged the constructs by linking teacher preparation to classroom realities, underscoring the need for support that enables novice teachers to enact CRT.

To demonstrate the process of inductively moving from initial themes to final themes, Table 5 presents examples of excerpts from participant interviews. These examples illustrate how participant responses were systematically analyzed and organized to support the development of themes. Not all themes are presented in the table that follows.

**Table 5**

*Sample Final Theme Development*

| Excerpts | Contributing initial themes | Final themes |
|---|---|---|
| "We're talking about altitude… I used a clip from Iron Man... and he's going up in the sky. 'His suit's freezing up. Why? I guess he's too high in the sky. What does that mean? Oh, it must be cold.'" (Participant F) | Incorporating Students' Cultural and Linguistic Funds of Knowledge<br>Making Science Culturally Relevant and Real-World Connected | Strategically designing and implementing inclusive, differentiated, and culturally relevant science instruction. |
| "Something as simple as having a morning meeting before you start teaching… I learned so much from the students… You can't teach people that you don't know" (Participant K) | Fostering Relationships and Classroom Community<br>Empowering Student Voice and Agency in Science | Intentionally fostering relationships and building a supportive classroom culture |
| "They push inquiry-based learning... but don't provide the time or tools to do that." (Participant I) | Systemic Challenges and Barriers to Culturally Responsive Teaching<br>Professional Growth, Support, and Collaboration | Navigating structural challenges and barriers while finding support in culturally responsive pedagogy implementation |

Each of the seven themes that emerged through analysis is defined in detail below.

### *Theme 1: Reflecting on Cultural Awareness and Developing an Identity That Values CRT*

This theme captures how novice middle grades science teachers engaged in self-reflection about their own cultural assumptions and recognized the importance of incorporating students' personal backgrounds and real-world experiences into instruction. Through this process, they began to shape a professional identity rooted in responsiveness, awareness, and a commitment to equitable teaching practices. This theme

was articulated by Participant C who noted, “Culturally responsive teaching is understanding and being aware of the cultural differences of the students and catering to that their particular needs.”

### *Theme 2: Strategically Designing and Implementing Inclusive, Differentiated, and Culturally Responsive Science Instruction*

This theme reflects how teachers intentionally crafted science lessons to meet the diverse cultural, linguistic, and academic needs of their students. Participants described using a variety of instructional strategies, relatable content, and accessible materials to ensure that all learners could engage meaningfully with science concepts. This theme was articulated by Participant E as she emphasized the importance of using visuals, frontloading vocabulary, and incorporating students’ cultural and linguistic backgrounds to ensure all learners can access science instruction according to their needs and experiences.

### *Theme 3: Intentionally Fostering Relationships and Building a Supportive Classroom Culture*

This theme emphasizes how novice teachers prioritized establishing strong, trust-based relationships with their students to foster a classroom environment characterized by respect, care, and a sense of belonging. Teachers described these relationships as essential for promoting engagement, encouraging risk-taking, and supporting students' academic and emotional growth. This theme was demonstrated by Participant I, who highlighted the importance of using the first week of school to build trust, set expectations, and foster a supportive classroom environment. By committing to

relationships with their students over content early on, teachers created a space where students felt safe, respected, and ready to engage in learning.

***Theme 4: Viewing Science Instruction as a Tool for Equity and Empowerment***

This theme reflects how teachers recognized science as a means to challenge inequities and empower students by affirming their identities and expanding their opportunities. Participants utilized science content to connect with students' real-world experiences, foster critical thinking, and promote confidence in their academic success and beyond. This theme was conveyed by Participant F, who explained that he used science to help students see themselves as problem-solvers by connecting lessons to familiar contexts, from movies like Iron Man to challenges in their community, which helped them feel empowered and recognize that their ideas carried value.

***Theme 5: Navigating Structural Challenges and Barriers While Finding Support in CRT Implementation***

This theme captures how teachers encountered institutional and systemic obstacles, such as rigid curricula, lack of resources, and limited administrative support, while striving to implement culturally responsive practices. Despite these barriers, participants identified moments of encouragement and advocacy that helped sustain their efforts. This theme was conveyed by Participant B, who voiced her frustration with the district's rigid curriculum, explaining that limited accommodations and lack of language support hinder her ability to meet the needs of her multilingual learners.

### *Theme 6: Valuing Cultural Responsiveness as Essential to Effective Science Teaching*

This theme highlights how teachers viewed CRT as a foundational element of good science instruction. Participants emphasized that understanding students' backgrounds, interests, and ways of knowing was critical to making science accessible, relevant, and engaging. This theme was articulated by Participant J, who shared their own experiences moving between schools to highlight the importance of making science instruction relevant and accessible, emphasizing that culturally responsive teaching is essential for engaging students who may lack background knowledge or face language barriers.

### *Theme 7: Bridging The Gap Between Teacher Preparation and Real-World Classroom Needs*

This theme reflects participants' perceptions that their teacher preparation programs did not fully equip them for the cultural and instructional demands of diverse classrooms. Teachers described learning to apply culturally responsive teaching practices through on-the-job experiences, collaboration, and ongoing self-reflection. This theme was illustrated by several participants, including Participant H who acknowledged that while her teacher preparation covered content knowledge, it did not equip her to teach culturally and linguistically diverse students, as her training took place in predominantly white, affluent settings that did not reflect the realities of her current classroom.

## Phase 6: Producing the Report

In this phase, I interpreted the final themes through the lens of Freire's (2017) theory of critical consciousness and Gay's (2010) framework of CRT. This inductive

process moved from descriptive codes to analytically constructed themes that aligned with the study's RQs and conceptual framework. To illustrate the connection between participants' experiences and the study's RQs, selected excerpts are presented in the results section to support and deepen the interpretation of each theme

## Evidence of Trustworthiness

Establishing trustworthiness is essential in qualitative research to ensure the integrity and authenticity of findings (Adeoye-Olatunde & Olenik, 2021; Megheirkouni & Moir, 2023). Effective strategies of Lincoln et al.'s (1985) four criteria of trustworthiness, including credibility, transferability, dependability, and confirmability, were implemented into all data collection processes for this study.

### Credibility

Credibility was supported through prolonged engagement with participants, which helped build trust and allow for deeper exploration of their experiences. Semistructured interviews with open-ended questions and strategic probing allowed participants to clarify responses and expand on key ideas. I reviewed audio recordings, field notes, and informal pre-interview conversations to verify the accuracy of responses and interpretations. These efforts ensured that the findings accurately reflected participants' experiences and perspectives (see Ahlin, 2019; Megheirkouni & Moir, 2023).

### Transferability

Transferability was established by obtaining participants from varied cultural and educational backgrounds who shared a common experience as novice science teachers engaging with CRT. The interview questions were designed to elicit detailed, context-

rich responses that could be applied to other school settings and similar educational roles. Thick descriptions of participant experiences were gathered and reported to allow readers to determine relevance to their own contexts (see Adeoye-Olatunde & Olenik, 2021; Stahl & King, 2020).

**Dependability**

Dependability was enhanced through the use of a consistent, organized interview protocol applied across all interviews. All participants were asked the same core questions, and any modifications or follow-up prompts were documented to maintain transparency. The structured yet flexible design of the interview process allowed for consistency while also accommodating the unique contexts of each participant (see Ahlin, 2019; Roberts, 2020).

**Confirmability**

Confirmability was addressed by bracketing personal biases and maintaining a reflexive stance throughout the research process. I avoided leading questions during interviews and ensured that all responses were grounded in the participant's language rather than the researcher's interpretation. Additionally, member checking was employed to validate participant responses, enabling individuals to confirm the accuracy of their contributions and clarify any potential misrepresentations (see Megheirkouni & Moir, 2023). These strategies promoted objectivity and authenticity in data analysis and interpretation.

# Results

This section presents the main findings from the interview data, organized into seven themes shaped by the study's conceptual framework of CRT and critical consciousness. Each theme is supported by participant quotes and explanations that show how the findings relate to the RQs.

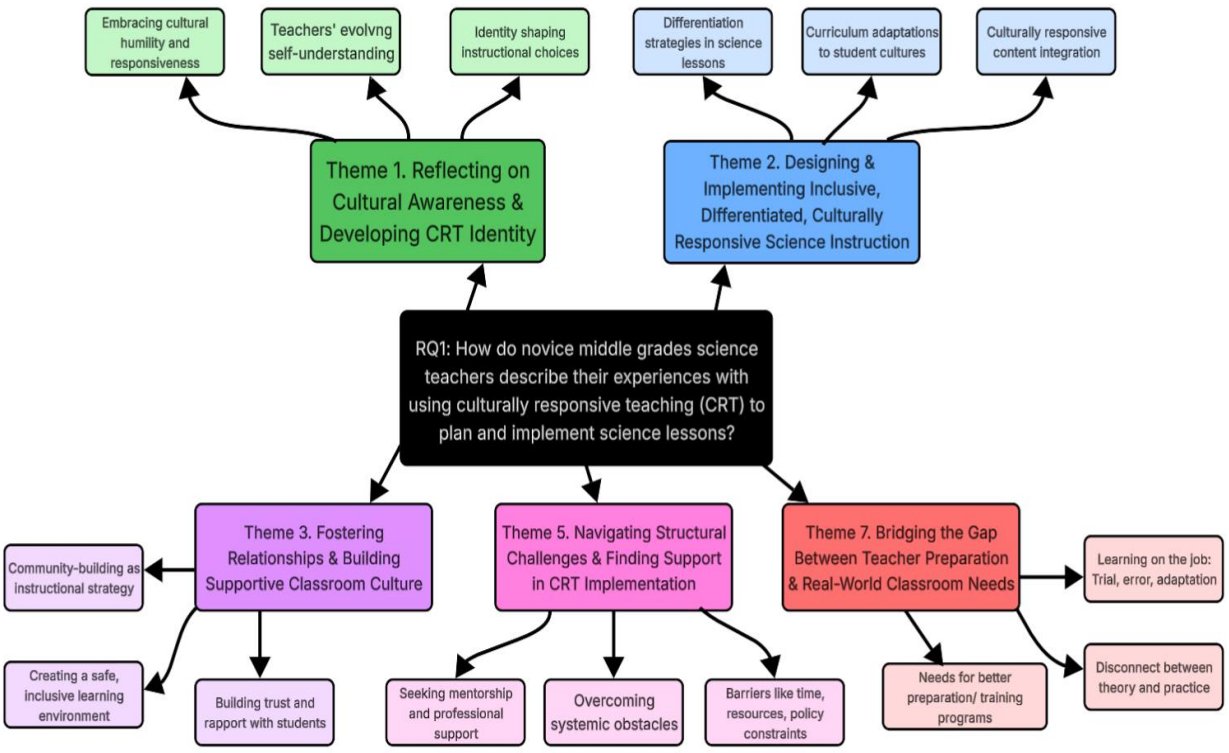
## RQ1

How do novice middle grades science teachers describe their experiences with using CRT to plan and implement science lessons?

This RQ was addressed through five final themes that emerged from the data's codes and initial themes, as shown in Figure 1. Each theme is supported with codes retrieved from the interview data.

