

What Do We Know About Teaching Statistics for Social Justice? A Scoping Review

Micayla Gooden 
University of Oklahoma

Miriam Sanders 
University of Wyoming

Jamaal R. Young 
Texas A&M University

ABSTRACT

Teaching statistics for social justice (TS4SJ) empowers students to use statistical data analysis skills to make positive changes in their communities. The aim of this study is to describe the volume, characteristics, and nature of the current research regarding teaching statistics for social justice. This scoping review provides an examination of the literature from multiple database searches. Inclusion criteria consist of literature published between 2007 and 2023, an explicit connection to statistics education in Pre-K-12 or post-secondary settings, and an explicit or implicit mention of TS4SJ elements. The systematic search of the literature yielded 16 relevant results toward our goal of providing a description of the characteristics and range of literature regarding TS4SJ. Our scoping review results provide evidence of a dearth of empirical studies, as well as a description of explicit and implicit TS4SJ elements aligned with the Guidelines for Assessment and Instruction in Statistics Education (GAISE). Thus, the scoping review results have implications for future research and practice in statistics education.

Keywords: pre-service teacher; in-service teacher; statistics education; social justice

Introduction

Statistics has become an essential subject in schools because it serves as a bridge between mathematics and everyday life. While often grouped under the umbrella of mathematics in the school curriculum, statistics is distinct in several important ways. Unlike mathematics, which emphasizes deterministic reasoning and exact solutions, statistics relies on inductive reasoning, contextual understanding, and managing variability and uncertainty (Tran & Lee, 2015). Statistical questions emerge from real-world contexts, requiring decisions about data collection, measurement, and appropriate analysis methods. This emphasis on context—such as understanding why outliers exist or determining appropriate models for data interpretation—distinguishes statistical reasoning from purely mathematical reasoning, which tends to prioritize generalizable proofs and exact answers. Ben-Zvi and Garfield (2008) suggest that statistics education provides students with the necessary tools to analyze quantitative information in the world around them. Similarly, Ramirez et al. (2012) recognize that one of the main learning outcomes of statistics is to produce statistically literate individuals who can apply statistical thinking to their surroundings. Thus, providing students and teachers alike with opportunities to connect real-world phenomena to statistical concepts (e.g., indicators of central tendency) is particularly salient for statistical education.

As such, the PreK-12 Guidelines in Assessment and Instruction in Statistics Education II (GAISE II) respond to the pressing needs of the public for data and statistical literacy (GAISE College Report ASA Revision Committee, 2016). The GAISE II further reinforces the role of statistics in connecting mathematics to the world outside of school by outlining the utility of students evaluating statistical conclusions and legitimacy, as well as formulating analyses to navigate a data-driven world (Bargagliotti et al., 2020). The GAISE II provides a framework for teachers to situate statistics lessons in the context of events such as global pandemics, climate change, volatile economic shifts, and important social issues such as Black Lives Matter, so that students may apply their learning to authentic, meaningful prompts. Moreover, the National Council of Teachers of Mathematics (NCTM; 2024) *High School Mathematics Reimagined, Revitalized, and Relevant* identifies the importance of engaging students in statistical modeling so that they may develop, test, and refine models to solve contextually rich, complex problems. Therefore, the call for a statistics-specific education curriculum that is responsive to real-world problems has increased over the last two decades.

Recent research suggests that students need the opportunity to experience the influence mathematics has on the social world (Weiland, 2019). This is indicative of the sociopolitical shift occurring in mathematics education (Gutiérrez, 2013; Lerman, 2000) that centers on the salient questions of identity, knowledge, and power in the mathematics classroom (Harper, 2019). Thus, the increased demand for statistics education has encouraged collaboration among mathematicians and statisticians. The connection to the real world has increased the importance of statistics education and called for the development of these skills for students and citizens (Gal, 2000). In turn, there has been an increase in accessible resources for teachers (Ben-Zvi & Garfield, 2008). For instance, Moore (1997) suggests that students are more likely to develop a desire to learn statistics if they are provided with hands-on and relevant opportunities to do so. In an effort to advance statistics education in the classroom, teachers have incorporated authentic games and technology into their lessons (Ben-Zvi & Garfield, 2008). Despite these efforts, motivating teachers and students to engage with statistics remains a challenge.

To effectively foster a passion for statistical thinking in students, teachers require the appropriate tools and education. Teachers should have a strong understanding of statistical reasoning and context, as they play a vital role in K-12 statistics education (Oliveira & Henriques, 2019). In a study on teacher perspectives about statistical reasoning, Oliveira and Henriques (2019) found that teachers understood the importance of developing students' statistical reasoning skills. Teachers described challenges faced, such as a lack of statistical language among students and students not being acquainted with this type of learning (Oliveira & Henriques, 2019). Despite these notable challenges, students also lack the proper critical thinking skills necessary to be “literate” consumers of data. A lack of statistical literacy can increase the prevalence of negative stereotypes and misinformation, which often fuels racism, sexism, homophobia, and other forms of oppression. Thus, it is critical for mathematics teachers to possess not only a strong understanding of mathematical (i.e., statistical) and pedagogical content knowledge (PCK) but also a strong foundation in culturally relevant pedagogy (CRP) (NCTM, 2021). To accomplish this goal, some mathematics teacher educators advocate for extending teachers' foundations in CRP to provide culturally relevant lessons and experiences, teaching mathematics through a lens of social justice to promote students' civic engagement (Bartell, 2013; Gist et al., 2019). Consequently, some argue that improving mathematics education requires culturally relevant instruction. Here, we argue that the statistical analysis and interpretation of “real” data pertinent to the cultural, social, and emotional experiences of students is one means to enact culturally relevant instruction.

Therefore, increasing social justice teaching efforts in teacher preparation programs and teacher training is critical to provide teachers with another “tool for their toolkit” as well as to support students' development of statistical literacy. Teaching for social justice entails both the recognition of

the existence of class, gender, sexuality, economic, and racial disparities and the commitment to take action to challenge such injustices (Cochran-Smith et al., 2016). Teaching mathematics for social justice includes analyzing or reading the world (i.e., existing inequities) through mathematics, which informs taking action or rewriting the world (Gutstein, 2003, 2006). Within the discipline of mathematics, teaching for social justice includes empowering students to leverage their mathematical skills to analyze critical issues and take action (Abdulrahim & Orosco, 2020; Larnell et al., 2016). Due to the operationalization of statistics, which connects areas of mathematics and bridges mathematics and the real world (Kader & Jacobbe, 2013), a specific branch of teaching mathematics for social justice has developed—teaching statistics for social justice. To this end, we argue that statistics is uniquely positioned to serve as a medium for teaching for social justice, precisely because so many social, political, and economic issues are best understood—and misunderstood—through statistical claims. Yet, despite the growing emphasis on critical mathematics education, the specific field of teaching statistics for social justice remains underexamined. There is little systematic understanding of how this approach is being conceptualized or implemented in curriculum and instruction. This leads us to investigate the scope of the literature regarding teaching statistics for social justice.

Problem Statement

While a sociopolitical shift in education has created opportunities for some teachers and students to engage with social issues through mathematics and statistics, this shift has not been uniformly adopted across educational settings. In contexts where it is embraced, teachers and students can focus on social issues that allow them to belong, be informed, and work toward change in the classroom (Gutiérrez, 2013). Still, ongoing political and institutional challenges continue to limit such opportunities in many classrooms. As a whole, mathematics curriculum writers have struggled to achieve equity (Allestaht-Snyder & Hart, 2001). As early as the 1970s, scholars have argued that mathematics education and pedagogy are rooted in Eurocentric precepts and exclude the experiences of African Americans and minorities in America (Tate, 1994). Allestaht-Snyder & Hart (2001) noted that the achievement gap between white students and African Americans, Latinos, Native Americans, and poor students remains a concern for educators despite previous research stating that the gap had grown smaller. Now more than ever, a diverse mathematics curriculum is urgently needed to help close the gap for underrepresented populations in mathematics classrooms.

As the nation becomes more diverse, teaching and learning mathematics for social justice (TLMSJ) has become imperative to ensure all students are represented and develop social, political, and critical knowledge to advocate for underserved populations (Gutiérrez, 2013). Abdulrahim and Orosco (2020) argue that meeting the needs of diverse learners is one of the biggest challenges educators continue to face today. As mathematics curriculum and pedagogy continue to evolve, it is important that educators find ways to incorporate multicultural perspectives and sociopolitical views in the classroom. As the language of social justice, statistics is one instructional medium to help fill this void. Yet, what remains underexamined are current conceptualizations and actualizations of teaching and learning statistics for social justice in the extant statistics education literature. To address this gap in the literature, this paper presents a scoping review of existing research on the conceptualizations and actualizations of teaching and learning statistics for social justice.

In the following sections, we first present a review of the literature to explore the purposes and challenges presented in extant literature related to teaching for social justice in mathematics education and statistics education, as well as prior systematic reviews in social justice education. After the literature review, we discuss our theoretical grounding (teaching statistics with social justice) as the overarching lens used to examine the characteristics of the observed studies in the present scoping review. We then present the scoping review methods used to collect and analyze our data, as well as the measures taken to maximize the reliability and validity of the results. We conclude with a review

of our findings and a discussion of the relevant research considerations and implications for teaching and learning statistics.

