


Equity in Secondary Career and Technical Education in the United States: A Theoretical Framework and Systematic Literature Review

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Career and technical education (CTE) has become increasingly popular in U.S. secondary schools, but equity has not always been a focus of federal legislation or state and local policies and programs. This literature review of trends in CTE research between 1998 and 2019 uses a novel equity framework to examine whether and how secondary CTE programs affect educational equity. A total of 123 sources were reviewed. Findings revealed that CTE research most commonly addresses access and participation, measured by high school graduation rates and GPA. Few studies disaggregate outcome measures by student subgroups to better assess equity. Furthermore, a dearth of large-scale, comparative, and longitudinal research limits generalizability. Most extant research on secondary CTE programs in the United States examines a single state, district, or school. This article identifies promising policies and practices for enhancing equity in CTE conveyed by extant literature and recommends important directions for future research.

KEYWORDS: equity, vocational education, high schools

The past decade has seen a resurgence of bipartisan interest in secondary career and technical education (CTE) in the United States (Abamu, 2017; Kreamer, 2017). This interest has spurred new CTE policies and programs across the country (Dougherty, 2016; Kreamer & Reyna, 2018; Visher & Stern, 2015). CTE offers organized educational activities providing both academic content and technical skills in current or emerging professions, and builds pathways connecting education and the workforce. In an already understudied field (Castellano et al., 2003), however, research has not kept pace with policy interest or program expansion (Dougherty, 2016; Dougherty & Lombardi, 2016), particularly in the area of equity.

In the wake of 2015's Every Student Succeeds Act (ESSA) and the more recent passage of the Strengthening Career and Technical Education for the 21st Century Act (Perkins V; 2018), it is an opportune moment to assess the implications of CTE policies and programs for students belonging to historically marginalized groups. Although ESSA requires states to report disaggregated student outcomes, and Perkins V specifies that funding should be used to eliminate inequalities in CTE, neither law includes explicit equity measures (ACTE & Advance CTE, 2018). Additionally, both devolve authority to the states (Duff & Wohlstetter, 2019; Ufijusa, 2018), allowing for more variation and potentially limiting equity.

Research Aims

Given CTE's roots in vocational education, an academic pathway with a "pernicious" history (Petrilli & Zeehandelaar, 2016, p. 1) of limiting the attainment and achievement of marginalized populations (Alexander & McDill, 1976; Gamoran, 1987; Heyns, 1974; Oakes et al., 1992; Wolfle, 1985), it is important to ask how CTE affects educational equity today. Focusing on the past 20 years in the United States, we reviewed research literature about secondary CTE, evaluating equity in the distribution of CTE opportunities across student subgroups and patterns in the academic outcomes of CTE participants. We focused on secondary CTE programs because these years, particularly ninth grade, are pivotal in whether students graduate from high school (Phillips, 2019) and ultimately avoid low-paying occupations (Iannelli, 2013). We limited our review to the United States because our indicators of equity reflect power hierarchies specific to this context.

To the best of our knowledge, this article is the first systematic literature review in the field of CTE with an explicit focus on equity. Eight reviews from the past 20 years all employed approaches substantively different from our own. In this journal, Castellano et al. (2003) reviewed articles published between 1992 and 2002 and focused on CTE programs with comprehensive school reform designs. Zirkle's (2003) review concentrated on distance learning programs. Gemici and Rojewski (2007) evaluated methodology and limited their review to articles published in *Career and Technical Education Research*. Rojewski et al. (2009) looked broadly at all types of CTE programs in order to identify gaps in the literature, as we do, but not from an equity perspective. Ward (2009) reviewed literature on CTE programs in U.S. prisons. Hersperger et al. (2013) reviewed research on CTE programs in Texas. Dougherty and Lombardi's (2016) review comprehensively covered a similar time period but focused on school-to-work transitions rather than academic outcomes. Most recently, Lombardi et al. (2018) reviewed literature addressing CTE opportunities specifically for students with disabilities.

In this article, we employ a self-designed equity framework, which combines standards of educational adequacy, equal treatment, and equal educational opportunity (EEO), to review the literature on CTE. We also outline implications for policy, practice, and research. Our review makes a critical contribution by identifying disparities in CTE programming and highlighting gaps in the literature. Furthermore, our equity framework offers researchers in the field a cogent theoretical tool for evaluating program outcomes in other contexts in the future. The following section traces the evolution of CTE from its inception to the present,

TABLE 1*Timeline of U.S. federal career and technical education legislation*

Phase 1: From vocational to career and technical education

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| 1917 | Smith-Hughes National Vocational Education Act is passed, establishing federal funds for vocational education. |
| 1963 | Vocational Education Act replaces Smith-Hughes, and provides a federal definition and increases federal funding for “vocational education.” |
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Phase 2: The “new vocationalism”