**Figure 1**

*Research Question 1 Mind Map: Themes and Supporting Codes*




Collectively, Themes 1, 2, 3, 5, and 7 captured how participants made sense of their early teaching experiences through the lens of CRT. Their reflections revealed a journey of growing cultural awareness, purposeful instructional planning, and building inclusive environments, often while navigating structural barriers and gaps in their teacher preparation. Through these themes, the data depict how novice teachers actively work to implement CRT in ways that are both meaningful and responsive to the needs of their diverse students.

### *Theme 1: Reflecting on Cultural Awareness and Developing an Identity That Values CRT*

Theme 1 examines how novice middle grades science teachers developed cultural awareness and began to shape their teaching identities, grounded in CRT. Data collected from the semistructured interviews revealed that participants commonly credited their growth in this area to direct classroom experiences rather than formal teacher preparation. Highlighting the significance of experiential learning, Participant A shared how most of the responsive techniques used in her classroom were skills that she developed over the years through teaching and observing other teachers, stating how the skills “would not necessarily come from the course I took in college.”

This sentiment was echoed by Participants D and C, who similarly emphasized that their practical teaching experiences provided more meaningful insight into CRT than coursework. Participant F reflected that their preparation program addressed culture only in broad, abstract ways, without guidance on how to integrate it into science instruction, illustrating the disconnect between abstract training and practical application. Participants described a deepening understanding of student diversity and an evolving sense of responsibility to create inclusive, identity-affirming spaces. Participant C defined CRT as "being aware of the cultural differences of the students and catering to their particular needs." At the same time, Participant J discussed how "checking himself" and acknowledging his own biases became a critical step toward becoming the teacher he aspired to be. Participant I emphasized the need for thoughtful and informed cultural awareness, stating, “Everyone who is ML does not come from the same country. We

have students from Peru, Ecuador, Mexico, Dominican Republic, Honduras, and we have to pick up on those cultural differences." Participant F shared that talking with students helped reveal the wide disparities in exposure and experiences, saying, "There is a kid out there that is going on a family cruise every year, and then I have a kid who has not seen the arena that's five minutes away from their house." These examples reinforced how teachers were learning to view student context not as background information, but as essential to their planning and instruction.

Teachers also began embracing their own identities as part of the culturally responsive teaching process. Participant B noted,

> I'm showing my students that I have different layers to my identity as well, not just as their teacher, but as a person… I enjoy showing the kids that it is okay to be not from America, it is okay to be an immigrant.

Participant E similarly discussed how reflecting on her own identity influenced her approach to instruction, encouraging students to bring their whole selves into the classroom. Collectively, participants highlighted the connection between teacher self-awareness, student identity affirmation, and meaningful science instruction.

These findings align with Freire's (2017) theory of critical consciousness and Gay's (2010) conceptualization of CRT. Participants demonstrated critical reflection about their identities, classroom practices, and roles in affirming students' cultural backgrounds. Their experiences directly address RQ1 by illustrating how novice teachers described becoming culturally responsive through practice, feedback, and purposeful engagement with student diversity. Rather than relying on formal instruction, teachers

developed their understanding of CRT through an ongoing process that involved learning from students, adjusting their instruction, and rethinking their assumptions. This identity development process cultivated a strong commitment to equity and inclusion in science teaching, emphasizing the role of awareness, reflection, and agency in becoming culturally responsive educators.

### *Theme 2: Strategically Designing and Implementing Inclusive, Differentiated, and Culturally Responsive Science Instruction*

Theme 2 examines how novice middle grades science teachers intentionally designed and delivered instruction that was inclusive, differentiated, and responsive to students' diverse cultural and academic needs. Insights gathered from the semistructured interviews revealed that participants made deliberate efforts to adapt their teaching strategies to meet students where they were. Participant A explained,

> Usually, it's the vocabulary, because I have several students who are well below grade level… I teach sixth grade, but have some reading at second and first grade levels. It is not that they don't know the answer, but they won't understand what the question's even asking.

She went on, sharing how she often modified activities by using vocabulary games or simpler tasks for her students receiving special education services. These modifications, such as focusing on vocabulary and simple sentences rather than lengthy “read and respond” paragraphs, helped prevent students from feeling overwhelmed and shutting down, while still building their confidence with the material. Participant C described adapting her instruction for multilingual learners by using laminated

vocabulary cards that included both images and definitions. This approach enabled students to derive meaning from visuals, even if they could not fully comprehend the terms. She also incorporated partner activities where students compared vocabulary words, promoting collaboration and reinforcing understanding.

Participant H also highlighted the importance of planning for equity both inside and outside the classroom. She explained that she incorporated tools such as visuals, anchor charts, and word banks to make science more accessible for her English language learners. Beyond instructional strategies, she noted that "the biggest resource that I know that some people don't have is internet service," so she avoided assigning online homework. Instead, she ensured that tasks were "on paper, and something that is not going to take you that long," allowing students to complete them independently even if family support or technology was unavailable. This intentional planning helped her identify who truly grasped the material while also creating more equitable opportunities for participation and success.

Participant F emphasized the importance of using multiple forms of representation. Repetition through drawing, reading, writing, and exploring reinforced students' understanding of the content. These instructional decisions show how novice teachers implemented strategies to remove participation barriers and make science more accessible to all learners.

Participants frequently described incorporating students' cultural backgrounds and everyday realities to make science instruction more relevant and engaging. Participant C structured vocabulary tasks to include peer collaboration, which promoted both

comprehension and classroom connection. Participant A explained her use of culturally familiar examples: “We do many food activities because they connect to their everyday food items… In the Oreo moon phase lab, when asked who has had an Oreo, everybody raises their hand.” Participant G described how she incorporated creative expression into her lessons, stating, “I may add, like, a little rap about one of the topics that we're speaking on.”

Participant B highlighted how connecting instruction to culturally relevant media could boost understanding, as she stated,

> When you reference it the way the school wants you to, they can't even secure it in their head. However, once you like reference one word, or like that one TikTok that they saw a long time ago, they're like, “Oh, wait, this makes total sense.”

These choices reflect how teachers linked abstract science concepts to real-life experiences in order to support understanding and engagement. Participant E spoke specifically about meeting students where they were by adjusting lessons based on local, relatable contexts. She reflected that many students lacked the background knowledge and vocabulary assumed in the curriculum, so she intentionally front-loaded key concepts and drew on familiar examples, from weather terms to cultural references, in order to make science content more accessible and meaningful. This shift toward community-connected content exemplifies how teachers drew from students’ environments and backgrounds to enhance the relevance and impact of science instruction.

Teachers employed flexible instructional methods, adapted materials for accessibility, and incorporated students' cultural knowledge to support their learning.

These practices directly address RQ1 by demonstrating how novice teachers implemented CRT when planning and teaching science lessons. While many were still developing confidence, the data show that participants were already applying CRT principles intentionally. They designed lessons that reflected students' cultural contexts, differentiated instruction to meet their diverse needs, and created classroom experiences that were accessible, relevant, and inclusive.

### *Theme 3: Intentionally Fostering Relationships and Building a Supportive Classroom Culture*

Theme 3 highlights how novice middle grades science teachers intentionally fostered relationships with students and cultivated classroom environments grounded in trust, emotional support, and a sense of belonging. Data from the semistructured interviews revealed that participants consistently identified relationship-building as foundational to their instructional practice, particularly when working with culturally and linguistically diverse learners. Participant H emphasized the importance of creating inclusive spaces where students felt acknowledged and respected, which in turn encouraged them to engage more fully with science content.

Participant D described fostering shared ownership by allowing students to select music during warm-ups, helping them feel like active members of the class community rather than passive participants. She also provided students with multiple opportunities to revisit lessons, join small group sessions, and engage in social-emotional check-ins, recognizing that many faced challenges at home that affected their readiness to learn. These examples illustrate the intentional strategies teachers employed to foster classroom

environments that prioritized students' social and emotional well-being as a foundation for academic learning.

Participants also described using everyday interactions to support students' sense of safety and engagement. Participant G described beginning class with brief check-ins, showing that even brief moments of personal connection contributed to students' readiness to learn. Participant F highlighted the value of informal conversations, describing how casual exchanges about students' weekends or upcoming events revealed important insights about their backgrounds and levels of prior knowledge, which in turn shaped how he introduced new science concepts. Participant A reflected on using activities and class discussions to learn more about students, noting that even simple icebreakers, like "get-to-know-you bingo" or students sharing personal experiences related to science topics, helped her connect with them and understand their backgrounds. Participant K described how she learned more about students' lives through simple routines, explaining, "I get to know my students with something as simple as having a morning meeting before you start teaching. Talk to the students, ask them how their day was, ask them who they had dinner with last night." She also discussed how her moon journal assignment deepened her understanding of student circumstances. She explained,

> With their moon journals, they had to tell me what they were doing when they saw the moon. I learned so much from the students who couldn't see the moon because there was no window in their room, or they had to babysit. So, while they were looking at the moon, they were watching four or five kids. Then, you had the kids who could sit outside with their father and look at the moon.

Several participants emphasized the importance of affirming students' identities and meeting them with compassion and encouragement. Participant B shared,

> I consistently show them it's okay to be learning. I'm currently learning Spanish from my students… It's okay to fail at this or that when you're learning new languages and other things. They have fun while they're helping me, and I have fun while I'm helping them. And that actually helps them learn more about science.

These insights reflect a common belief among participants that positive relationships enhance student engagement, build trust, and increase students' willingness to participate in learning, especially when they feel seen and valued.

Participants recognized that strong student–teacher relationships were essential to culturally responsive science instruction. This theme addresses RQ1 by demonstrating how novice teachers fostered inclusive learning environments by prioritizing student connection and care. Their experiences suggest that supportive classroom cultures were intentionally developed through daily practices that emphasized relationship-building, respect, and inclusion.

### *Theme 5: Navigating Structural Challenges and Barriers While Finding Support in CRT Implementation*

Theme 5 captures the ongoing tension novice science teachers experienced as they attempted to implement CRT within educational systems that were often not structured to support it. Participants described a range of structural barriers, including time constraints, inflexible and unrealistic pacing guides, limited training, and a lack of

access to culturally relevant resources. Participant D expressed frustration about being expected to reach all learners while receiving minimal preparation on inclusive instruction, noting that while she received some planning support as a new teacher, “it wasn’t anything in depth as far as cultural type planning,” and professional learning at her current school focused mostly on basic content rather than multicultural approaches.

Participant C noted that school and district support for multilingual learners often started and ended with translation tools, and that deeper strategies for inclusive instruction were rarely addressed. Participant H echoed these limitations, explaining that a lack of resources often forced her to create her own solutions. Participant F voiced concern about the lack of support for the academic growth of culturally diverse students, stating, "More kids of color are coming in under grade level, and I think we are just passing them along instead of truly educating them."

Despite these challenges, participants identified mentorship, peer collaboration, and self-directed learning as essential to sustaining their CRT efforts. Participant A described how informal mentorship helped her tailor instruction, stating, “They were all super helpful as they would be telling me about the kids, their experiences, what they're like, and that helps me to kind of gear my instruction more towards them.” Participant F shared how working with a team that valued inclusion gave him the confidence to try new approaches. Participant G and Participant H both noted that they regularly sought out their own resources, such as online communities and culturally relevant materials, when institutional guidance was lacking.