Prior Systematic Reviews of Social Justice in Education

The section below is designed to bridge gaps in the literature between the broader field of education and statistics education as it relates to teaching for social justice. Prior systematic reviews of social justice research in education have examined the following themes: definitions and conceptualizations of social justice, teacher education and preparation for social justice, and intersectionality and the role of identity in social justice education. As noted earlier, to our knowledge, a systematic review of the use of social justice within statistics education does not exist. However, a number of previous systematic reviews highlight the complexity of defining and conceptualizing social justice in the broader field of educational research (e.g., Dover, 2009; North, 2008; Xenofontos et al., 2021). In the section below, we address the need for a more precise definition and application of social justice in statistics education, based on the aforementioned body of literature. Secondly, in the sections below, we explore the importance of teacher education in preparing educators to teach statistics through a social justice lens. This is accomplished by reviewing prior research within teacher education that sought to foster critical thinking and awareness of inequalities. Lastly, this section exposes a critical gap in the literature by exploring how social justice education has been integrated into different subject areas and grade levels, with a limited focus on mathematics education and statistics education specifically.

A more precise and operational definition of social justice is essential for advancing scholarship and practice in statistics education. Without clear definitions, educators and researchers may struggle to design curricula, assess impact, or evaluate pedagogical interventions grounded in social justice. Hytten and Bettez (2011) emphasize that social justice in education requires both the recognition of systemic inequities and a commitment to disrupting them—yet what that disruption looks like in practice, particularly within statistics instruction, is often underspecified. North (2008) adds that social justice also involves examining how power and privilege are embedded in educational systems, which raises critical questions about whose knowledge is centered in data selection, analysis, and interpretation. Thrupp and Lupton (2006) further argue that the broader social and economic conditions surrounding schools fundamentally shape what kinds of justice-oriented teaching are possible. Taken together, these syntheses reveal a conceptual gap: while the field acknowledges the importance of social justice, it lacks a shared framework for enacting it in discipline-specific ways. For statistics education in particular, this ambiguity makes it difficult to distinguish between surface-level applications of social justice themes and more transformative pedagogical approaches.

A second central theme explored in prior syntheses is the role of teacher education and preparation in cultivating a social justice orientation. Several scholars (Kaur, 2012; Mills & Ballantyne, 2016; Reagan & Hambacher, 2021; Wiedeman, 2002) emphasize that preservice and in-service teachers must be explicitly supported in critically examining their assumptions, identities, and positionalities to effectively enact social justice in their future classrooms. Kaur (2012) calls for teacher education programs to move beyond surface-level inclusion of equity topics and instead prioritize reflective practices that allow educators to interrogate their own biases and develop actionable commitments. Similarly, Mills and Ballantyne (2016) argue that preservice teachers benefit from immersive, experience-based learning opportunities that build lasting dispositions toward equity-focused teaching. Reagan and Hambacher (2021) add historical depth to the conversation, noting that social justice education must be situated within broader institutional narratives and power structures. Collectively, these reviews point to the importance of intentional, well-structured learning experiences in shaping educators who are prepared to integrate social justice meaningfully into their instruction. However, few studies specify how this preparation translates to subject-specific practices, including in statistics

education, which highlights a persistent disconnect between broad ideals and practical classroom enactment.

The third theme across prior syntheses concerns intersectionality and the central role of identity in shaping how social justice is conceptualized and enacted in education. Pugach et al. (2019) advocate for an intersectional approach that accounts for how individuals' multiple and overlapping identities, such as race, gender, class, and language, interact to influence experiences of privilege and marginalization. This lens challenges one-size-fits-all approaches to social justice pedagogy and highlights the need for nuanced, responsive teaching practices. Xenofontos et al. (2021) extend this idea into mathematics education, arguing that educators' own identities, shaped by their lived experiences, cultural backgrounds, and prior schooling, profoundly affect how they understand and promote social justice in their instruction. Building on this, Dover (2009) contends that teacher education must create space for educators to interrogate how their identities influence their beliefs, decisions, and pedagogical choices. In the context of statistics education, these findings suggest that educators' positionalities may shape which data are centered, which questions are asked, and how statistical claims are interpreted. Although identity development is a growing focus in mathematics and statistics education research, its connection to social justice remains underexamined (Pugach et al., 2019; Xenofontos et al., 2021). Prior syntheses affirm that identity is not just a background factor but a fundamental component in how social justice teaching takes shape, further underscoring the need for frameworks that explicitly link identity, power, and disciplinary practices in statistics education (Dover, 2009; North, 2008).

Aside from a limited number of prior systematic reviews on social justice in mathematics education, other gaps in the literature abound. Researchers observed that limited attention is given to the experiences and perspectives of students from marginalized backgrounds in social justice education research (Meister et al., 2017). The experiences of marginalized populations are an important consideration for statistics education as we, scholars and teacher educators, continue striving toward equitable learning outcomes for all students. Others identified a lack of research exploring the impact of social justice education on student outcomes (Dover, 2009). As we continue to develop processes, procedures, and policies to support student achievement in statistics, it is essential to consider the impact, or lack thereof, related to social justice education. Additionally, researchers suggest that the prior literature does not fully explore how social justice education can be integrated into different subject areas and grade levels (Capper et al., 2006). Given that there was only one systematic review on social justice in mathematics education, this gap in the literature is especially pertinent. Here we seek to help fill this gap by conducting the first systematic review, to our knowledge, that examines social justice within the context of statistics education.

Theoretical Underpinnings

Our scoping review utilizes Lesser's (2007) conceptualization of teaching statistics with social justice (TSSJ) to analyze the extant literature. Lesser (2007) expands Gutstein's (2003) Freirean description of using the critical lens of mathematics to statistics as a:

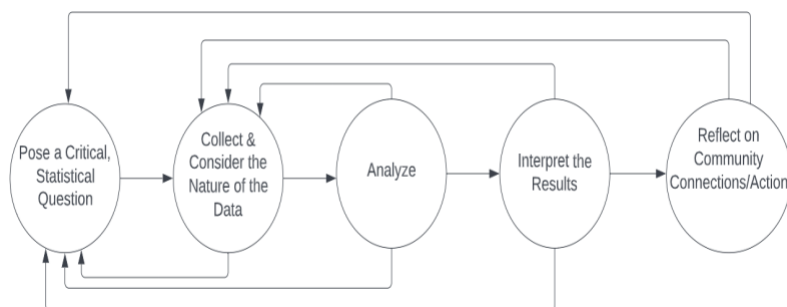
“Means to use mathematics to understand the relations of power, resources, inequities, and disparate opportunities between different social groups, and to understand explicit discrimination based on race, class, gender, language, and other differences. Further, it means to dissect and deconstruct media and other forms of representation and to use mathematics to examine these various phenomena both in one's immediate life and in the broader social world and to identify relationships and make connections between them” (p. 45).

This quote highlights Gutstein's (2003) argument that mathematics can be a tool for understanding and challenging social injustices. Gutstein (2003) posits that by critically examining data and representations, students can gain insights into power structures and inequalities that might otherwise remain hidden. Gutstein's (2003) examples of providing opportunities for students to analyze and question data and data representations lays the groundwork for understanding how a critical perspective can be brought into statistics education. To this end, Lesser (2007) defines TSSJ, more commonly known as teaching statistics for social justice (TS4SJ), as a method of statistical instruction that provides nontrivial contextualization, reflection, and application of social justice examples and statistics for students. TS4SJ represents the nexus of statistics *conceptual* and *computational proficiency* and *critical perspective*. The goals of TS4SJ are twofold: 1) students' data/statistical literacy and 2) students' application of statistical analyses to social justice issues (Figure 1). Lesser (2007) posits that TS4SJ prepares students to become part of a competitive workforce and to become active participants in a democracy. Of note, TS4SJ differs from other traditions in critical mathematics education such as teaching mathematics for social justice (Gutstein, 2003) and critical statistical literacy (Weiland, 2017) by focusing specifically on statistics education as well as empowering students to reflect and take action based on their findings from their critical analysis.

The belief that learning statistics is a mechanism to not only navigate daily life but also to catalyze social change in the world is foundational to TS4SJ (Lesser, 2007). For instance, teachers may use TS4SJ lessons in the context of social justice issues such as representation, internet access, wages, pollution, or health to situate students' statistics learning in authentic, meaningful scenarios (Knurek, 2021; Pollack & Wunderlich, 2005; Wall, 2016). Applying a critical lens to the operational definitions of variables (e.g., race, gender, poverty line) involves examining how these definitions are constructed, whose interests they serve, and what assumptions they embody. This approach provides students with ways to respond to and pose critical questions regarding the collection and nature of the data, as well as the systems from which the data originates. Thus, TS4SJ allows for an opportunity for students to reflect upon the relationship of the data to socio-political, geographic, cultural, or economic influences. Students are afforded space to "talk back" or pose arguments based on their statistical analyses and analyses of critical events (i.e., affordable housing, response to Lahaina fires). This empowers students with statistical knowledge to use data judiciously (Bargagliotti et al., 2020) by identifying inequities in their communities (Enyedy et al., 2006) and becoming agents of change (Dacia et al., 2021). To this end, TS4SJ provides the opportunity to extend the GAISE II statistical problem-solving process (Bargagliotti et al., 2020) beyond interpreting the results to allow students to make connections with their communities and create plans for action (Figure 1).