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|------|---|
| 1984 | Vocational Education Act is reauthorized and renamed the Carl D. Perkins Vocational and Technical Education Act (Perkins I). |
| 1990 | Carl D. Perkins Vocational and Applied Technology Act (Perkins II) establishes federal vision for “new vocationalism” including secondary and postsecondary curriculum alignment. |
| 1998 | The name of federal CTE law changes slightly with its 1998 reauthorization, to the name it bears today: The Carl D. Perkins Career and Technical Education Act (Perkins III). |
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Phase 3: CTE’s shift from labor to education policy

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| 2001 | Reauthorization of the Elementary and Secondary Education Act (informally known as No Child Left Behind) sets the stage for a federal focus on educational equity. |
| 2006 | Reauthorization of the Carl D. Perkins Career and Technical Education Act (Perkins IV). |
| 2009 | Common Core State Standards are released by the National Governors Association, offering learning goals to prepare students for both college and the workforce. |
| 2015 | Most recent reauthorization of the Elementary and Secondary Education Act (the “Every Student Succeeds Act”) includes CTE in its definition of a well-rounded education. |
| 2018 | Most recent reauthorization of the Carl D. Perkins Career and Technical Education Act (Perkins V). |
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Note. CTE = career and technical education.

highlighting the role of equity. From there, we discuss our novel equity framework and its use in this literature review.

CTE Legislation and Equity: A Slow Evolution

In this section, we describe the path of CTE in the United States from vocational education programs targeting low-income and historically marginalized students to its current, more inclusive definition—preparing all students for college and career. We describe how U.S. federal legislation and its advocates shaped the evolution of CTE from an explicit labor policy to one that today aims to bridge the gap between secondary and postsecondary education and to facilitate more equitable transitions to the labor market for more students (see Table 1).

Phase 1: From Vocational to Career and Technical Education

What we today know as career and technical education began in the early 20th century as “vocational education”—an American adaptation of the German industrial education system (Brewer, 2009). Prompted by socioeconomic changes after World War I, vocational education aimed to prepare children for careers not requiring a bachelor’s degree, including those in agriculture, industrial trades, and home economics. The Smith-Hughes National Vocational Education Act (VEA) of 1917 was the first act of Congress to establish federal funds for vocational education (Alexander et al., 2014). Smith-Hughes represented ideas of “social efficiency”—matching some students to pathways toward leadership positions and training others for lower levels of employment (Collins, 1971; Labaree, 1997). What is known today as “tracking” was at the time decried by educational philosopher John Dewey, who believed vocational education embedded class distinctions into the design of public schooling, reinforcing class- and race-based inequalities (Lewis & Cheng, 2006; DeFalco, 2016). Early 20th-century secondary schools were intended only for the children of better educated families, while vocational education offered work training for those young people destined not for college but for a trade.

The focus of vocational programs remained unchanged for most of the 20th century (Oakes et al., 1992). Federal law continued supporting vocational education during the 1930s and 1940s, but as globalization increased throughout the late 20th century, Congress increased funding for training programs outside the traditional areas of factories and farms (Castellano et al., 2003; Imperatore & Hyslop, 2017). By the 1960s, the VEA had further expanded federal support for work-study programs and vocational research, emphasizing support for students considered “hard to reach and hard to teach” and painting vocational programs as less desirable for college-bound students (Thompson, 1973, p. 79).

Phase 2: The “New Vocationalism”

In 1984, Congress renamed the VEA as the Carl D. Perkins Vocational and Technical Education Act, after a leading vocational education advocate. At the same time, labor market changes demanded higher levels of literacy and cognitive skills (Lewis & Cheng, 2006), and vocational education programs as traditionally conceived could not keep pace with the demand for academic rigor (Goodlad, 1984). National fears about diminishing economic activity and an unprepared workforce led to VEA amendments in the 1980s focused specifically on enrolling more girls (Castellano et al., 2003)—the first major shift in the law’s target demographic, and the first hint at a future emphasis on equity (J. R. Stone, 2014). Concurrently, policymakers began challenging the notion of differentiated curriculum in American secondary schools (Oakes et al., 1992; Levesque et al., 2000), while the need for rigor sparked attempts to integrate academic and vocational curriculum (Castellano et al., 2003; Lewis & Cheng 2006; Oakes et al., 1992).