Collectively, these insights demonstrate how novice teachers continued to pursue equity in their science instruction despite the systemic obstacles they faced. Their narratives reflect a growing commitment to culturally responsive teaching, supported more by peer mentorship and personal initiative than by formal institutional structures. This theme addresses RQ1 by highlighting how teachers navigated and resisted structural barriers in order to implement inclusive science instruction.

### *Theme 7: Bridging the Gap Between Teacher Preparation and Real-World Classroom Needs*

Theme 7 explores the disconnect novice teachers experienced between their teacher preparation programs and the realities of teaching culturally and linguistically diverse students. Across the interviews, participants described widely varying preparation experiences, with many pointing to inconsistent or insufficient training on how to apply CRT in actual classrooms. Teachers who completed alternative certification programs, such as Teach for America, reported minimal focus on instructional strategies that considered student identity, cultural background, or language differences. Participant B recalled, “With Teach for America, they told us that we would get time to understand the curriculum about science before we got in, but mostly that they were not really responsible for that.” Similarly, Participant F explained the culturally responsive preparation from his teaching program as, “That’s one of those things where you have to kind of get thrown into the fire and you learn as you go.” Participant H reflected, “There was never a time that I was put into a situation where it was a group of minorities.” Furthermore, Participant I noted that her preparation program offered very little guidance

on how to adapt lessons for specific cultural groups or address classroom scenarios that required such considerations. Instead, she explained, “They really just did the broad stroke of being culturally aware… so you’re not offending anyone.”

Participants who completed traditional undergraduate certification programs, district-sponsored residencies, and graduate-level preparation also described variation in the extent to which their programs addressed CRT. Although a few noted limited exposure to the concept of cultural awareness, most shared that their training did not adequately prepare them to teach in classrooms with significant linguistic, cultural, and socioeconomic diversity. Several participants explained that while they felt confident in their content knowledge, their preparation programs offered little guidance on how to connect science instruction to the realities of the diverse learners they now served.

Participant H reflected that while her major prepared her well in science content, her training did little to address the realities of teaching in culturally and linguistically diverse classrooms. Her school placements, which were “predominantly White kids… all sitting down there listening,” were very different from the challenges she encountered in her current Title I context. She further noted that her preservice training “never… honed down on a specific group of kids,” leaving her to figure out how to engage students whose backgrounds required more intentional support than she had anticipated.

Participant J explained, “I don’t feel like I received a lot of good training on what to do in those situations,” adding that much of his approach to helping diverse students involved “coming up with things at the last minute and Googling at home.” Participant F added that although equity is often discussed, teachers rarely receive training on how to

apply it in the science classroom. He explained that the professional development he encountered tended to emphasize theory rather than providing strategies for navigating the realities of day-to-day instruction. Participant L emphasized, "Experience has been my best teacher for sure. The classes that I took online and in person could have never prepared me for actually stepping into the classroom."

While some participants acknowledged being well-prepared in terms of content knowledge, they emphasized that this did not necessarily translate into readiness to teach students with diverse cultural backgrounds, learning needs, and real-world experiences. Participant K reflected, "I was well prepared to understand my content. I was not prepared to teach it to the students that were in front of me." She described how her teacher education program focused on idealized classroom scenarios, stating,

> All the students were always on the same basic level, lived in ideal family situations, and all spoke English. No one ever said, what happens if 10 of them are below level, or one doesn't speak English, two are homeless, and four of them just don't care.

Similarly, Participant J and Participant C expressed that teacher prep left little room for critical application. Participant C observed, "Maybe it would be better addressed if we had more people who look like our students running the program and teaching these teachers how to teach."

To compensate for these gaps, participants leaned heavily on mentorship and experiential learning once they entered the classroom. Participant A shared, "I would say 95% of what I use in the classroom was just from having a mentor teacher at school.

Most of what I learned, I don't apply to the classroom." Participant F reflected that novice teachers were often left to figure things out on their own, describing the experience as overwhelming and compounded by limited resources and training. At the same time, he acknowledged that the mentors he had were instrumental in helping him develop strategies to make science relatable and accessible for his students. Several teachers emphasized that peer support and culturally affirming mentorship were instrumental in bridging the divide between theory and practice. Participant L highlighted, "I was very fortunate to have a support system that honestly looked like me, talked like me, walked like me."

These insights address RQ1 by highlighting how novice middle grades science teachers came to understand and implement CRT primarily through hands-on experience rather than formal preparation. Their narratives revealed a significant disconnect between what they were taught in teacher education programs and the realities of teaching in culturally and linguistically diverse classrooms. This gap prompted many to rely on mentorship, reflection, and trial-and-error as they developed responsive practices that met the needs of their students.

Themes 1, 2, 3, 5, and 7 collectively address RQ1 by illustrating how novice middle grades science teachers describe their experiences with CRT in science instruction. Participants emphasized that developing cultural awareness and a professional identity rooted in equity (Theme 1) informed their instructional decisions. As their understanding of CRT deepened, they designed inclusive and differentiated lessons that reflected students' cultural and linguistic backgrounds (Theme 2) and built

supportive classroom environments grounded in trust and a sense of belonging (Theme 3). However, teachers faced structural challenges, including limited training, insufficient institutional support, and a lack of relevant resources (Theme 5), which were further compounded by inadequate preparation to teach in diverse classrooms (Theme 7). Collectively, these themes reveal that novice teachers are engaging with CRT through reflection and adaptation, often relying on their own initiative to meet students' needs.

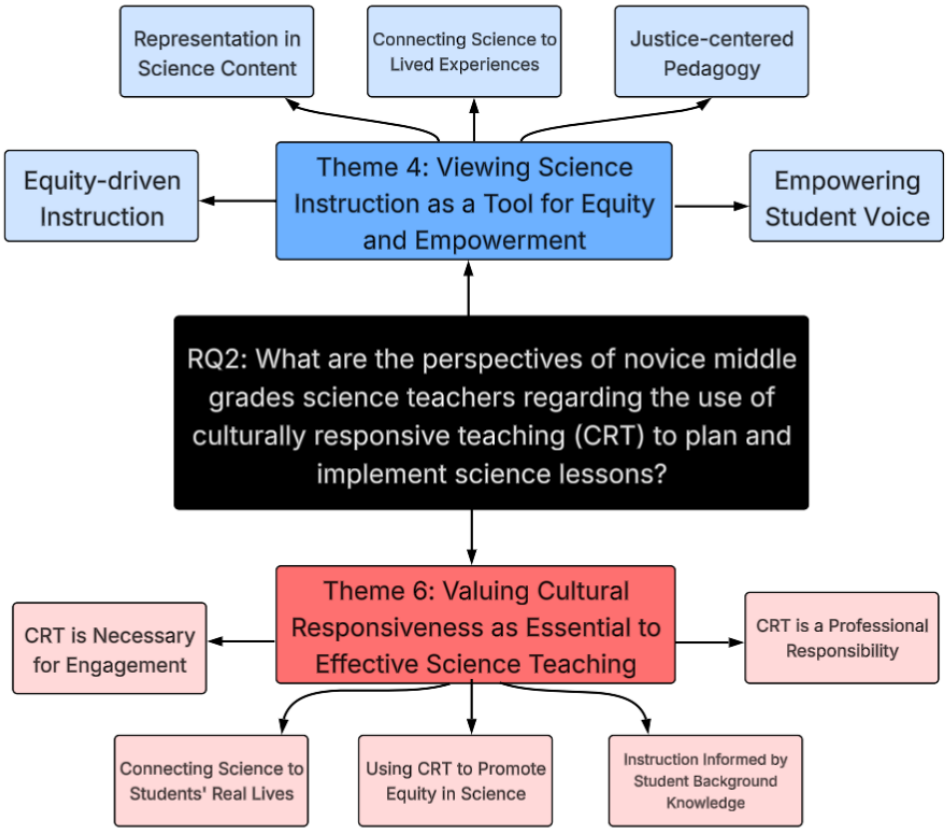
**RQ2**

RQ2 asked: What are the perspectives of novice middle grades science teachers regarding the use of CRT to plan and implement science lessons?

This RQ was addressed through two final themes that emerged from the data's codes and initial themes, as shown in Figure 2. Each theme is supported with codes retrieved from the interview data.

**Figure 2**

*Research Question 2 Mind Map: Themes and Supporting Codes*




RQ2 was examined by analyzing participants' perspectives on the use of CRT to plan and implement science lessons. Themes 4 and 6 were central to this analysis, as they reflect how novice teachers perceive the purpose, value, and application of CRT in their instructional decision-making. These themes provide insight into how teachers conceptualize CRT as a tool for promoting equity and effective science instruction, and how their beliefs influence their classroom practices.

### *Theme 4: Viewing Science Instruction as a Tool for Equity and Empowerment*

Theme 4 illustrates how novice middle grades science teachers viewed science instruction not merely as the delivery of academic content but as a means to promote equity, access, and student empowerment. Participants described intentional instructional decisions aimed at addressing disparities in exposure, resources, and representation. Several teachers emphasized the importance of accounting for students' socioeconomic backgrounds when designing lessons. Participant A explained how she planned for opportunity gaps by ensuring all students could participate in activities, sharing,

> With the Oreo moon phase lab, I'm providing materials for them and not expecting them to bring it in, because then, if I was like, 'Oh, well, you can't do the lab if you don't bring Oreos,' then children who don't have access to that, they're robbed of that opportunity. I plan for these gaps by being mindful of what I think they have access to, as well as any limitations they might have.

Similarly, Participant D acknowledged how material barriers influenced learning, stating, "If you are worried about your academics, but you don't have supplies that you need to take notes or write stuff down, now you're missing that piece academically."

Participants often saw it as their responsibility to bridge gaps in student experience through science. Participant E emphasized the importance of supplementing students' limited experiences by intentionally integrating background knowledge into classroom instruction. She explained,

> You have to try to bring those things into the classroom, which they may not be able to get outside the classroom or the school. Try to see if you can provide some

> of that background knowledge here in the school, even if it's just exploratory. Let's take a trip on the computer to explore or learn about different things you may not have had firsthand experience with.

She continued by describing an instructional example in which students explored the Blue Creek rainforest in Belize through virtual resources, studied the region's animals and plant life, and created their own visual representations to imagine what the environment might be like. These instructional approaches allowed students to explore and envision worlds beyond their everyday experiences.

Participant G reflected on a similar challenge when teaching weather concepts, noting, "One time I was talking about a land breeze and sea breeze, and I realized that some students haven't really been to the beach." This awareness prompted teachers like Participant G to adjust their lessons by embedding sensory experiences, visuals, or alternative analogies to help students grasp unfamiliar phenomena. Participant I shared how she connected science to students' lived environments, stating,

> I know we were talking about ecosystems… So [School Name] is an ecosystem in itself. What does that look like? So, if you're talking about niches and roles, what's your role as a student in the classroom? What's your role as an eighth grader in the school? So, trying to bring it to their level, to the place that is tangible.

These kinds of localized examples made science more concrete, accessible, and relevant to students' daily lives. These strategies fostered deeper understanding while also affirming students' identities.