Figure 1

Teaching Statistics for Social Justice (Lesser 2007) with the Statistical Problem-Solving Process (Bargagliotti et al., 2020)



When pre-service teachers (PSTs) participate in TS4SJ learning, they develop a better understanding of how social issues can help enhance and guide statistical learning in the classroom. For instance, Nguyen and Eisenreich (2018) found that K-8 PSTs gained awareness of social issues and content knowledge by participating in teaching statistics for social justice (TS4J) lessons that situate sampling issues and two-way frequency tables of school voucher programs. Furthermore, Register and colleagues (2022) support the need for PSTs to participate in social justice lessons as learners to obtain a more robust understanding of how to adopt the strategy. For social justice to become an attribute of educational practice, it is essential to provide mathematics teachers with appropriate pedagogical training to successfully interweave mathematics standards and social justice initiatives (Garii & Appova, 2013). PSTs and in-service teachers should continuously be provided with these opportunities to engage in TS4SJ as learners in order to prepare to incorporate this practice in the classroom.

Present Study

TS4SJ empowers students to use statistical data analysis skills to make positive change in their communities. Lesser (2007) concludes that statistics are numbers with context, and therefore TS4SJ equips students with the necessary skills to analyze and interpret the world. To this end, we seek to answer the following research questions:

1. What are the characteristics of works published on teaching statistics for social justice?
2. How has teaching statistics for social justice been described and implemented in the literature?

Method

Researchers are increasingly using scoping reviews to describe the volume, characteristics, and nature of the research they are conducting (Arksey & O'Malley, 2005; Cacchione, 2016; Daudt et al., 2013; Levac et al., 2010; Pham et al., 2014). When there is an absence of syntheses available (i.e., systematic reviews, meta-analyses), scoping reviews provide a precursor to describe the range of research. Researchers utilize the scoping review method to map disparate literature surrounding a specific policy or practice to inform next steps for research (Joanna Briggs Institute, JBI, 2015). Due to the widespread dispersal of research on TS4SJ across evidence and publication types, as well as an absence of synthesis of empirical evidence, we found it appropriate to conduct a scoping review of the existing literature (Barker et al., 2020; Mays et al., 2001). As such, we seek to inform future research and practice regarding TS4SJ by describing the volume, characteristics, and nature of the current research.

As scoping reviews have become more widely utilized, researchers have refined Arksey and O'Malley's (2005) original framework to provide improved rigor and consistency among scholars. Arksey and O'Malley (2005) originally outlined the following scoping review steps: 1) identify the research question; 2) identify relevant studies; 3) select studies; 4) chart the data; 5) collate/summarize/report results; and 6) optionally consult with consumers and stakeholders. Levac et al. (2010) expanded the original scoping review framework to include the adaptations: 1) clarify the purpose and connection to the research question(s); 2) balance feasibility with breadth/comprehensiveness; 3) utilize an iterative team approach to the search and extraction processes; 4) include a numeric summary of qualitative themes; 5) identify implications of the study findings; and 6) require consultation with consumers or stakeholders.

The Joanna Briggs Institute (JBI) (2015) protocol builds on the aforementioned scoping review frameworks. JBI (2015) set a minimum research team size of $n = 2$ to agree on the study design

(i.e., inclusion and exclusion criteria, extraction information). The scoping review protocol from JBI (2015) bolsters the first requirement from Arksey and O'Malley (2005) and Levac et al. (2010) to align the title of the scoping review study with its purpose and research questions. Further, the title of the scoping review must be in alignment with the inclusion/exclusion criteria identified for the study (e.g., population, context, practice). In addition, authors must provide a background of the scoping review topic to situate the study within the existing literature. Under the JBI (2015) scoping review, clear definitions of inclusion/exclusion criteria are required. This adds a level of transparency and rigor previously not required in the Arksey and O'Malley (2005) and Levac et al. (2010) scoping review frameworks. Furthermore, the JBI (2015) scoping review protocol requires authors to organize the included records from the search with information extraction to be presented in a table. JBI (2015) provides reporting recommendations such as authors, year of publication, purpose, participants, and methodology. To attend to rigor and fidelity as the scoping review method is advanced and refined, our scoping review follows the JBI (2015) protocol and reporting guidelines.

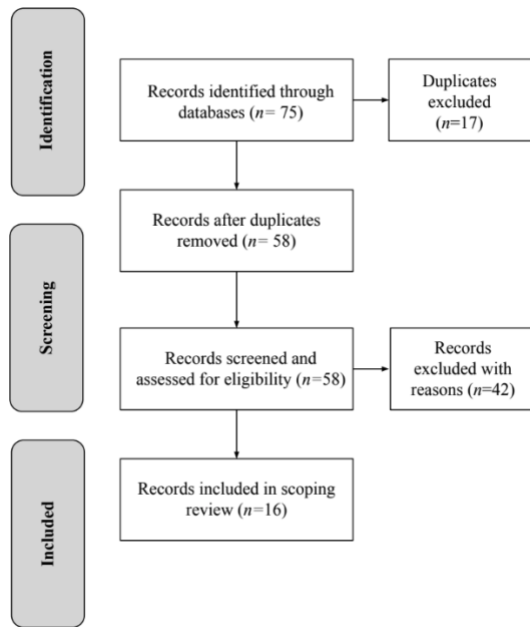
Data Collection

Inclusion criteria

Prior to carrying out database searches, the research team of two mathematics education researchers identified inclusion criteria (Figure 2) for screening articles. To determine the scope of the literature since the inception of TS4SJ from Lesser (2007), only works from 2007 to the present were included. To explore the range of the limited scholarship on TS4SJ, records were not limited to academic journal articles but included practitioner articles, dissertations, and book chapters as well. Only records published in English were included. Using the GAISE II and College GAISE frameworks, titles and abstracts were required to include a clear, explicit connection to statistics in K-12 or post-secondary education (Bargagliotti et al., 2020; GAISE College Report ASA Revision Committee, 2016). Further, the records had to include explicit or implicit mentions of TS4SJ elements in the title or abstract (Table 1).

Search strategy

To ensure consistent search results, we ran the database search procedure as a team. In alignment with our purpose of describing the characteristics and range of the existing literature on TS4SJ, we utilized the databases Academic Search Ultimate, ERIC, APA PsycInfo, and Education Full Text. The aforementioned databases offer broad access to texts from the humanities and social sciences, including texts such as journal articles and edited book chapters. Our search terms were “statistics education” OR “teaching statistics” AND “social justice,” with a separate search in each database for “critical statistical literacy.” This search approach yielded an initial pool of $n = 75$ records, including $n = 17$ duplicates (see Figure 2). The search terms were used in the aforementioned databases, which are also included in Figure 2. When conducting the searches in the databases, we did not limit the search terms to components of the literature (e.g., titles, abstracts, full text). Our rationale for conducting a scoping review is further strengthened by the relatively small pool of results.

Figure 2*Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Flowchart of Study Selection***Screening**

Following the database search and removal of duplicates, the initial pool of records was reduced from 75 to 58 unique entries. To ensure alignment with the goals of our scoping review, we applied the inclusion criteria described earlier, which required records to (a) be published between 2007 and 2023, (b) include an explicit connection to statistics education in Pre-K-12 or post-secondary settings, and (c) contain either explicit or implicit mention of teaching statistics for social justice (TS4SJ) elements within the title or abstract. These criteria reflect our commitment to identifying literature that engages with the conceptual and instructional dimensions of TS4SJ as described by Lesser (2007). For inter-reviewer agreement, two reviewers screened an initial subset of three abstracts. We reached a 100% consensus threshold during this calibration phase by discussing the alignment of the abstracts with our inclusion criteria. Our conversations during calibration helped to ensure a shared and consistent understanding of the inclusion criteria prior to independent screening. This approach is recommended in scoping review methodology to increase rigor and mitigate subjective bias during study selection (Joanna Briggs Institute, 2015; Levac et al., 2010). Once consensus was established, the remaining abstracts were screened independently, with any disagreements discussed and resolved collaboratively. This iterative process ultimately yielded 16 records that met all inclusion criteria and were selected for full data extraction and analysis.

Extraction

Information from the included records was extracted using a Google Form (Table 1). To ensure reviewer consistency for extraction, we examined two articles together with the Google Form. We extracted information pertaining to the type of publication (i.e., empirical, non-empirical). The representation, characterization, and operationalization of TS4SJ were also coded dichotomously as either *explicit* or *implicit*. Records that utilized an *explicit* characterization identified the strategy as TS4SJ explicitly and provided examples to justify the designation, while studies that utilized an *implicit*

approach provided a description of the activities involved that alluded to or could be characterized as TS4SJ, but did not explicitly define the process as such. To examine the application of TS4SJ to statistics standards, we extracted information regarding the GAISE standards utilized in the records (Table 1).