The perspectives of novice middle grades science teachers revealed that they viewed CRT as a critical tool for advancing equity and student empowerment in science education. Participants described using CRT to affirm students' identities, close opportunity gaps, and ensure content was accessible and meaningful. By planning lessons that reflected students' cultural backgrounds and everyday experiences, they aimed to create inclusive, engaging, and equitable learning environments. These insights directly address RQ2 by illustrating how novice teachers perceived CRT as a central and necessary element of planning and delivering science instruction that fosters equity, relevance, and student empowerment.

***Theme 6: Valuing Cultural Responsiveness as Essential to Effective Science Teaching***

Theme 6 reflects how participants came to view CRT as an essential component of effective science instruction rather than an optional strategy. Across interviews, teachers described CRT as central to building understanding, fostering engagement, and ensuring that science lessons were inclusive and relevant. Participant C described CRT as "just good teaching," while Participant G noted that when students are unable to connect to the content culturally, they lose interest and disengage.

Participants emphasized the need to ground science instruction in students' real lives. Participant L observed that "real-world examples look different to different people," underscoring the importance of aligning instruction with students' cultural contexts and everyday experiences. Participant F shared, "My students are always asking, 'What do I need this for?' So, when I can have them understand that this meets you in real life, you'll understand that I'm giving you tools for your tool belt for life." He also

criticized the “one-size-fits-all” approach, stating how districts think their students are “just like a gray blob…same kind of deal, and we all come from the same walks of life” and how that mentality just doesn't work.

Many participants noted that embracing CRT helped strengthen their professional identity. Participant J explained, “When you build that relationship, they’re a little bit more forthcoming and sharing things with you, and you can build on from that.” Participant K added, “You can’t teach people that you don’t know,” emphasizing the importance of understanding students’ backgrounds. Participant E echoed this, noting that while science can feel universal, it often misses opportunities to reflect students’ diverse backgrounds and could be made more meaningful by drawing on their cultural experiences.

Participants also expressed a desire for more high-quality and practical support and professional development. Participant K called for "real professional development, not a band-aid," that explores ways to reach culturally diverse learners. B1 advocated for more Spanish-speaking teachers to support diverse populations, highlighting the need for more representative staffing. Together, these insights address RQ2 by demonstrating how novice science teachers viewed CRT as an integral part of their instructional planning and delivery. Their experiences reflect a commitment to combining academic rigor with cultural relevance, which they identified as essential elements of equitable science teaching.

Themes 4 and 6 collectively offer important insight into how novice middle grades science teachers conceptualize and implement CRT in their instructional practice.

Participants consistently viewed CRT not as an optional practice, but as an essential aspect of effective science teaching. Theme 4 highlights how teachers used science instruction as a vehicle for equity and empowerment by linking content to students' real-world experiences and cultural contexts, fostering access, relevance, and agency. Theme 6 builds on this perspective, illustrating how participants saw CRT as central to their professional identity and essential for fostering student engagement, comprehension, and achievement. Together, these themes directly address RQ2 by demonstrating that novice teachers view CRT as a foundational approach to planning and delivering science instruction in diverse classrooms.

## Summary

The findings presented in this chapter offer insight into how novice middle grades science teachers understood and enacted CRT within their instructional practice. In response to RQ1, participants described developing cultural awareness and a professional identity that prioritized equity through classroom experiences rather than formal teacher preparation. They emphasized the importance of building strong relationships with students, adapting instruction to meet diverse needs, and making science accessible and relevant. Teachers navigated structural barriers, such as limited resources, demanding instructional frameworks, and inconsistent support, and often relied on their own reflection, mentorship, and problem-solving to implement culturally responsive strategies.

RQ2 focused on teachers' perspectives regarding how they used CRT to plan and implement science instruction. Participants viewed CRT as critical and essential to

effective instruction. They described science as a tool for empowerment, representation, and real-world application, using content to affirm students' cultural identities and promote engagement. Teachers viewed relevance, inclusion, and student-centeredness as guiding principles in their planning, often drawing on students' cultural backgrounds and experiences to enhance learning and foster a sense of belonging.

Chapter 5 will contain an interpretation of these findings within the context of existing literature and conceptual frameworks. It will also include a discussion of the implications for teacher preparation, professional development, and science instruction. Finally, the chapter will include recommendations for policy and practice to support culturally responsive teaching in middle grades classrooms.

# Chapter 5: Discussion, Conclusions, and Recommendations

## Introduction

The purpose of this basic qualitative study was to explore the experiences and perspectives of middle grades (6–8) science teachers in their first 5 years of teaching regarding their use of CRT to plan and implement science lessons. This study followed a basic qualitative approach to examine how novice teachers interpreted their classroom experiences with culturally diverse populations and how those experiences shaped their instructional decisions. A basic qualitative design was appropriate for this study because it supported an in-depth exploration of how participants understood and reflected on their real-world teaching contexts (see Merriam & Tisdell, 2016). Semistructured interviews were conducted with novice science teachers, and thematic analysis was used to interpret their perspectives through the conceptual lenses of CRT (Gay, 2010) and critical consciousness (Freire, 2017).

This study was conducted in response to the increasing need for science teachers who are prepared to meet the needs of culturally diverse student populations. Despite growing diversity in U.S. classrooms, many novice teachers enter the profession without the specific tools or mindsets needed to implement culturally responsive practices effectively (Lomelí, 2021; Moore et al., 2021). By examining authentic teacher experiences, this study aimed to address gaps in the literature and inform improvements in teacher preparation and professional development. The findings may contribute to a stronger foundation for developing teachers who are better equipped to implement culturally responsive science instruction.

The findings from this study revealed that novice science teachers often developed their understanding of CRT through personal reflection, classroom experiences, and ongoing adjustments to their instructional practices. Participants described specific strategies they used to meet the needs of diverse learners and emphasized the importance of relationship-building and inclusive practices. While many expressed a strong commitment to CRT, they also identified institutional barriers and limitations in their preparation programs. Overall, the findings illustrated how novice teachers implemented culturally responsive practices while navigating challenges related to training, support, and real-world application.

## Interpretation of the Findings

From the semistructured interviews, data were collected to answer the following RQs:

RQ1: How do novice middle grades science teachers describe their experiences with using CRT to plan and implement science lessons?

RQ2: What are the perspectives of novice middle grades science teachers regarding the use of CRT to plan implement science lessons?

Based on the data analysis, seven key themes were identified. To answer the study's RQs, the seven themes identified are as follows:

1. Reflecting on cultural awareness and developing an identity that values CRT
2. Strategically designing and implementing inclusive, differentiated, and culturally responsive science instruction

3. Intentionally fostering relationships and building a supportive classroom culture
4. Viewing science instruction as a tool for equity and empowerment
5. Navigating structural challenges and finding support in CRT implementation
6. Valuing cultural responsiveness as essential to effective science teaching
7. Bridging the gap between teacher preparation and real-world classroom needs

The findings from this study provide a clear look at how novice middle grades science teachers described and used CRT in their classrooms. Teachers' experiences highlighted the role of personal reflection, instructional choices, and real-world teaching challenges in shaping how they approached CRT. These themes provide the basis for interpreting how participants' perspectives support, expand upon, or challenge the current literature on culturally responsive science teaching and teacher preparation.

**Theme 1: Reflecting on Cultural Awareness and Developing an Identity That Values Culturally Responsive Teaching**

The findings showed that novice science teachers engaged in intentional reflection to better understand their own cultural perspectives and how these influenced their teaching practices. This aligns with the findings of Lindo and Lim (2020) and Wilcoxen et al. (2021), who emphasized that through these reflections, PSTs (preservice teachers) understand their impact on culturally and linguistically diverse students, leading to a deeper connection to culturally responsive teaching. The participants in this study described learning to value CRT as a gradual process that involved examining their beliefs, building cultural awareness, and redefining their teaching identity. This reflects

Kondo's (2022) position that teacher preparation programs must ensure that teacher candidates achieve mastery of cultural awareness and critical consciousness. Similarly, the participants' recognition of the importance of honoring students' cultural assets supports Brady and Esmail's (2019) finding that teacher candidates must identify and reflect on their personal perspectives to assess the adequacy of their cultural understanding. These findings confirm that reflection and cultural awareness are essential components of developing a professional identity that prioritizes CRT.

**Theme 2: Strategically Designing and Implementing Inclusive, Differentiated, and Culturally Responsive Science Instruction**

The findings from this study support the importance of intentional lesson planning that incorporates students' cultural backgrounds and real-world experiences. Participants described designing lessons that made abstract science concepts more tangible and relevant by linking them to students' everyday lives, aligning with research which states that in culturally responsive science classrooms, students are able to link abstract scientific ideas to real-world, concrete experiences (Kim et al., 2021). Participants also emphasized differentiated instruction, student choice, and community-connected content, aligning with Barron et al. (2021) and Madkins and McKinney de Royston's (2019) claim that teachers incorporate the students' prior knowledge and experiences as learning resources into their daily classroom activities, instruction, and assessment. These student-centered strategies often involved collaboration and group work to promote deeper engagement and shared responsibility, which is supported by research stating that as students work collaboratively, they increase their engagement, accountability, and

concept retention (Barron et al., 2021; Tanase, 2022). By designing culturally relevant and inclusive lessons that reflect students' realities, participants contributed to the literature on effective implementation of CRT in science classrooms and demonstrated how responsive lesson design can support student motivation and achievement (see Kim et al., 2021; D. R. Williams et al., 2018).

### Theme 3: Intentionally Fostering Relationships and Building a Supportive Classroom Culture

Participants in this study described the importance of fostering meaningful relationships with students and creating a supportive classroom community, which reflects core elements of CRT. Supported by literature, culturally responsive science teachers begin by creating safe, supportive learning environments and work to build strong relationships with students, families, and communities (O'Leary et al., 2020; D. R. Williams et al., 2018). This emphasis on relationship-building was also evident in how participants learned about students' interests and backgrounds to make science relevant and personal. Tanase (2022) and D. R. Williams et al. (2018) emphasized that through activities, surveys, and discussions, teachers learn about students' backgrounds and make science relevant and cultural for their diverse learner population. Professional learning experiences contributed to participants' growth in this area, as B. Brown et al. (2020) found that novice teachers who participated in design-based professional development enhanced their abilities to build effective relationships with diverse learners. These relationship-based practices support the research showing that when teachers value

students' home lives and communities as assets, they cultivate a classroom culture that fosters academic growth and cultural pride (Barron et al., 2021; Dodo Seriki, 2018).

**Theme 4: Viewing Science Instruction as a Tool for Equity and Empowerment**

Participants described using science instruction as a vehicle to advance equity and empower their culturally and linguistically diverse students. They recognized that Eurocentric and westernized science content, assessments, and instruction often fail to reflect students' lived realities, which contributes to persistent achievement gaps (see Garvin-Hudson & Jackson, 2018; Kayser et al., 2020). Their efforts to integrate culturally responsive practices enabled students to connect science content to their personal interests and cultural backgrounds, fostering pride, empowerment, and greater confidence, as supported by the literature (Barron et al., 2021; Pejaner & Mistades, 2020). Participants also described efforts to help students view science as meaningful beyond the classroom, aligning with findings showing that culturally responsive science encourages students to recognize their ability to use science to address inequities and promote social change, such as in Madkins and McKinney de Royston (2019) and Pejaner and Mistades (2020). These instructional decisions supported students in forming strong science identities and viewing themselves as capable scientists and agents of change, reinforcing research by Barron et al. (2021) and D. R. Williams et al. (2018).

**Theme 5: Navigating Structural Challenges and Barriers While Finding Support in CRT Implementation**

Participants described structural challenges that hindered the implementation of CRT in science, including strict pacing guides, standardized testing, and limited access to

multicultural science materials. These concerns mirror findings in the literature, where science education is often characterized as acultural, relying on Eurocentric content and assessments that overlook students' identities and lived experiences (Dodo Seriki, 2018; Garvin-Hudson & Jackson, 2018). This echoes J. C. Brown and Livstrom (2020) and Madkins and McKinney de Royston (2019), who explained that standardized testing and norm-referenced grading perpetuate the science achievement gap for diverse students, thereby limiting equity in instructional design. Despite these systemic barriers, participants highlighted the value of peer collaboration and professional learning communities, aligning with Borrero et al. (2018), who found that support networks enable novice teachers to navigate school demands while pursuing culturally responsive goals. Participants also viewed CRT as a means to affirm students' cultures and counter marginalizing practices, supporting Wallace et al. (2022), who argued that teachers must actively challenge systemic inequities. Through collaboration and a commitment to inclusive instruction, participants worked to push past institutional constraints and foster equitable science learning environments.

**Theme 6: Valuing Cultural Responsiveness as Essential to Effective Science Teaching**

Participants emphasized that CRT is essential, not an add-on, for effective science instruction in today's diverse classrooms. They described how CRT shifts the focus from teacher-directed instruction to student-centered learning, where students' cultural identities, real-world experiences, and interests inform and enrich science learning. Research supports this view, indicating that when educators integrate students' cultures

and interests into instruction, students show improved attitudes, greater cultural pride, and higher science achievement (Madkins & McKinney de Royston, 2019; Wallace et al., 2022). Studies by Kayser et al. (2020) and D. R. Williams et al. (2018) showed that culturally responsive science instruction increases student motivation, engagement, content mastery, and test scores. One study revealed that when students were encouraged to design science inventions using culturally familiar materials, they not only gained a deeper understanding of the concepts but also felt value in their family and cultural identity (Kim et al., 2021). Teachers who implement CRT create inclusive learning spaces where students draw from their funds of knowledge and community experiences to make meaningful connections between science content and their own lives (McGlynn & Kelly, 2018; Tanase, 2022). These findings make it clear that cultural responsiveness is not just beneficial, but critical to making science instruction equitable, relevant, and empowering for all students.

**Theme 7: Bridging the Gap Between Teacher Preparation and Real-World Classroom Needs**

Many participants described feeling underprepared to implement CRT due to the limited and often surface-level treatment of cultural responsiveness in their teacher preparation programs. While CRT may have been introduced in theory, participants consistently noted that it was rarely woven into science-specific coursework or connected to the realities of diverse classrooms. This gap mirrors findings from Aronson (2020) and (Meadows, 2021), who observed that novice teachers are expected to display levels of practice and instruction similar to experienced teachers but lack adequate support and

training. Participants' experiences echoed this disconnect, as they were often held to high instructional expectations without the tools or training to meet them. This aligns with research showing that science teacher education often misses the mark on addressing the cultural aspects of teaching, leaving teachers without the strategies needed to create equitable, student-focused learning environments (Pejaner & Mistades, 2020; Wallace et al., 2022). These findings highlight how inconsistent and underdeveloped preparation limits new teachers' ability to confidently and effectively bring CRT into their science classrooms.

Despite this gap, participants pointed to the power of continued support, particularly through mentoring, collaboration, and well-designed professional development. Teachers who received hands-on training and space for self-reflection shared that they felt more prepared to incorporate students' cultural knowledge and experiences into their science instruction. This supports findings by Austin et al. (2019), who found that teacher effectiveness, teacher self-efficacy, student motivation, and ultimately student achievement improved after participants engaged in a year-long professional learning program focused on CRT. Participants' reflections reinforced that CRT skills grow best through ongoing learning, thoughtful mentoring, and authentic classroom practice, rather than through one-time lessons in teacher preparation courses. Their insights are consistent with Wallace et al. (2022), who emphasized that implementing culturally responsive science instruction calls for more than awareness. It requires dedication, practice, and intentional support. These findings highlight the

pressing need for teacher preparation and professional learning programs to bridge the gap between expectations and the practical realities faced by novice teachers.

## Interpretation of Findings Through the Lens of Freire's Theory of Critical Consciousness

The findings across the seven themes reflect a growing sense of critical consciousness among novice middle grades science participants, aligning with Freire's (2017) call for educators to recognize and respond to social, political, and educational inequities. Participants demonstrated critical reflection by questioning traditional, Eurocentric science practices and instead advocating for instruction that acknowledges students' cultural identities and real-world experiences. Similar to Garvin-Hudson and Jackson (2018), participants believed that students are not just able to do science work, but become scientists when instruction reflects who they are. This mindset aligns with Freire's belief that awareness is the first step toward transformation. Participants began to reimagine their roles not just as content deliverers, but as equity-focused educators acting in service of liberation through culturally relevant learning.

Participants also demonstrated political efficacy, particularly in their commitment to culturally responsive teaching despite structural barriers such as standardized testing, rigid pacing guides, and limited multicultural resources. They leaned on peer support and professional learning networks to sustain their culturally responsive goals even in the absence of institutional backing. Reflecting the findings of Austin et al. (2019), teachers relied on each other for ideas and shared resources to help navigate challenges with pacing guides and school curriculum. These actions reflect Freire's concept of

transformative practice, which involves reflection and action working together to challenge inequities. Participants used this approach to prioritize student voice, equity, and inclusive science instruction in real and tangible ways.

The final themes revealed how participants moved from awareness to intentional implementation by embedding cultural responsiveness into their science teaching. Rather than viewing CRT as an optional enhancement, participants described it as essential to promoting student engagement, identity development, and success. Still, they noted that their teacher preparation programs did not provide consistent or adequate training in these practices, leaving them underprepared to support diverse learners. This confirms Freire's assertion that meaningful change requires more than knowledge; it requires critical reflection, intentional dialogue, and sustained action. Through this process, participants expressed a commitment to delivering science instruction that is equitable, affirming, and culturally responsive.

## Limitations of the Study

This study focused on the perspectives and experiences of novice middle grades science teachers, which means the findings may not apply to teachers in other grade levels, subject areas, or stages of their careers. The small sample size, while appropriate for a basic qualitative design, naturally narrowed the range of voices included. While the study aimed to gather rich, detailed insights, the limited group of participants means the findings reflect a small portion of the overall teaching population. Rather than generalizing to all teachers, the goal was to better understand how CRT was understood and used by this specific group of novice science teachers.

The study relied only on self-reported data from interviews, which can introduce response bias. Participants may have shaped their responses to reflect what they thought was expected or viewed as positive, especially around culturally responsive practices. This concern was noted in Chapter 1, as participant responses were inherently shaped by their own experiences and preparation, which may have influenced how they described their use of culturally responsive practices. The variety in participants' educational backgrounds and training programs also may have affected the depth of their answers. Because interviews were the only data source, the study did not include other forms of evidence like classroom observations or teaching materials that could have added another layer of understanding.

As the sole researcher, my own background in education may have influenced how I interpreted the data. To support trustworthiness and reduce bias, I followed a consistent coding process, maintained detailed notes during analysis, and made sure my codes stayed closely connected to the framework of critical consciousness. I also used member checks to help confirm the accuracy of participants' responses. These steps helped improve the study's credibility, even though the absence of additional coders and data sources remains a limitation.

## Recommendations

The results of this study offer insight into the culturally responsive teaching practices of novice middle grades science teachers. However, the narrow focus on novice middle grades science teachers limits the extent to which the findings can be applied to other grade levels, subjects, or experience levels. Future research should consider

exploring culturally responsive science teaching across a broader range of teaching contexts, including elementary and high school levels, and among teachers with more years of experience. Studies involving a more diverse sample of participants, including those from different geographic regions, school types (e.g., charter, magnet, rural), or training pathways, could provide additional perspectives to strengthen and expand the current findings.

Another valuable direction for research includes investigating the long-term development of CRT among science teachers. Future studies might follow novice teachers across their early years in the classroom to examine how their culturally responsive practices evolve over time. This type of follow-up research could provide a deeper understanding of how mentorship, professional development, school context, and lived classroom experiences shape teachers' growth. In particular, examining how teachers' beliefs and instructional strategies shift as they gain experience may offer important insights into supporting and retaining teachers committed to equity-focused science education. Additionally, further research could explore how specific supports—such as instructional coaching, learning communities, or equity-centered science curriculum—impact the development and enactment of culturally responsive teaching.

Future studies should also explore how science teacher preparation programs address CRT in subject-specific ways. This study suggests that science-specific training on CRT is inconsistent or lacking altogether. Investigating the content and structure of teacher education programs, particularly their attention to equity-based science instruction, may help identify key leverage points for improvement. Researchers could

also examine how teacher educators' own conceptualizations of CRT influence the preparation of preservice teachers. Finally, while this study centered on teacher perspectives, future research may benefit from including the voices of students and school leaders to provide a more holistic understanding of how CRT plays out in science classrooms. Incorporating multiple perspectives would strengthen the field's understanding of what effective, inclusive science teaching looks like in practice and how it can be cultivated within schools and educator preparation programs.

## Implications

### Potential Impact for Positive Social Change

This study has the potential to contribute to positive social change by amplifying the voices and experiences of novice middle grades science teachers who are actively working to implement CRT. Their reflections reveal how novice educators are developing equity-focused mindsets, creating inclusive classroom environments, and designing instruction that affirms and reflects the diverse cultural backgrounds of their students. These practices can influence how students see themselves in science, strengthening their sense of belonging and encouraging deeper engagement with scientific learning.

At the individual level, this research may contribute to improved student participation, identity affirmation, and academic confidence, particularly among those historically underrepresented in STEM fields. For novice teachers, the findings highlight the importance of self-reflection, relationship-building, and responsive planning, offering a model for how new educators can begin implementing CRT despite structural

challenges. At the school and organizational level, these insights may inform mentoring programs, professional development opportunities, and support systems that position cultural responsiveness as central to effective science instruction. These findings may also inform middle grades science teacher preparation and professional development by highlighting the practices and supports novice teachers need to create inclusive, culturally affirming classroom environments.

Additionally, the conclusions of this study may offer a framework for reimagining teacher preparation and ongoing training to better meet the needs of culturally and linguistically diverse students. By focusing on the authentic experiences of novice teachers, this research may guide policy and curricular decisions that prioritize equity, student-centered learning, and real-world relevance in science education. Ultimately, these shifts may empower educators to challenge systemic inequities, foster inclusive learning environments, and support transformative change in schools and communities.

## Methodological, Theoretical, and Empirical Implications

### *Methodological Implications*

This study contributes methodologically by showing how authentic, in-depth qualitative interviews can reveal the real-world classroom experiences of novice science teachers using CRT. The design allowed teachers to express their instructional choices and cultural reflections in their own words, offering insight that quantitative measures may overlook. Through detailed notes, consistent reflection, and alignment with the study's conceptual framework, the data analysis prioritized transparency and rigor. This approach demonstrates how participant voice can be elevated to inform equity-focused

educational research. Gay (2010) highlighted the value of capturing teacher perspectives to deepen our understanding of culturally responsive instruction, and the present study builds on that foundation by focusing on novice educators' firsthand experiences. Future research can continue using this model to study how novice teachers build their pedagogical identities in real-time while also supporting the development of culturally responsive teaching practices in diverse classroom contexts.