Table 1*Record Coding Rubric*

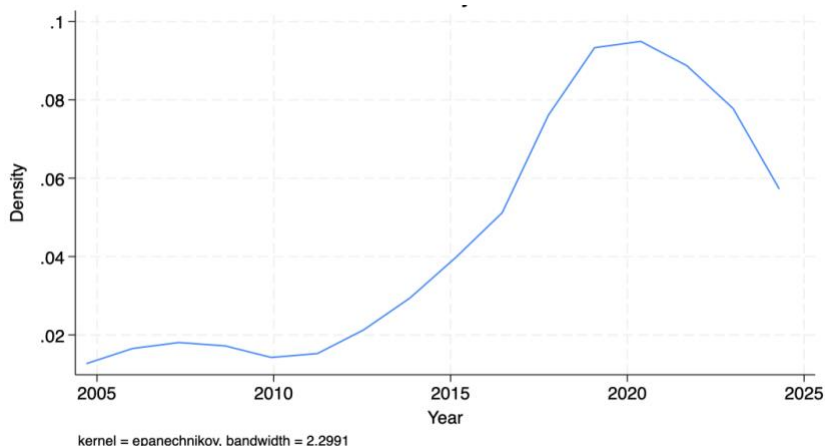
Topic	Item	Description
Record Information	Purpose	Aim of study
	Research questions/hypotheses	
	Publication	Empirical, non-empirical
	Publication Type	Academic Journal Article, Practitioner Article, Book Chapter, Dissertation, Other
	Participants	Pre- or in-service teacher, K-12 student, post-secondary student
	Grade Level	EC-6, 4-8, 9-12, post-secondary, NA
	Methodology	Qualitative, quantitative, mixed methods, other
	Data Sources	Instruments
	Analysis	Methods
	Findings	Results
Explicit/ Implicit Mention of TS4SJ	Implications	Significance for research and practice
	Teaching mathematics for social justice	Re-centering mathematics curriculum and instruction to build upon marginalized students' experiences and investigate critical issues (Gutstein, 2006)
	Teaching statistics for social justice	Use of statistics to identify inequities in students' communities and empower students to become agents of change (Lesser, 2007; Dacia et al., 2021)
	Critical questions	Ask about operational definitions of variables (e.g., poverty line, ethnicity) (Lesser, 2007)
	Student empowerment	Agency gained through statistical reasoning and connections
	Talk-back	Formation of arguments based on statistical analysis of critical events (e.g., Lahania fires)
	Community	Analyzing the conditions of the community
	Reflect upon context	Analyze the data in relation to socio-political, geographic, cultural, or economic influences

Topic	Item	Description
	Issue-driven	Statistics teaching and learning is problematized and contextualized
	Other	Free response for reviewers to add any other key words pertaining to TS4SJ (e.g., critical statistical literacy)
Pre-K-12 GAISE II (Bargagliotti et al., 2020)	Questioning in Statistics	Questioning throughout the statistical problem-solving process
	Different data and variable types	There is evidence of traditional data (quantitative) and/or non-traditional data types (pictures, sound, words)
	Multivariable thinking in statistics	Multivariable thinking throughout Levels A, B, & C. As students advance they will develop tools for comparisons and associations
	Probability in statistics	Probabilistic thinking throughout Levels A, B, & C. Students can make formal and informal predictions beyond the scope of the data
	The role of technology in statistics and how it develops through the levels	The role of technology in statistics depends on access. Teaching statistics with technology can enhance learning
	Assessment in statistics	Assessment items that measure statistical reasoning
GAISE College Student Goal Alignment (GAISE College Report ASA Revision Committee, 2016)	Critical consumers	Critical consumption of statistically-based results
	Investigative process	Recognize and answer questions for which the investigative process is in statistics
	Graphing	Produce and interpret graphical displays and numerical summaries
	Variability	Recognize and be able to explain the central role of variability
	Randomness	Recognize and be able to explain the central role of randomness
	Statistical model application	Gain experience with how statistical models are used
	Statistical inference	Understand and apply the basic ideas of statistical inference
	Statistical software packages	Interpret and draw conclusions from statistical software
	Ethical issues	Demonstrate an awareness of ethical issues associated with sound statistical practice

Results

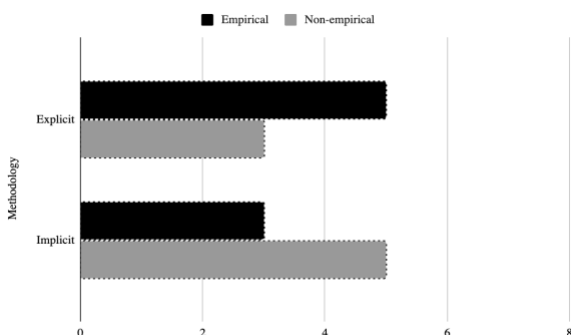
RQ1: Characteristics of works published on TS4SJ

The systematic search of the literature yielded 16 relevant results for our goal of providing a description of the characteristics and range of literature regarding TS4SJ. Following the JBI (2015) protocol recommendations for data reporting, Table 1 provides a complete list of the characteristics of the included records, including extracted data regarding the authors, year, purpose, study population, and methodology.

Figure 3*Kernel Density Plot of TS4SJ Publication Years*

The publication dates range from 2007 to 2023 (Table 1). As shown in Figure 3, the density of publications is greatest between the years 2019 and 2022, following the low density of publications after Lesser's (2007) inception of TS4SJ. The scoping review provides evidence of a dearth of empirical studies and methods (Tables 2 and 3). For instance, non-empirical records ($n = 10$) represent over half of the data set. Furthermore, there is a critical absence of traditional quantitative inquiry regarding TS4SJ, as the only sources of empirical evidence are qualitative ($n = 5$) and mixed methods ($n = 1$).

Furthermore, our results demonstrate that the majority of publications describe TS4SJ implicitly through the description of curriculum and instruction, including key attributes such as critical questions, student empowerment, talk back, community, reflection upon context, and issue-driven approaches (Lesser, 2007), as well as teaching mathematics and/or statistics through social justice (Figure 4, Table 3). Comparing explicit to implicit mentions of TS4SJ across methodologies, non-empirical publications explicitly use "teaching statistics for social justice" more frequently than empirical records that use qualitative and mixed methods combined (Figure 4, Table 3).

Figure 4*Frequency of Explicit and Implicit Mention of TS4SJ Across Methodologies*

Although the data reflect the limited quantity of existing literature, the range of participants, including in-service teachers, pre-service teachers, K-12 students, and post-secondary students, is fair (Table 3). In regard to K-12 grade level, the majority of TS4SJ tasks in the literature have a secondary

focus, with an emphasis on questioning through the statistical problem-solving process, data and variable types, and multivariable thinking (Table 3).

RQ2: Description and Implementation of TS4SJ

From this data, we identified four major themes across the records describing the implementation of TS4SJ: incorporating social justice in statistics education, using social justice data to teach statistics, teaching statistics for social justice in specific contexts, and developing critical statistical literacy for social justice.

The first theme, incorporating social justice in statistics education, refers to the trends of records seeking to add social justice-related content into the traditional statistics curriculum. Several records in the present scoping review discuss the importance of incorporating social justice into statistics education. This approach typically involves modifying course goals, instructional objectives, or lesson topics to include justice-oriented content, without necessarily altering the structure or format of traditional instruction. For instance, Conway and Nguyen (2020) used action research to explore the impact of incorporating social justice into pre-service teacher training, while Bergen (2016) suggested melding data with social justice in undergraduate statistics courses. Dacia et al. (2021), in an autoethnographic report, described how they incorporated social justice into their statistics instruction by rethinking data examples and instructional framing. These studies illustrate a shift toward recontextualizing statistics instruction to include critical social issues, even when those changes do not fundamentally alter the pedagogical format.

The second theme was using social justice data to teach statistics. Unlike the first theme, this theme seeks to use “real-world” data that concerns social justice issues as a means to apply traditional statistics knowledge. In this model, the structure of the statistics lesson may remain conventional, but the data sets themselves are deliberately chosen to center sociopolitical issues, thereby connecting students’ learning to real-world phenomena. Data from this scoping review indicates that several recent studies used social justice data to teach statistics. Louie et al. (2021) promoted interest in statistics by using social justice data investigations, while Wall (2016) used wealth data to teach statistics and its impact on quality of life. One specific example from the literature is Loux and Gibson (2019), who used water data from Flint, Michigan, in an introductory statistics course as a class assignment. Another key example is how Lasater et al. (2022) explored a complex gender wage gap dataset through data visualization. Together, these studies represent an important pedagogical tradition incorporating “real-world” data. While these studies may not foreground social justice as a curricular goal, they leverage the content of the data as a way to deepen student interest and awareness of injustice. The key distinction from the first theme is that social justice, in this case, is primarily a vehicle for statistical learning, rather than a goal of instruction in and of itself.

The third theme was teaching statistics for social justice in a specific context. In this category, instruction is designed around authentic, real-world problems that are central to students’ communities or to broader societal concerns. Studies exploring teaching statistics for social justice in specific contexts typically take place in a project-based, contextualized pedagogical environment. For instance, Maloney (2015) explored teaching introductory statistics using social justice contexts in community colleges through different projects related to societal issues. Others used more specific societal contexts or social issues, like poverty or female body image. McCoy (2008) explored teaching students about poverty through a statistics project, while Frydryk (2017) examined issues surrounding female body image and Barbie using a project-based learning example. These examples go beyond thematic or data-driven integration to involve students in the active exploration and construction of knowledge. Here, statistics becomes both a tool and a lens for examining social realities. Unlike the first two themes, where social justice is added to or illustrated through statistics instruction, these studies restructure the learning environment itself to center justice-oriented inquiry.