### *Theoretical Implications*

Using Freire's (2017) theory of critical consciousness, this study revealed how novice science teachers engaged in reflection, cultural awareness, and deliberate instructional action. Participants described how gaining a deeper understanding of their students' cultural backgrounds prompted them to question prior assumptions and adjust their science instruction to be more inclusive. These practices align with Ladson-Billings's (1995) view that culturally relevant teaching is not simply about curriculum but also about teachers' mindsets and responsiveness. The findings also support research suggesting that transformative teaching is rooted in critical reflection and action (Madkins & McKinney de Royston, 2019). Additionally, professional development opportunities that prioritize reflection, adaptability, and CRT support teachers' development of critical consciousness and effective practice (Borrero et al., 2018; Hayden & Gratteau-Zinnel, 2019). These findings demonstrate that equity-driven theoretical frameworks can meaningfully inform the instructional practices and professional growth of novice science teachers navigating diverse classroom contexts.

### *Empirical Implications*

Empirically, this study addressed a clear gap in the literature by focusing on novice middle grades science teachers, a group often overlooked in CRT research. Participants frequently shared that their teacher preparation programs provided minimal guidance in applying CRT to science instruction, leaving them underprepared for the realities of diverse classrooms. Many described learning to incorporate culturally responsive practices through mentorship, trial and error, and direct student interactions rather than through formal coursework. These findings echo the concerns of Borrero et al. (2018), Arroyo et al. (2020), and Chaney et al. (2020), who emphasize that novice teachers often learn CRT through experiential means, without adequate structural support. Participant insights validated this disconnect, reflecting a clear need for teacher education programs to better align theoretical instruction with the practical demands of teaching in culturally and linguistically diverse contexts.

These insights reinforce the need for teacher preparation and professional development programs to incorporate authentic, classroom-based CRT experiences and scaffold reflective practice. Participants' experiences support previous research suggesting that professional growth in CRT often emerges from intentional reflection, collaboration, and contextual responsiveness rather than prescribed methods alone (Borrero et al., 2018; Hayden & Gratteau-Zinnel, 2019). To ensure equitable science instruction early in their careers, novice teachers need targeted training and practical support to help them navigate the complexities of culturally and linguistically diverse classrooms. Career teachers may also benefit from continued exposure to CRT models

that are grounded in classroom realities, ensuring sustained relevance and effectiveness. This study contributes empirical evidence that highlights the importance of bridging preparation with practice to promote equity-focused science instruction from the start.

## Recommendations for Practice

Based on the findings of this study and supported by relevant literature, the following recommendations are offered to improve the preparation and support of novice middle grades science teachers implementing CRT. These practices aim to enhance teacher self-efficacy, strengthen instructional relevance, and promote equitable science learning environments.

### *Integrate Authentic, Classroom-Based CRT Training Into Teacher Preparation Programs*

Many novice teachers entered the classroom without formal training in CRT, instead learning by trial and error, observation, and collaboration. This gap aligns with research by J. C. Brown and Livstrom (2020), who noted that many science teachers exit preparation programs without adequate CRT training. Integrating hands-on, classroom-based CRT experiences into teacher preparation programs will help teachers better connect culture to science content and build confidence in their instructional decisions.

### *Develop Professional Development Opportunities That Center on Culturally Responsive Science Instruction*

Participants described how their confidence grew when professional development was ongoing, relevant, and rooted in their classroom experiences. Teachers need sustained opportunities to strengthen their CRT competencies, particularly in the context

of science instruction. Professional development that is iterative, practical, and responsive to teachers' needs can build their self-efficacy and support culturally responsive teaching practices.

### *Establish Structured Mentorship Programs for Novice Science Teachers*

Several participants emphasized the value of learning from more experienced colleagues. Mentorship programs can provide crucial support for navigating challenges, building CRT competencies, and promoting reflective practice. Structured mentorship also fosters a culture of collaboration and sustained professional growth in science education.

### *Provide Collaborative Planning Spaces Where Novice Teachers Can Co-Develop CRT Lessons*

Novice teachers in this study expressed a desire to collaborate with colleagues to design responsive, relevant science lessons. Planning spaces allow teachers to share strategies, troubleshoot challenges, and learn from diverse perspectives. These environments promote shared responsibility and foster stronger implementation of CRT.

### *Incorporate CRT-Focused Reflection Tools into Regular Teacher Support Systems*

Reflection played a key role in how teachers in this study developed their understanding of CRT. Embedding tools such as CRT self-assessments or guided reflection protocols into coaching sessions, team meetings, or PD can promote critical thinking about culture, bias, and instruction. These tools can help teachers refine their practices and deepen their cultural awareness over time.

### *Align Science Curriculum Resources with Culturally Responsive Pedagogy*

Participants noted challenges in adapting standardized curricula to reflect their students' cultures and experiences. When curriculum materials are misaligned with CRT goals, even well-prepared teachers face implementation barriers. Ensuring that science curriculum resources include diverse perspectives and culturally relevant contexts can support novice teachers in delivering equitable and meaningful instruction.

Collectively, these recommendations emphasize the importance of systemic, sustained support for novice science teachers striving to implement CRT. When teacher preparation, professional learning, and instructional resources are aligned with CRT principles, educators are better equipped to meet the needs of diverse learners. Implementing these practices can foster more equitable science classrooms and strengthen teacher self-efficacy from the very start of their careers.

## Conclusion

This study examined how novice middle grades science teachers understand and implement CRT in classrooms shaped by cultural diversity and structural barriers. With limited preparation and minimal institutional support, many of these teachers entered the field without the tools needed to meet the realities of diverse student populations. This ongoing lack of training and guidance contributes to the high attrition rates among novice educators, particularly those working in under-resourced schools. The authentic voices of participants offered a candid look at what it means to teach science responsively in today's classrooms and why that work is both urgent and relevant for 21st-century learning.

The findings aligned with both RQs and were interpreted through Freire's theory of critical consciousness, highlighting how teachers developed cultural awareness, reflective habits, and purposeful action through classroom experiences and collaboration. Participants described cultivating inclusive learning environments by building relationships, adapting instruction, and connecting science content to students' realities, even without formal support such as professional development or mentoring. Their growth in CRT practices emerged not from coursework, but through trial-and-error, feedback, and ongoing peer collaboration. These insights highlight the urgent need for educator preparation that moves beyond abstract theory, prioritizing hands-on learning that prepares teachers to respond to real classroom demands with clarity, responsiveness, and equity in focus.

As student populations grow more diverse, education systems must prioritize the development of novice teachers who are equipped with the tools, awareness, and strategies needed for responsive instruction. This work affirms that novice teachers are not empty vessels but are capable of transformative teaching when provided with intentional guidance, mentorship, and space for reflection. By equipping new educators with both the critical consciousness and the practical tools to teach all students effectively, the field can begin to foster meaningful and lasting change in science education.

# References

Ackah-Jnr, F. R. (2020). The teacher should be learning: In-service professional development and learning of teachers implementing inclusive education in early childhood education settings. *International Journal of Whole Schooling*, *16*(*2*), 93-121. https://doi.org/10.13140/RG.2.2.13653.86248

Adeoye-Olatunde, O. A., & Olenik, N. L. (2021). Research and scholarly methods: Semi-structured interviews. *JAACP: Journal of the American College of Clinical Pharmacy*, *4*(10), 1358-1367. https://doi.org/10.1002/jac5.1441

Ahlin, E. (2019). Semi-structured interviews with expert practitioners: Their validity and significant contribution to translational research. In *Sage Research Methods Cases Part 2*. SAGE Publications. https://doi.org/10.4135/9781526466037

Aronson, B. A. (2020). From teacher education to practicing teacher: What does culturally relevant praxis look like? *Urban Education*, *55*(8–9), 1115–1141. https://doi.org/10.1177/0042085916672288

Arroyo, M., Quinn, L. F., Paretti, L., & McCarthy, J. (2020). A content analysis of coaching novice teachers. *Educational Research: Theory and Practice*, *31*(1), 22–25. https://files.eric.ed.gov/fulltext/EParticipant J250270.pdf

Assante, G. M. (2020). The impact of critical consciousness on teacher conceptions and beliefs about teaching and learning: The mediator role of career identity. *Journal Plus Education / Educatia Plus*, *26*(1), 80–90. https://www.uav.ro/jour/index.php/jpe/article/view/1473/1494

Austin, D. W., Atencio, M., Yeung, F., Stein, J., Mathur, D., Ivester, S., & Woods, D. R. (2019). Diversity and inclusion curriculum: Addressing culturally relevant pedagogy and the achievement gap at a racially diverse university. *Currents in Teaching & Learning*, *11*(1), 112–134. https://webcdn.worcester.edu/currents-in-teaching-and-learning/wp-content/uploads/sites/65/2022/05/Currents-Volume-11-Issue-01-Fall-2019.pdf

Barron, H. A., Brown, J. C., & Cotner, S. (2021). The culturally responsive science teaching practices of undergraduate biology teaching assistants. *Journal of Research in Science Teaching*, *58*(9), 1320–1358. https://doi.org/10.1002/tea.21711

Bearman, M. (2019). Focus on methodology: Eliciting rich data: A practical approach to writing semistructured interview schedules. *Focus on Health Professional Education: A Multi-Professional Journal*, *20*(3), 1-11. https://doi.org/10.11157/fohpe.v20i3.387

Bhardwaj, P. (2019). Types of sampling in research. *Journal of the Practices of Cardiovascular Science, 5*(3), 157. https://doi.org/10.4103/jpcs.jpcs_62_19

Billups, F. D. (2021). *Qualitative data collection tools: Design, development, and applications*. SAGE Publications. https://doi.org/10.4135/9781071878699

Borrero, N., Ziauddin, A., & Ahn, A. (2018). Teaching for change: new teachers' experiences with and visions for culturally relevant pedagogy. *Critical Questions in Education*, *9*(1), 22–39. https://files.eric.ed.gov/fulltext/EParticipantJ172314.pdf

Bottiani, J. H., Larson, K. E., Debnam, K. J., Bischoff, C. M., & Bradshaw, C. P. (2018). Promoting educators' use of culturally responsive practices: A systematic review of in-service interventions. *Journal of Teacher Education*, *69*(4), 367-385. https://doi.org/10.1177/0022487117722553

Braaten, B., Kramer, A., Henderson, E., Kajfez, R., & Dringenberg, E. (2020). Accessing complex constructs: Refining an interview protocol. *2020 IEEE Frontiers in Education Conference (FIE)*, 1–3. https://doi.org/10.1109/FIE44824.2020.9274260

Brady, J., & Esmail, A. (2019). The impact of multicultural education training for pre-service teachers. *Journal of Education & Social Justice*, *6*(1), 42–53.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3* (2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Brodeur, K., LaVenia, K. N., Galletta Horner, C., & Huziak-Clark, T. (2020). Interrupting the pattern: Knowing why and respecting who we teach. *Mid-Western Educational Researcher*, *32*(3), 206–230. https://scholarworks.bgsu.edu/mwer/vol32/iss3/3

Brown, B., Friesen, S., & Beck, J., & Roberts, V. (2020). Supporting new teachers as designers of learning. *Education Sciences*, *10* (8), 207. https://doi.org/10.3390/educsci10080207

Brown, B. A., Boda, P., Lemmi, C., & Monroe, X. (2019). Moving culturally relevant pedagogy from theory to practice: Exploring teachers' application of culturally

relevant education in science and mathematics. *Urban Education*, *54*(6), 775–803. https://doi.org/10.1177/0042085918794802

Brown, J. C., & Livstrom, I. C. (2020). Secondary science teachers' pedagogical design capacities for multicultural curriculum design. *Journal of Science Teacher Education*, *31*(8), 821–840. https://dx.doi.org/10.1080/1046560X.2020.1756588

Brown, J. C., Ring-Whalen, E. A., Roehrig, G. H., & Ellis, J. A. (2018). Advancing culturally responsive science education in secondary classrooms through an induction course. *International Journal of Designs for Learning*, *9*(1), 14–33. https://doi.org/10.14434/ijdl.v9i1.23297

Campbell, S., Greenwood, M., Prior, S., Shearer, T., Walkem, K., Young, S., Bywaters, D., & Walker, K. (2020). Purposive sampling: complex or simple? Research case examples. *Journal of Research in Nursing*, *25*(8), 652–661. https://doi.org/10.1177/1744987120927206

Carter Andrews, D. J. (2021). Preparing teachers to be culturally multidimensional: Designing and implementing teacher preparation programs for pedagogical relevance, responsiveness, and sustenance. *The Educational Forum*, *85*(4), 416–428. https://doi.org/10.1080/00131725.2021.1957638

Chaney, B., Braun, H., & Jenkins, F. (2020). Novice middle school teachers' preparedness for teaching, and the helpfulness of supports: A survey of one state. *Education Policy Analysis Archives, 28*, 107. https://doi.org/10.14507/epaa.28.5001

Christens, B. D., Winn, L. T., & Duke, A. M. (2016). Empowerment and critical consciousness: A conceptual cross-fertilization. *Adolescent Research Review, 1*(1), 15–27. https://doi.org/10.1007/s40894-015-0019-3

Clark, S. K., & Andreasen, L. (2021). Exploring elementary teacher self-efficacy and teacher beliefs: Are we preparing teachers to teach culturally diverse students? *Asia-Pacific Journal of Teacher Education*, *49*(1), 128–142. https://doi.org/10.1080/1359866X.2020.1777528

Collins, C. S., & Stockton, C. (2022). The theater of qualitative research: The role of the researcher/actor. *International Journal of Qualitative Methods, 21*, 1-9. https://doi.org/10.1177/16094069221103109

Creswell, J. W., & Creswell, J. D. (2018). *Research design: qualitative, quantitative, and mixed methods approaches*. 5th ed. SAGE. https://lccn.loc.gov/2017044644

Delve. (2024). *Delve* [Computer software]. https://delvetool.com

Denzin, N. K. (2017). Critical qualitative inquiry. *Qualitative Inquiry*, *23*(1), 8-16. https://doi.org/10.1177/1077800416681864

Diaz, K. (2018). Paulo Freire (1921-1997). *Internet encyclopedia of philosophy.* https://iep.utm.edu/freire/#H9

Diemer, M. A., Rapa, L. J., Voight, A. M., & McWhirter, E. H. (2016). Critical consciousness: A developmental approach to addressing marginalization and oppression. *Child Development Perspectives*, *10*(4), 216–221. https://doi.org/10.1111/cdep.12193

Dodo Seriki, V. (2018). Advancing alternate tools: Why science education needs CRP and CRT. *Cultural Studies of Science Education*, *13*(1), 93–100. https://dx.doi.org/10.1007/s11422-016-9775-z

Donahue-Keegan, D., Villegas-Reimers, E., & Cressey, J. M. (2019). Integrating social-emotional learning and culturally responsive teaching in teacher education preparation programs: The Massachusetts experience so far. *Teacher Education Quarterly*, *46*(4), 150. https://www.jstor.org/stable/26841580

Evans, L. M., Turner, C. R., & Allen, K. R. (2020). "Good teachers" with "good intentions": Misappropriations of culturally responsive pedagogy. *Journal of Urban Learning, Teaching, and Research*, *15*(1), 51–73. https://files.eric.ed.gov/fulltext/EJ1283416.pdf

Freire, P. (2017). *Pedagogy of the oppressed*. Penguin Classics.

Garvin-Hudson, B., & Jackson, T. O. (2018). A case for culturally relevant science education in the summer for African American youth. *International Journal of Qualitative Studies in Education (QSE)*, *31*(8), 708–725. https://dx.doi.org/10.1080/09518398.2018.1478156

Gay, G. (2002). Preparing for culturally responsive teaching. *Journal of Teacher Education, 53*(2), 106-116. https://doi.org/10.1177/0022487102053002003

Gay, G. (2010). *Culturally responsive teaching: Theory, research, and practice* (2nd ed.). Teachers College Press.

Gutierrez, L. (1995). Understanding the empowerment process: Does consciousness make a difference? *Social Work Research*, *19* (4), 229-237

Hanover Research. (2015). *Review of grade level configurations.* Hanover Research.

Hayden, E., & Gratteau-Zinnel, T. (2019). Not a moment to lose: Mentoring teacher candidates for new cultures and climate. *Mid-Western Educational Researcher*, *31*(2), 144–165. https://scholarworks.bgsu.edu/cgi/viewcontent.cgi?article=1081&context=mwer

Holliday, C. G. (2021). Culturally relevant coaching: Empowering new teachers. *English in Texas*, *51*(1), 33–41. https://files.eric.ed.gov/fulltext/EJ1312155.pdf

Johnson, V., Carpenter, J., Richards, C., & Vincent, K. B. (2019). Culturally responsive practices for teacher candidates: A neighborhood treasure hunt. *Journal for Multicultural Education*, *13*(1), 19–32. https://doi.org/10.1108/JME-07-2017-0042

Jones, B. L., & Donaldson, M. L. (2022). Preservice science teachers' sociopolitical consciousness: Analyzing descriptions of culturally relevant science teaching and students. *Science Education*, *106*(1), 3–26. https://doi.org/10.1002/sce.21683

Kayser, A. A., Nash, A. M., & Kayser, B. (2020). Change-makers: A grassroots approach to culturally responsive leadership and teaching. *Journal of Education Human Resources, 38*(1), 35-56. https://doi.org/10.3138/jehr.2019-0009

Kim, D., Kim, S. L., & Barnett, M. (2021). “That makes sense now!”: Bicultural middle school students’ learning in a culturally relevant science classroom. *International Journal of Multicultural Education*, *23*(2), 145–172. https://doi.org/10.18251/ijme.v23i2.2595

Kondo, C. S. (2022). Walking the talk: Employing culturally relevant pedagogy in teacher education. *Teachers College Record: The Voice of Scholarship in Education*, *124*(4), 65–94. https://doi.org/10.1177/01614681221096797

Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal*, *32*(3), 465–491. https://doi.org/10.3102/00028312032003465

Ladson-Billings, G. (2009). *The dreamkeepers: Successful teachers of African American children* (2nd ed.). Jossey-Bass.

Ladson-Billings, G. (2014). Culturally relevant pedagogy 2.0: a.k.a. the remix. *Harvard Educational Review, 84*(1), 74–84. https://doi.org/10.17763/haer.84.1.p2rj131485484751

Lakhwani, M. (2019). Insights into new teacher professional development: A focus on culturally responsive teaching practices. *Journal of Behavioral & Social Sciences*, *6*(2), 101–107.

Lavee, E., & Itzchakov, G. (2023). Good listening: A key element in establishing quality in qualitative research. *Qualitative Research, 23*(3), 614-631. https://doi.org/10.1177/14687941211039402

Lincoln, Y. S., & Guba, E. G., & Pilotta, J. J. (1985). *Naturalistic inquiry*. Sage Publications, Inc. https://doi.org/10.1016/0147-1767(85)90062-8

Lindo, E. J., & Lim, O. J. (2020). Becoming more culturally competent educators. *Perspectives on Language and Literacy*, *46*(2), 33–38.

https://www.proquest.com/scholarly-journals/becoming-more-culturally-competent-educators/docview/2429853603/se-2?accountid=14872

Lomelí, R. S. (2021). Critical praxis círculos: The impact of culturally responsive teacher development. *Taboo: The Journal of Culture & Education*, *20*(2), 120–141. https://doi.org/10.31979/etd.htq8-8ac2

Madkins, T. C., & McKinney de Royston, M. (2019). Illuminating political clarity in culturally relevant science instruction. *Science Education*, *103*(6), 1319–1346. https://dx.doi.org/10.1002/sce.21542

McGlynn, K., & Kelly, J. (2018). Creating a culturally responsive middle school science classroom. *Science Scope*, *42*(2), 16–21. https://doi.org/10.2505/4/ss18_042_02_16

Meadows, J. A. (2021). *Perspectives of novice teachers applying differentiated instruction in heterogeneous elementary classrooms*. [Doctoral dissertation, Walden University]. ScholarWorks. https://scholarworks.waldenu.edu/dissertations/9774

Megheirkouni, M., & Moir, J. (2023). Simple but effective criteria: Rethinking excellent qualitative research. *The Qualitative Report*, *28*(3), 848-864. https://doi.org/10.46743/2160-3715/2023.5845

Mensah, F. M., Brown, J. C., Titu, P., Rozowa, P., Sivaraj, R., & Heydari, R. (2018). Preservice and in-service teachers' ideas of multiculturalism: Explorations across two science methods courses in two different contexts. *Journal of Science*

*Teacher Educat*ion, *29*(2), 128–147. https://doi.org/10.1080/1046560X.2018.1425820

Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: A guide to design and implementation* (4th ed.). Jossey Bass.

Moore, A. L., Giles, R. M., & Vitulli, P. (2021). Prepared to respond? Investigating preservice teachers' perspectives of their readiness for culturally responsive teaching. *International Journal for the Scholarship of Teaching & Learning*, *15*(1). https://doi.org/10.20429/ijsotl.2021.150110

Nassaji, H. (2020). Good qualitative research. *Language Teaching Research, 24*(4), 427–431. https://doi.org/10.1177/1362168820941288

O'Leary, E. S., Shapiro, C., Toma, S., Sayson, H. W., Levis-Fitzgerald, M., Johnson, T., & Sork, V. L. (2020). Creating inclusive classrooms by engaging stem faculty in culturally responsive teaching workshops. *International Journal of STEM Education*, *7*(1). https://dx.doi.org/10.1186/s40594-020-00230-7

Parker, C., Scott, S., & Geddes, A. (2019). Snowball sampling. *SAGE Research Methods Foundations.* https://doi.org/10.4135/9781526421036831710

Patton, M. Q. (2015). *Qualitative research and evaluation methods* (4th ed.). Sage Publications.