Lastly, the fourth theme, developing critical statistical literacy for social justice, focuses on cultivating students' abilities to question how data are constructed, represented, and interpreted, especially in relation to power and equity. This theme emphasizes skills such as evaluating variable definitions (e.g., race, poverty line), identifying bias in data collection, and understanding the implications of statistical claims. Studies in this category attend to the ways that statistics education can equip students to critically consume and challenge quantitative narratives. For example, Cannon (2022) described a course design that helped preservice teachers interrogate "messy" data and develop critical habits of mind. Krishnannair and Krishnannair (2022) made a theoretical case for critical statistical consciousness in higher education. In these cases, the goal is not just to use data about justice or embed justice themes, but to fundamentally reshape how students think about the nature and use of data itself. This theme is distinct in its emphasis on epistemology and critique, positioning students as informed skeptics and agents of accountability in a data-driven world.

Table 2

Evidence Chart of Characteristics of Included Literature

Record	Methodology	Publication Type	Participants	Grade Level	Purpose
Louie et al. (2022)	MM	AJA	IST, K-12 student	9-12	To promote diverse student populations' interests in working with data
Frydryk (2017)	NE	PA	K-12 student	EC-6	Discuss a lesson using TS4SJ where students form a question, collect data, analyze data, and interpret data using the Barbie body lesson from Mukhopadhyay (1998) for statistics
Amdat (2021)	NE	AJA	NA	Post-sec	Illustrates how the author used hardship index data in three different types of courses and includes additional ideas for classroom activities
Wall (2016)	NE	PA	NA	9-12	Communicate the value in teaching for social justice in a mathematics classroom by describing a lesson with the intent of empowering students to reach statistically sound conclusions that hold weight and change their perspectives through the vehicle of social justice
Knurek (2016)	NE	PA	NA	4-8, 9-12	Propose a lesson using the GAISE II framework that can be implemented into a statistics classroom. The lesson allows students to learn about the four components of the statistical problem-solving process as they interact with real-world data
Loux & Gibson (2019)	NE	AJA	Post-sec	Post-sec	Show Flint water crisis provided a starting point for discussions on sampling design, data collection, and ethical data practices
Lesser (2007)	NE	PA	K-12 student, Post-sec	9-12, Post-sec	Provides examples of TSSJ in different areas of statistics

Record	Methodology	Publication Type	Participants	Grade Level	Purpose
McCoy (2008)	NE	AJA	IST, K-12 student	9-12	Introduce what poverty is to students and give them an example of living in poverty
Cannon (2022)	NE	Book chapter	Pre-service teacher	NA	Report of a statistics course designed to build preservice teachers' pedagogical knowledge for statistics, comfort in working with messy data, and critical statistical literacy
Kahn et al. (2022)	NE	AJA	K-12 student	9-12	Introduce Notice, Wonder, Feel, Act, and Reimagine (NWFAR) to promote social justice in data science (DS) education
Krishnannair & Krishnannair (2022)	NE	AJA	NA	NA	Discuss theoretical underpinnings and applications of critical statistical literacy
Dacia et al. (2021)	Q	AJA	PST & Post-sec	Post-sec	Present a research base for teaching for social justice followed by a description of a lesson, observations during enactment, and reflection of change in beliefs about teaching for social justice afterward
Maloney (2015)	Q	Dissertation	Post-secondary	Post-sec	To investigate the way class activities designed around real-world social justice contexts help introductory statistics community college students develop an understanding of statistics concepts
Register et al. (2022)	Q	AJA	PST	4-8 & 9-12	To examine how PSTs use the CRMT tool to design social justice centered lessons
Conway & Nguyen (2020)	Q	AJA	PST, K-12 student	EC-6 & 4-8	To help future teachers, current teachers, and teacher educators begin to integrate TS4SJ.
Lasater et al. (2022)	Q	PA	K-12 student, Post-sec	Post-sec	Describe the distribution of a single variable and explore two-variable relationships within the gender wage gap

Note. MM = mixed methods; NE = non-empirical; Q = qualitative; AJA = academic journal article; PA = practitioner article; D = dissertation; NA = not applicable; Post-sec = post-secondary; PST = pre-service teachers; IST = in-service teachers

Table 3

Frequency trends across record characteristics

Category	Frequency
Method	
Mixed Methods	1
Qualitative	5
Quantitative	0
Non-empirical	10
Participants	
In-service Teachers	1
Pre-service Teachers	3
K-12 Students	4
Post-Secondary	3
Not applicable	5
Statistics Task Grade Level	
K-6	1
4-8	2
9-12	6
Post-secondary	7
Pre-K-12 GAISE II	
Questioning throughout the statistical problem-solving process	6
Different data and variable types	5
Multivariable thinking throughout Levels A, B, & C	3
Probabilistic thinking throughout Levels A, B, & C	0
The role of technology in statistics and how it develops through the levels	1
Assessment items that measure statistical reasoning	1
GAISE College Goal Alignment	
Students should become critical consumers of statistically-based results	2
Recognize and answer questions for which the investigative process in statistics	2
Produce and interpret graphical displays and numerical summaries	
Recognize and be able to explain the central role of variability	2
Recognize and be able to explain the central role of randomness in	1

Category	Frequency
Experience with how statistical models are used	2
Demonstrate an understanding of and ability to use basic ideas of statistical inference	2
Interpret and draw conclusions from standard output from statistical software	1
Demonstrate an awareness of ethical issues associated with sound statistical practice	2
Explicit Mention	
Teaching mathematics for social justice	8
Teaching statistics for social justice	8
Critical questions	3
Student empowerment	5
Talk back	1
Community	6
Reflect upon context	5
Issue-driven	7
Implicit Mention	
Teaching mathematics for social justice	8
Teaching statistics for social justice	8
Critical questions	10
Student empowerment	3
Talk back	3
Community	3
Reflect upon context	6
Issue-driven	5

Discussion

Teaching for social justice across all disciplines includes exploring diverse literature that has multicultural perspectives, considering the different impacts of political and economic decisions, and recognizing oppression caused by differences (Garii & Appova, 2013). However, in the present study, we argue that statistics is the language of social justice. Almost all social issues can be described by the notable statistics surrounding the phenomenon. In his groundbreaking work *No BS (Bad Stats): Black People Need People Who Believe in Black People Enough Not to Believe Every Bad Thing They Hear About Black People*, Toldson (2019) explores how the use and misuse of statistics often lead to public policies and practices that negatively impact the Black community. However, these statistics (e.g., The National Assessment of Educational Progress) often come from national data collection efforts that highlight inequity, which lead to subsequent social justice initiatives. Hence, the data that describe inequity and injustice are translated to the public through statistical summaries, making statistics the language of social justice. The emergence of these and other data-driven social justice efforts has led to a sociopolitical shift in mathematics and statistics education.

In the present study, we sought to 1) identify what scholarly articles have been published from 2007 to 2023 in relation to teaching statistics for social justice, 2) identify the characteristics of those works published, and 3) identify how teaching statistics for social justice is described in the literature. Utilizing a scoping review, we were able to identify sixteen records that met the all-inclusive criteria established for the study. The scoping review results indicate that there is not only a dearth of literature focusing on teaching statistics for social justice but also limited empirical study of pedagogy, as evidenced by the larger number of non-empirical works on TS4SJ. Furthermore, through the lens of Lesser's (2007) conceptualization of TS4SJ, the findings reveal both alignment (e.g., issue driven) and divergence (e.g., community) from his original framework.

These results echo the findings of other syntheses of the literature related to teaching mathematics for social justice (Xenofontos et al., 2021). Xenofontos et al. (2021) conducted a systematic review of mathematics for social justice more broadly. Their synthesis identified 23 related records that examine a wide range of mathematics education contexts. Of these results, several of the records concluded that incorporating social justice into their mathematics classrooms had a positive impact on their students (Conway & Nguyen, 2020; Dacia et al., 2021; Lesser, 2017; ; Louie et al., 2022; Maloney, 2015; McCoy, 2008). The findings also included student growth, student empowerment, and a new respect for mathematics among students (Lesser, 2007; Louie et al., 2021; McCoy, 2008). In contrast, the present scoping review narrows the lens to TS4SJ and operationalizes this focus through Lesser's (2007) framework and alignment with GAISE standards. This distinction is important because our review systematically describes how statistics education has been conceptualized and enacted for social justice. By emphasizing both statistical literacy goals and the presence of TS4SJ in the literature, our work compliments and extends prior syntheses.

There were several characteristics of the published works that warrant further consideration. For instance, of the records identified, over half were non-empirical and only had implicit mentions of the terms set forth in the inclusion criteria. Alternatively, the empirical records displayed an even distribution of implicit and explicit mentions of the selected terms and phrases (Figure 4). The most common were *teaching mathematics for social justice* and *teaching statistics for social justice*, which closely resembled the search terms used to map the literature. The prevalence of implicit rather than explicit mentions suggests that authors may find it safer to frame social justice indirectly by weaving it into examples or curriculum descriptions without calling it out by name. This choice may reflect concerns about political resistance in educational settings or the lack of consistent frameworks for naming and evaluating TS4SJ. While implicit mentions allow for flexibility and broader acceptance, they also make it harder to identify and study TS4SJ in systematic ways.

Beyond terminology, the literature described TS4SJ in several ways. *Issue-driven* and *student empowerment* were among the most frequent descriptions used. In addition, TS4SJ was also described by the phrases: *reflect upon context* and *community*. Unexpectedly, *critical questions* did not emerge as having any connection to TS4SJ. This absence may reflect the political climate of education, where directly encouraging students to question systems of power and inequity can be seen as controversial. As a result, authors may have chosen to emphasize less politically charged ideas, such as empowerment or community, which are more widely accepted in schools. Future research should explore how TS4SJ can effectively support students in engaging with critical questions, even within politically sensitive environments and periods.

Finally, when reviewing the distribution of participants in the records, the data did not sway one way or the other. There was an even spread of results among pre-service teachers, in-service teachers, K-12 students, post-secondary students, and none. K-12 students were the front-runners, with five records naming this group as participants. When looking at the age groups considered in each study, grades 9-12 and post-secondary students accounted for almost three-fourths of the participants.

Additionally, the results of our review revealed four recurring themes that characterize how TS4SJ has been taken up in the literature. These themes highlight both the breadth of approaches to TS4SJ and the ongoing lack of coherence in how it is conceptualized and studied. The first theme, *incorporating social justice into statistics education*, reflects a growing recognition that statistics curricula can be reshaped to address societal issues alongside technical skills (e.g., Dacia et al., 2021). This aligns with Lesser's (2007) call to include social justice issues into statistics content. This integration shows the potential of TS4SJ to enrich learning, yet most examples remain at the conceptual level and provide little evidence of impact on students. One possible reason for this gap is that developing and testing fully integrated TS4SJ curricula requires time, resources, and institutional support, which are often limited in practice.

The second theme, *using social justice data to teach statistics*, emphasizes the value of authentic, real-world datasets for engaging students in meaningful analysis (e.g., Loux & Gibson, 2019). The second theme aligns with Lesser's (2007) emphasis on using authentic, meaningful data while developing critical statistical literacy. This approach encourages both statistical literacy and critical thinking, but many examples are context-specific and leave open questions about how such data-driven approaches can be scaled across classrooms. The dominance of secondary-level contexts in this body of work may reflect the availability of justice-related datasets that align with secondary standards and the emphasis on engaging adolescents in civic issues. However, this also reveals a gap. Little is known about how TS4SJ could be taken up in elementary or postsecondary settings, where the developmental goals and curricular constraints differ.

The third theme centers on *teaching statistics for social justice in specific contexts*, often through project-based or experiential learning such as service-learning environments or community projects (e.g., Maloney, 2015). This theme aligns with Lesser's (2007) idea that students should see statistics connected to real communities and problems. Additionally, these approaches demonstrate how contextualized learning can make statistical concepts more relevant and engaging, though they also raise questions about transferability outside of specialized projects. The prevalence of context-specific studies may point to the experimental nature of this work: educators and researchers often pilot TS4SJ in small, localized settings where they have freedom to innovate, but these designs have yet to be scaled or systematically assessed.

The fourth theme focuses on *developing critical statistical literacy for social justice*, where students are encouraged to question how data are collected, represented, and interpreted (e.g., Cannon, 2022). This theme reflects Lesser's (2007) emphasis on critical reflection and has the most transformative potential of TS4SJ, yet it is also the least developed, with few studies showing systematic ways to build or assess these skills. The limited attention to critical statistical literacy may be linked to the dominance of implicit rather than explicit approaches to TS4SJ in the literature. When social justice is addressed implicitly, it is often woven into data or examples without unpacking the broader social implications. While this can make TS4SJ feel seamlessly integrated, it also risks minimizing critical discussions about power, equity, and data ethics.

Taken together, the four themes show that teaching statistics for social justice is still developing and uneven. Themes one and two focus on curriculum, while themes three and four highlight pedagogy. This suggests the field has grown along two separate but not well-connected paths. The use of social justice content and authentic datasets shows a shift toward statistics as a tool for civic engagement. At the same time, the reliance on context-specific and often implicit approaches shows a lack of clear frameworks for design and evaluation. Current approaches are flexible and allow for innovation, but they are also fragile because there is little agreement on how to measure impact. Across all themes, there is limited evidence of how TS4SJ influences student learning, critical thinking, or teacher preparation. Future research should not only describe practices but also examine why certain approaches dominate, how they can be adapted across contexts, and what long-term effects

they have on both students and teachers. These patterns show that the four themes are not only descriptors of current work but also indicators of where the field needs to grow.

Implications

The present scoping review provides a comprehensive overview of the current state of TS4SJ literature and offers valuable insights into its characteristics, trends, and implementation. The identified implications highlight opportunities for future research, curriculum development, and pedagogical innovation in the field of teaching statistics for social justice. By addressing these implications, educators and researchers can contribute to the advancement of TS4SJ, ultimately fostering a more equitable and socially conscious approach to statistics education. The results of this scoping review shed light on several critical implications for the field of teaching statistics for social justice (TS4SJ). These implications are outlined below:

1. *Researchers should be attentive to TS4SJ publication trends and should prioritize empirical investigations to provide evidence-based insights into the impact of TS4SJ on student learning and social justice awareness.* One of the notable findings of this scoping review is the temporal distribution of TS4SJ publications. The peak in publications between 2015 and 2020 suggests a growing interest in TS4SJ within the last decade. This trend is indicative of the evolving landscape of education and the increasing recognition of the importance of social justice in teaching statistics. There is also a noticeable absence of empirical research in the TS4SJ literature. Over half of the included records were non-empirical, and there was a dearth of traditional quantitative inquiry. This highlights a pressing need for more empirical studies that assess the effectiveness and outcomes of TS4SJ pedagogical approaches.
2. *Researchers should consider the benefits of explicitly mentioning or, more importantly, operationalizing TS4SJ in their work.* This will promote a clearer understanding of the approach, its objectives, and how it can be measured with validity and reliability. The prevalence of implicit descriptions of TS4SJ in curriculum and instructional materials is noteworthy. While TS4SJ principles are often embedded in educational practices, the lack of explicit representation hinders the growth of the field.
3. *Researchers and educators should explore ways to adapt TS4SJ principles to meet the needs of diverse educational contexts.* The majority of TS4SJ tasks in the literature have a secondary school focus. While this suggests that TS4SJ is gaining traction in K-12 education, there is room for expanding its application to elementary and post-secondary education levels. The inclusion of various participant groups, including in-service teachers, pre-service teachers, K-12 students, and post-secondary students, indicates that TS4SJ is not confined to a specific educational level or context. However, more research is needed to explore the unique challenges and opportunities associated with each group. Understanding the needs and perspectives of different participants can inform tailored TS4SJ interventions.
4. *The identification of four major themes related to TS4SJ implementation provides a roadmap for educators and researchers.* Incorporating social justice into statistics education, using social justice data to teach statistics, teaching statistics for social justice in specific contexts, and developing critical statistical literacy for social justice are all areas that warrant further exploration and development, as noted in the scoping review results. The four trends, in particular, have unique and potentially transformative implications for mathematics education. First, incorporating social justice into statistics education highlights a growing interest in modifying traditional statistics curricula to include social justice content. This suggests that educational institutions should consider the integration of TS4SJ principles into their curriculum development processes. This will ensure that future statisticians and educators are equipped with a social

justice perspective. Second, using social justice data to teach statistics underscores the importance of using real-world data to engage students in meaningful statistical learning experiences. This approach not only enhances statistical literacy but also encourages critical thinking about social justice issues. Educators should explore diverse datasets and methods for incorporating such data into their teaching. Third, teaching statistics for social justice in specific contexts emphasizes the value of project-based and experiential learning. Finally, developing critical statistical literacy for social justice highlights the need to prepare students to question how data are constructed, represented, and interpreted. This approach positions students as critical consumers of quantitative information and fosters deeper engagement with both statistics and social justice. Together, these approaches allow students to apply statistical concepts to real-world problems and immerse themselves in social justice issues. Educators should consider the benefits of contextualized pedagogical environments to foster deeper engagement with TS4SJ.

Limitations

While the scoping review helped to identify the literature on teaching statistics for social justice, it does have limitations. Arksey and O'Malley (2005) noted in their scoping studies that scoping reviews do not allow for the synthesis of literature. In other words, this scoping review provided a descriptive overview of the available literature but did not assess the quality or relative weight of each study (Arksey & O'Malley, 2005). A deep analysis of the collected data was not possible for this study. Another limitation of this study is the possibility of missing relevant records that should have been included in the review (Pham et al., 2014). The selected databases and time constraints may have contributed to missing relevant records.

Conclusion

This scoping review, grounded in Lesser's (2007) framework for TS4SJ, reveals a dynamic research landscape in statistics education for social justice. The literature search uncovered a recent surge in TS4SJ publications, signifying interest in this critical line of inquiry in mathematics education. Upon examining the methodology, it became evident that over half of the publications were non-empirical in nature. This suggests a significant gap in the empirical foundation of TS4SJ. This gap in the empirical literature raises critical questions about the pedagogical impact and effectiveness of TS4SJ. Additionally, one distinctive feature of the results is the prevalence of implicit descriptions of TS4SJ, often intertwined rather than explicitly defined and unpacked in the included studies. However, one could argue that this implicit portrayal of TS4SJ underscores the seamless integration of social justice principles into mathematics and statistics education. This trend was evident in non-empirical publications that more frequently adopt the term "Teaching Statistics for Social Justice," highlighting the evolution of the discourse surrounding TS4SJ.