Pejaner, K. J. B., & Mistades, V. M. (2020). Culturally relevant science teaching: A case study of physics teaching practices of the "Obo Monuvu" tribe. *Science Education International, 31*(2), 185–194. https://doi.org/10.33828/sei.v31.i2.8

Purna Singh, A., Vadakedath, S., & Kandi, V. (2023). Clinical research: A review of study designs, hypotheses, errors, sampling types, ethics, and informed consent. *Cureus*, *15*(1). https://doi.org/10.7759/cureus.33374

Quinn, D., & Cooc, N. (2015). Science achievement gaps by gender and race/ethnicity in elementary and middle school. *Educational Researcher, 44* (6). https://doi.org/10.3102/0013189X15598539

Rappaport, J. (1981). In praise of paradox: A social policy of empowerment over prevention. *American Journal of Community Psychology*, *9*(1), 1–25. https://doi.org/10.1007/BF00896357

Ravitch, S., & Carl, N. M. (2021). *Qualitative research: Bridging the conceptual, theoretical, and methodological* (2nd ed.). Sage Publications.

Roberts, R. E. (2020). Qualitative interview questions: Guidance for novice researchers. *The Qualitative Report*. https://doi.org/10.46743/2160-3715/2020.4640

Saldaña, J. (2021). *The coding manual for qualitative researchers* (4th ed.). Sage.

Schauer, M. (2021). Race is a big deal: The childhood experiences of white, female teachers and the development of critical consciousness to "see, judge and act." *Mid-Western Educational Researcher*, *33*(1), 11–35. https://www.mwera.org/MWER/volumes/v33/issue1/MWER-V33n1-Schauer-FEATURE-ARTICLE.pdf

Smit, B., & Onwuegbuzie, A. J. (2018). Observations in qualitative inquiry: When what you see is not what you see. *International Journal of Qualitative Methods*, *17*(1). https://doi.org/10.1177/1609406918816766

Stahl, N. A., & King, J. R. (2020). Expanding approaches for research: Understanding and using trustworthiness in qualitative research. *Journal of Developmental Education*, *44*(1), 26-28. https://www.jstor.org/stable/45381095

Stepp, Z. A., & Brown, J. C. (2021). The (lack of) relationship between secondary science teachers' self-efficacy for culturally responsive instruction and their observed practices. *International Journal of Science Education*, *43*(9), 1504–1523. https://doi.org/10.1080/09500693.2021.1919335

Subedi, K. (2021). Determining the sample in qualitative research. *Scholars' Journal*, 1-13. https://doi.org/10.3126/scholars.v4i1.42457

Tanase, M. F. (2022). Culturally responsive teaching in urban secondary schools. *Education and Urban Society*, *54*(4), 363–388. https://doi.org/10.1177/00131245211026689

Tanguay, C. L., Bhatnagar, R., Barker, K. S., & Many, J. E. (2018). AAA+ professional development for teacher educators who prepare culturally and linguistically responsive teachers. *Curriculum and Teaching Dialogue*, *20* (1–2), 87–104.

Thomas, C. A., & Berry, R. Q. (2019). A qualitative metasynthesis of culturally relevant pedagogy & culturally responsive teaching: Unpacking mathematics teaching practices. *Journal of Mathematics Education at Teachers College*, *10*(1), 21–30. https://doi.org/10.7916/jmetc.v10i1.1668

Toombs, J. M., Terry, R., Ramsey, J. W., Robinson, S., & Ivey, T. A. (2021). *Professional development needs of Oklahoma induction-year school-based agricultural education teachers across certification pathways: A mixed-methods*

*approach* [Doctoral dissertation, Oklahoma State University]. ProQuest Dissertations and Theses Global. https://doi.org/10.13140/RG.2.2.13615.05285

Trumbull, E., Greenfield, P. M., Rothstein-Fisch, C., Maynard, A. E., Quiroz, B., & Yuan, Q. (2020). From altered perspectives to altered practice: Teachers bridge cultures in the classroom. *School Community Journal*, *30*(1), 243–266. https://files.eric.ed.gov/fulltext/EJ1257613.pdf

Underwood, J. B., & Mensah, F. M. (2018). An investigation of science teacher educators' perceptions of culturally relevant pedagogy. *Journal of Science Teacher Education*, *29*(1), 46–64. https://doi.org/10.1080/1046560X.2017.1423457

Ungvarsky, J. (2020). *Snowball sampling*. Salem Press Encyclopedia.

Wallace, J., Howes, E., Funk, A., Krepski, S., Pincus, M., Sylvester, S., Tsoi, K., Tully, C., Sharif, R., & Swift, S. (2022). Stories that teachers tell: Exploring culturally responsive science teaching. *Education Sciences*, *12*(6), 401. https://doi.org/10.3390/educsci12060401

Watson, S. (2021). Culturally relevant pedagogy and the 5e lesson plan. *The Science Teacher*, *89*(2), 56–61. https://doi.org/10.1080/00368555.2021.12293655

Watts, R. J., Diemer, M. A., & Voight, A. M. (2011). Critical consciousness: Current status and future directions. *New Directions for Child and Adolescent Development*, *2011*(134), 43–57. https://doi.org/10.1002/cd.310

Watts, R. J., & Hipolito-Delgado, C. P. (2015). Thinking ourselves to liberation?: Advancing sociopolitical action in critical consciousness. *The Urban Review*, *47*(5), 847–867. https://doi.org/10.1007/s11256-015-0341-x

West, J. J., & Frey-Clark, M. L. (2019). Traditional versus alternative pathways to certification: Assessing differences in music teacher self-efficacy. *Journal of Music Teacher Education*, *28*(2), 98–111. https://doi.org/10.1177/1057083718788035

Wilcoxen, C., Steiner, A., & Bell, J. (2021). Strengthening preservice teachers' understanding of culturally responsive classrooms through exposure, immersion, and dialogue. *Journal of Community Engagement and Scholarship*, *14*(1). https://doi.org/10.54656/flxy2991

Williams, D. R., Brule, H., Kelley, S. S., & Skinner, E. A. (2018). Science in the learning gardens (SciLG): A study of students' motivation, achievement, and science identity in low-income middle schools. *International Journal of STEM Education, 5*(1). https://doi.org/10.1186/s40594-018-0104-9

Williams, M., & Moser, T. (2019). The art of coding and thematic exploration in qualitative research. *International Management Review*, *15*(1), 45-55. https://www.imrjournal.org/uploads/1/4/2/8/14286482/imr-v15n1art4.pdf

Wolff, C. E., Jarodzka, H., & Boshuizen, H. P. A. (2021). Classroom management scripts: A theoretical model contrasting expert and novice teachers' knowledge and awareness of classroom events. *Educational Psychology Review*, *33*(1), 131–148. https://doi.org/10.1007/s10648-020-09542-0

Yoon, B., & Uliassi, C. (2022). “Researcher-as-instrument” in qualitative research: The complexities of the educational researcher’s identities. *The Qualitative Report, 27* (4), 1088-1102. https://doi.org/10.46743/2160-3715/2022.5074

# Appendix: Interview Protocol

**Introduction Script**

Thank you for agreeing to participate in my study. I greatly appreciate your willingness to share your personal perspectives and experiences through this interview process. This proposed study will explore the perspectives of novice middle grades science teachers regarding their cultural awareness and use of culturally responsive teaching practices to plan and execute science instruction. This guided conversation will take approximately 45- 60 minutes. I will record this interview through video and audio tools presented on the platform. Following the interview, I will use these recordings, along with my notes, to transcribe our conversation.

Before we begin, I am reminding you about the informed consent document you received via email. Do you agree to be interviewed for this study? If, at any point in the interview, you decide that you would like to discontinue, please let me know. All of your responses, as well as your identity, are confidential. You will be provided an alphanumerical alias so that your responses will not be directly connected to your name. All the information I collect will be stored on a password-protected laptop. Aside from me, the only other person who may access your information and identity is my Walden University Chair, Dr. Harrison. I do have questions to guide our talk, but please feel free to elaborate or dive deeper into your responses. Please share as much or as little as you are comfortable with. Again, all of your responses and your identity will be confidential. Do you have any questions before we begin? Great. Let’s begin.

## Interview Questions

1. How many years of experience do you have as a certified teacher? (*Background information)*

2. What type of teacher certification program did you complete? (*Background information)*

**Follow-up [If clarification needed]:** Traditional Teacher Education Program (TEP), Alternative Certification Program, or Other? If "Other", what was the program?

3. What grade level(s) are you currently teaching? (*Background information)*

4. What factors describe your current teaching environment? (*Background information)*

**Follow-up:** Do you work in a public, charter, private, or Montessori school? What grade levels does your school have? Does your school offer online or virtual classes? Does your school offer ESL/ESOL services? Is your school considered Title 1? Is your school in a rural, suburban, or urban/inner city area?

5. How do you define culturally responsive teaching? (*Culturally responsive perspective)*

6. What considerations do you make when planning to differentiate lessons for diverse learners? (*Culturally responsive/instructional practices/Critical consciousness)*

7. Researchers state that science is "acultural." Do you agree with this statement? Why or why not? (*Culturally responsive perspective)*

8. Please describe any specific activities you use to connect to the diverse cultures in your classroom. (*Culturally responsive/Critical consciousness perspective)*

9. Please describe a time when there was a "cultural disconnect" between students and the science curriculum.

**Follow-up:** How did you address the issue? (*Critical consciousness planning/instruction)*

10. Please describe any training or courses you received in your teacher education program/alternate certification program that focused on multicultural education or culturally responsive teaching. *(Culturally responsive teacher preparation)*

11. Now that you've been teaching for [x amount of time], do you feel that you were well prepared by your TEP to effectively teach science to culturally diverse students? Why/Why not?

**Follow-up [Optional]:** What gaps in your teaching are evident to you? *(Culturally responsive teacher preparation)*

12. As a novice teacher, can you describe any support you've received from colleagues, induction programs, or mentoring that focused on planning and instruction for diverse learners? *(Culturally responsive teacher preparation)*

13. Can you describe any professional development conducted through your school or district, focusing specifically on culturally responsive teaching or teaching science to diverse populations? *(Culturally responsive teacher preparation)*

**Follow-up:** (If PD has occurred) How often has this PD occurred?

14. How did you learn about the different cultures to promote inclusivity in your classroom? (*Critical consciousness planning/instruction)*

15. Many diverse students face an "opportunity gap" where they don't have equitable access to opportunities or resources. How do you consider these gaps when planning and executing instructional activities? (*Critical consciousness planning/instruction)*

16. At this point in your career, what support and/or resources would you like to receive in order to better implement culturally responsive science pedagogy? *(Culturally responsive teacher preparation)*

The following probes will be employed as needed to acquire deeper or more detailed responses:

P1. Can you please elaborate on that?

P2. What did you mean when you said….?

P3. Can you give me an example of that?

P4. Why do you think that happened?

**Conclusion Script**

This concludes our interview. I greatly appreciate your time and effort in completing this process. Do you have any questions or concerns? {*Answer as necessary}* I will be getting this interview transcribed to ensure accuracy and my understanding of your responses. Once I receive the transcription, I will email it to you so that you can check your ideas and responses. If you have any corrections or questions about it, you can email me within five business days. My email address and phone number are located on your copy of the informed consent document. Feel free to contact me with any further questions or insight you would like to provide for the study. Again, thank you for your participation. I will email your virtual gift card to compensate you for your time and effort. Enjoy the rest of your day!