Regarding praxis, the diversity of participants in TS4SJ initiatives reflects its potential to engage learners across various educational levels, from in-service teachers to K-12 and post-secondary students. Yet, the predominance of TS4SJ tasks within secondary education is a noteworthy trend, because it could suggest that the complexities of incorporating social justice into mathematics and statistics education are most problematic in elementary and post-secondary settings due to the practical and political challenges that one must navigate to engage these two groups in TS4SJ tasks. However, this complexity could be addressed by exploring the themes of the present scoping review related to TS4SJ implementation. Our review revealed four major themes that shed light on TS4SJ implementation. "Incorporating Social Justice in Statistics Education" underscores the growing movement to infuse social justice content into traditional statistics curricula. Alternatively, "Using

Social Justice Data to Teach Statistics" reveals the use of real-world data tied to social justice issues as a pedagogical strategy. "Teaching Statistics for Social Justice in Specific Contexts" reflects an exploration of TS4SJ within project-based, contextualized environments, offering a rich tapestry of experiential learning. Finally, "Developing Critical Statistical Literacy for Social Justice" emphasizes that equipping learners with critical statistical literacy skills is pivotal.

In conclusion, this scoping review unravels the multifaceted dimensions of TS4SJ, demonstrating its growing significance in the field of education. While the field of statistics education has embraced Lesser's (2007) emphasis on nontrivial contextualization (i.e., themes 1 and 2) and reflection upon socio-political context (i.e., theme 3), critical gaps remain in implementing his vision for critical questioning and student 'talk back' or action-taking. Moreover, the stark gap in empirical research, juxtaposed with the diverse approaches to TS4SJ implementation, presents both challenges and opportunities. As TS4SJ continues to evolve, interdisciplinary collaboration and rigorous empirical inquiry must guide its trajectory, ensuring its enduring impact on the landscape of social justice in mathematics education.

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Micayla Gooden (mgooden@ou.edu) Ph.D. is an Assistant Professor at the University of Oklahoma. She is a former high school mathematics teacher and is passionate about advancing mathematics teaching and learning. Her research focuses on mathematics education, STEM project-based learning, and preservice teachers, with an emphasis on preparing future teachers to support meaningful mathematics learning.

Miriam Sanders (msande27@uwyo.edu), Ph.D. is an Assistant Professor at the University of Wyoming in the School of Teacher Education. She is a former high school mathematics teacher. Her research focuses on developing and replicating best practices in mathematics education to address inequitable student outcomes.

Jamaal R. Young (jamaal.young@tamu.edu) Ph.D. is Associate Professor of Mathematics Education in the Department of Teaching, Learning & Culture and Director of Aggie STEM at Texas A&M University. His scholarship examines equity in STEM learning with emphases on research synthesis (meta-analysis), large-scale data analyses, and the roles of opportunity structures (e.g., teacher quality, access to technology, out-of-school learning) in shaping STEM identities for historically marginalized learners. He currently serves as Editor-in-Chief of the Journal of Urban Mathematics Education (JUME).

References

- Abdulrahim, N. A., & Orosco, M. J. (2020). Culturally responsive mathematics teaching: A research synthesis. *The Urban Review*, 52(1), 1-25. <https://doi.org/10.1007/s11256-019-00509-2>
- Alleksaht-Snyder, M., & Hart, L. E. (2001). "Mathematics for all": How do we get there? *Theory Into Practice*, 40(2), 93-101. https://doi.org/10.1207/s15430421tip4002_3
- Amdat, W. C. (2021). The Chicago hardship index: An introduction to urban inequity. *Journal of Statistics Education*, 29(3), 328-336. <https://doi.org/10.1080/26939169.2021.1994489>
- Arksey, H., & O'Malley, L. (2005). Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology: Theory and Practice*, 8(1), 19-32. <https://doi.org/10.1080/1364557032000119616>
- Bargagliotti, A., Franklin, C., Arnold, P., Gould, R., Johnson, S., Perez, L., & Spangler, D. (2020). *Pre-K-12 guidelines for assessment and instruction in statistics education II (GAISE II): A framework for statistics and data science education*. National Council of Teachers of Mathematics. https://www.amstat.org/asa/files/pdfs/GAISE/GAISEIIPreK-12_Full.pdf
- Barker, M., Adelson, P., Peters, M. D. J., & Steen, M. (2020). Probiotics and human lactational mastitis: A scoping review. *Journal of the Australian College of Midwives*, 33(6), 483-491. <https://doi.org/10.1016/j.wombi.2020.01.001>
- Bartell, T. G. (2013). Learning to teach mathematics for social justice: Negotiating social justice and mathematical goals. *Journal for Research in Mathematics Education*, 44(1), 129-163. <https://doi.org/10.5951/jresmetheduc.44.1.0129>
- Ben-Zvi, D., & Garfield, J. (2008). Introducing the emerging discipline of statistics education. *School Science & Mathematics*, 108(8), 355-361. <https://doi.org/10.1111/j.1949-8594.2008.tb17850.x>
- Bergen, S. (2016). Melding data with social justice in undergraduate statistics and data science courses. Paper presented at the *LASE Roundtable Conference 2016: Promoting Understanding of Stats about Society*, Berlin, Germany.
- Cacchione, P. Z. (2016). The evolving methodology of scoping reviews. *Clinical Nursing Research*, 25(2), 115-119.
- Cannon, S. O. (2022). Investigating and interrogating: Rethinking statistics curriculum for preservice teachers. *Curriculum & Teaching Dialogue*, 24(1/2), 233-250.
- Capper, C. A., Theoharis, G., & Sebastian, J. (2006). Toward a framework for preparing leaders for social justice. *Journal of Educational Administration*, 44(5), 445-469. <https://doi.org/10.1108/09578230610679452>
- Cochran-Smith, M., Ell, F., Grudnoff, L., Haigh, M., Hill, M., & Ludlow, L. (2016). Initial teacher education: What does it take to put equity at the center? *Teaching and Teacher Education*, 57, 67-78. <https://doi.org/10.1016/j.tate.2016.03.006>
- Conway, B. M., IV., & Nguyen, H. (2020). Incorporating social justice into statistical instruction: Using action research to impact pre-service teachers. *International Journal for the Scholarship of Teaching and Learning*, 14(1). <https://doi.org/10.20429/ijsotl.2020.140113>
- Dacia, S. L., Brooks, S., Conway, B. M., & Nguyen, H. (2021). Teaching statistics for social justice: An autoethnographic research report. *Georgia Educational Researcher*, 18(1), 48-71. <https://doi.org/10.20429/ger.2021.180103>
- Daudt, H. M., van Mossel, C., & Scott, S. J. (2013). Enhancing the scoping study methodology: A large, inter-professional team's experience with Arksey and O'Malley's framework. *BMC Medical Research Methodology* 13(48). <https://doi.org/10.1186/1471-2288-13-48>.

- Dover, A. G. (2009). Teaching for social justice and K-12 student outcomes: A conceptual framework and research review. *Equity & Excellence in Education*, 42(4), 506-524. <https://doi.org/10.1080/10665680903196339>
- Enyedy, N., Mukhopadhyay, S., & Danish, J. (2006). At the intersection of statistics and culturally relevant pedagogy: Potential and potential challenges of learning statistics through social activism. In A. Rossman & B. Chance (Eds.), *Proceedings of 7th International Conference on Teaching Statistics*. Voorburg, The Netherlands: International Statistical Institute. https://www.stat.auckland.ac.nz/~iase/publications/17/7A1_ENYE.pdf.
- Frydryk, C. (2017). Body image and Barbie. *Ohio Journal of School Mathematics*, 75, 8–12.
- GAISE College Report ASA Revision Committee. (2016). *Guidelines for Assessment and Instruction in Statistics Education College Report 2016*. American Statistical Association. <http://www.amstat.org/education/gaise>.
- Gal, I. (Ed.). (2000). *Adult numeracy development: Theory, research, practice*. Hampton Press.
- Garii, B., & Appova, A. (2013). Crossing the great divide: Teacher candidates, mathematics, and social justice. *Teaching and Teacher Education*, 34, 198-213. <https://doi.org/10.1016/j.tate.2012.07.004>
- Gist, C., Jackson, I., Nightengale-Lee, B., & Allen, K. (2019). Culturally responsive pedagogy in teacher education. *Oxford Research Encyclopedia of Education*. <https://doi.org/10.1093/ACREFORE/9780190264093.013.266>
- Gutiérrez, R. (2013). The sociopolitical turn in mathematics education. *Journal for Research in Mathematics Education*, 44(1), 37-68. <https://doi.org/10.5951/jresmetheduc.44.1.0037>
- Gutstein, E. (2003). Teaching and learning mathematics for social justice in an urban, Latino school. *Journal for Research in Mathematics Education*, 34(1), 37-73. <https://doi.org/10.2307/30034699>
- Gutstein, E. (2006). *Reading and writing the world with mathematics: Toward a pedagogy for social justice*. Routledge.
- Harper, F. (2019). A qualitative metasynthesis of teaching mathematics for social justice in action: Pitfalls and promises of practice. *Journal for Research in Mathematics Education*, 50(3), 268-310. <https://doi.org/10.5951/jresmetheduc.50.3.0268>
- Hytten, K., & Bettez, S. C. (2011). Understanding education for social justice. *Educational Foundations*, 25, 7-24.
- Joanna Briggs Institute. (2015). *Methodology for JBI scoping reviews (Joanna Briggs Institute Reviewer's Manual: 2015 edition/ Supplement)*. The Joanna Briggs Institute.
- Kader, G. D., & Jacobbe, T. (2013). *Developing essential understanding of statistics for teaching mathematics in grades 6–8*. National Council of Teachers of Mathematics.
- Kahn, J. B., Peralta, L. M., Rubel, L. H., Lim, V. Y., Jiang, S., & Herbel-Eisenmann, B. (2022). Notice, wonder, feel, act, and reimagine as a path toward social justice in data science education. *Educational Technology & Society*, 25(4), 80-92. <https://www.jstor.org/stable/48695983>
- Kaur, B. (2012). Equity and social justice in teaching and teacher education. *Teaching and Teacher Education*, 28(4), 485-492. <https://doi.org/10.1016/j.tate.2011.12.007>
- Knurek, R. M. (2021). Interrogating data to explore digital inequity. *Ohio Journal of School Mathematics*, 88, 8–16.
- Krishnannair, A., & Krishnannair, S. (2022). “Critical statistical literacy”, “Social justice statistics”, and “Critical statistical consciousness” as higher education imperatives, amidst the covid-19 pandemic in South Africa. *South African Journal of Higher Education*, 36(1), 154-170. <https://doi.org/10.20853/36-1-4509>
- Larnell, G. V., Bullock, E. C., & Jett, C. C. (2016). Rethinking teaching and learning

- mathematics for social justice from a critical race perspective. *Journal of Education*, 196(1), 19–29. <https://doi.org/10.1177/002205741619600104>
- Lasater, R. S., Joseph, A., & Cummiskey, K. (2022). Exploring a complex gender wage gap dataset: an introductory activity in identifying issues and data visualization. *Teaching Statistics*, 45(1), 14–21. <https://doi.org/10.1111/test.12319>
- Lerman, S. (2000). The social turn in mathematics education research. In J. Boaler (Ed.), *Multiple perspectives on mathematics teaching and learning* (pp. 19–44). Ablex.
- Lesser, L. M. (2007). Critical values and transforming data: Teaching statistics with social justice. *Journal of Statistics Education*, 15(1). <https://doi.org/10.1080/10691898.2007.11889454>
- Levac, D., Colquhoun, H., & O'Brein, K. K. (2010). Scoping studies: Advancing the methodology. *Implementation Science*, 5(1), 1–9.
- Louie, J., Chance, B., Roy, S., Fagan, E., Stiles, J., & Finzer, W. (2021). Promoting Interest in Statistics with Social Justice Data Investigations. In D. Olanoff, K. Johnson, & S. M. Spitzer (Eds.) *Proceedings of the forty-third annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics & Education* (pp. 107–108).
- Loux, T., & Gibson, A. K. (2019). Using Flint, Michigan, lead data in introductory statistics. *Teaching Statistics*, 41(3), 85–88. <https://doi.org/10.1111/test.12187>
- Maloney, L. A. (2015). *Teaching community college introductory statistics using social justice contexts*. ProQuest Dissertations & Theses Global. <http://proxy.library.tamu.edu/login?url=https://www.proquest.com/dissertations-theses/teaching-community-college-introductory/docview/1696782340/se-2>
- Mays, N., Roberts, E., & Popay, J. (2001). Synthesizing research evidence. In N. Fulop, P. Allen, A. Clarke, & N. Black (Eds.), *Studying the organisation and delivery of health services: Research methods* (pp. 188–219). Routledge.
- McCoy, L. P. (2008). Poverty: Teaching mathematics and social justice. *The Mathematics Teacher*, 101(6), 456–461. <https://doi.org/10.5951/MT.101.6.0456>
- Meister, S. M., Zimmer, W. K., & Wright, K. L. (2017). Social justice in practitioner publications: A systematic literature review. *Journal of Urban Learning, Teaching, and Research*, 13, 90–111. <https://files.eric.ed.gov/fulltext/EJ1150167.pdf>
- Mills, C., & Ballantyne, J. (2016). Social justice and teacher education: A systematic review of empirical work in the field. *Journal of Teacher Education*, 67(4), 263–276. <https://doi.org/10.1177/0022487116660152>
- Moore, D. S. (1997). New pedagogy and new content: The case of statistics. *International Statistical Review*, 65(2), 123–137.
- National Council of Teachers of Mathematics (2021). *Position statement, access and equity in mathematics education*. <https://www.nctm.org/Standards-andPositions/Position-Statements/Access-and-Equity-in-Mathematics-Education/>
- National Council of Teachers of Mathematics. (2024). *High school mathematics reimagined, revitalized, and relevant: Executive summary*. <https://www.nctm.org/HSreimagined>
- North, C. E. (2008). What is all this talk about “social justice”? Mapping the terrain of education’s latest catchphrase. *Teachers College Record: The Voice of Scholarship in Education*, 110(6), 1182–1206. <https://doi.org/10.1177/016146810811000607>
- Nguyen, H., & Eisenreich, H. (2018). Using school choice to connect to mathematics learning in a statistics and probability course for K-8 Pre-service teachers. *Georgia Educational Researcher*, 15(1). <https://doi.org/10.20429/ger.2018.15101>
- Oliveira, H., & Henriques, A. (2019). Teachers’ perspectives about statistical reasoning: Opportunities and challenges for its development. In Burrill, G. & Ben-Zvi, D. (Eds.), *Topics and trends in current statistics education research* (ICME-13 Monographs).

- Springer, Cham. https://doi.org/10.1007/978-3-030-03472-6_14
- Pham, M. T., Rajic, A., Greig, J. D., Sargeant, J. M., Papadopoulos, A., & McEwen, S. A. (2014). A scoping review of scoping reviews: Advancing the approach and enhancing the consistency. *Research Synthesis Methods*, 5(4), 371–385. <https://doi.org/10.1002/jrsm.1123>
- Pollack, E., & Wunderlich, G. (2005). Measuring abuse, disparity, and discrimination. *Amstat News*, 336, 44-46.
- Pugach, M. C., Gomez-Najarro, J., & Matewos, A. M. (2019). A review of identity in research on social justice in teacher education: What role for intersectionality? *Journal of Teacher Education*, 70(3), 206-218. <https://doi.org/10.1177/0022487118760567>
- Ramirez, C., Schau, C., & Emmioğlu, E. S. M. A. (2012). The importance of attitudes in statistics education. *Statistics Education Research Journal*, 11(2), 57-71. <https://doi.org/10.52041/serj.v11i2.329>
- Reagan, E. M., & Hambacher, E. (2021). Teacher preparation for social justice: A synthesis of the literature, 1999–2019. *Teaching and Teacher Education*, 108, 103520. <https://doi.org/10.1016/j.tate.2021.103520>
- Register, J., Fernandes, A., & Pugalee, D. (2022). Supporting preservice mathematics teachers' culturally responsive teaching: A focus on teaching for social justice. *Mathematics*, 10(6). <https://doi.org/10.3390/math10060896>
- Tate, W. F. (1994). Race, retrenchment, and the reform of school mathematics. *The Phi Delta Kappan*, 75(6), 477-484.
- Thrupp, M., & Lupton, R. (2006). Taking school contexts more seriously: The social justice challenge. *British Journal of Educational Studies*, 54(3), 308-328. <https://doi.org/10.1111/j.1467-8527.2006.00348.x>
- Tran, D., & Lee, H. S. (2015). The difference between statistics and mathematics. In Teaching statistics through data investigations MOOC-Ed, Friday Institute for Educational Innovation: NC State University, Raleigh, NC. https://fi-courses.s3.amazonaws.com/tsdi/unit_2/Essentials/Statvsmath.pdf
- Toldson, I. A. (2019). *No BS (bad stats): Black people need people who believe in Black people enough not to believe every bad thing they hear about Black people* (Vol. 4). Brill.
- Wall, M. (2016). Social justice drives students deeper: A statistics lesson on wealth impacting quality of life. *Ohio Journal of School Mathematics*, 74, 24–28.
- Weiland, T. (2017). Problematizing statistical literacy: An intersection of critical and statistical literacies. *Educational Studies in Mathematics*, 96(1), 33–47. <https://doi.org/10.1007/s10649-017-9764-5>
- Weiland, T. (2019). Critical mathematics education and statistics education: Possibilities for transforming the school mathematics curriculum. In Burrill, G., Ben-Zvi, D. (eds) *Topics and trends in current statistics education research*. ICME-13 Monographs. Springer, Cham.
- Wiedeman, C. R. (2002). Teacher preparation, social justice, equity: A review of the literature. *Equity & Excellence in Education*, 35(3), 200-211. <https://doi.org/10.1080/713845323>
- Xenofontos, C., Fraser, S., Priestley, A., & Priestley, M. (2021). Mathematics teachers and social justice: A systematic review of empirical studies. *Oxford Review of Education*, 47(2), 135-151. <https://doi.org/10.1080/03054985.2020.1807314>