The Perkins Act of 1990, or Perkins II, laid out a vision for a “new vocationalism” (Lewis & Cheng, 2006).¹ This iteration idealized what was becoming known as “career and technical” education, preparing students for “broad curriculum

TABLE 2*U.S. secondary career and technical education program types*

Program	Description
Comprehensive high schools	“Traditional” high schools offering CTE courses and programs of study, often as electives
Career academies	Small schools, or “schools-within-a-school,” that provide a college preparatory curriculum in the context of a career-oriented theme
Technical/vocational high schools	Schools that primarily or solely offer CTE programs
Area technical centers	Colocated sites where CTE is delivered to students from one or more local school districts
Work-based learning	Many schools offer work-based learning opportunities (i.e., apprenticeships, internships, job-shadowing, mentorships, and simulated workplaces) in conjunction with other CTE delivery forms, allowing students to earn course credit and/or certification through on-the-job training combined with related classroom instruction

Note. Information adapted from briefs by Advance CTE (August 2018). CTE = career and technical education.

clusters” rather than specialized training for “particular jobs” (Castellano et al., 2003), and bringing the “new vocationalism” much closer to John Dewey’s vision of education for democracy rather than “social efficiency” (DeFalco, 2016). Perkins II also introduced new requirements for alignment between secondary and postsecondary career programs, cementing CTE as an integrated part of the U.S. education system (J. R. Stone, 2014). Within this new framework, models of CTE still known today—including career academies and comprehensive high schools—began to blossom (Lewis & Cheng, 2006; see Table 2).

Phase 3: CTE’s Shift From Labor to Education Policy

Taking cues from the changing landscape, federal legislation was renamed the Carl D. Perkins Career and Technical Education Act in 1998 (Perkins III), formalizing terminological and conceptual shifts in the field. Despite Perkins’ updated vision of CTE, discourse around the new vocationalism still lacked explicit attention to equity, even as other pieces of federal education legislation began reflecting such a shift (Lewis & Cheng, 2006). The No Child Left Behind Act (NCLB) represented a greater pivot toward equity than did any of its legislative predecessors, requiring public schools, for the first time, to report on the achievement of student subgroups in addition to overall school populations (Manna, 2011). While no formal mention of CTE exists within NCLB, its emphasis on programs and strategies with demonstrated effectiveness created challenges for the promotion

TABLE 3*Educational adequacy in CTE*

Learning standards	<p>These are aligned with Common Career Technical Core, Common Core State Standards, and Next Generation Science Standards.</p> <p>All program completers across schools and demographic subgroups possess minimum competencies outlined in the standards.</p>
Resource inputs	<p>CTE teachers meet certification and professional development requirements of the states in which they work.</p> <p>CTE teachers use culturally responsive and sustaining pedagogies.</p> <p>CTE programs have safe facilities with materials and equipment appropriate to the nature of career training they provide.</p> <p>CTE funding is sufficient for cultivating basic employment and citizenship skills.</p>

Note. Adapted from Benadusi (2001) and Meuret (2001b). CTE = career and technical education.

of CTE courses within secondary schools (Reeves, 2003). A study by Fletcher and Zirkle (2009) found that CTE was ultimately “left behind” by this piece of legislation, as a result of increased focus on core academics.

NCLB’s successor, the ESSA (2015), took yet another step toward equity by requiring the same disaggregation of data by underperforming subgroups but also requiring multiple accountability measures, including one or more indicators of “school quality or student success” (Cook-Harvey et al., 2016). ESSA also leverages college and career readiness language made popular by the Common Core State Standards and includes provisions that formally define CTE as a component of a well-rounded education (U.S. Department of Education, 2015).

ESSA continued the federal shift toward equity in education legislation, and the most recent iteration of Perkins—Perkins V—leverages similar language and accountability metrics for CTE. Perkins V builds on previous provisions, requiring all states to report on CTE program participation rates, with data broken down by federally defined subgroups (Perkins V, 2018). Acquiring more detailed, program-level data will ideally allow stakeholders to identify previously unidentified disparities and to adjust course. The equity implications of these legislative adjustments for students in the United States remain to be seen. The following section considers the ideal role of equity in CTE.

An Equity Framework for CTE

To ground our study, we designed a framework that provides a nuanced definition of equity in conjunction with indicators for assessing equity in the field of CTE. Although these indicators (outlined in Tables 3, 4, and 5) point to gold standards, educational equity as a matter of justice is a moral imperative (Levin,

TABLE 4

Equal treatment in CTE

Program distribution (across schools)	
Quality	The distribution of program types is independent of student body composition. The distribution of program types across schools reflects variation in needs and interests of local communities. Program efficacy and rigor are independent of school location and student body composition.
Quantity	Number of CTE programs accessible is independent of school location and student body composition. Length or intensity of CTE programs accessible is independent of school location and student body composition.
Program access (within schools)	Students' background characteristics do not influence staff decisions regarding CTE placement. CTE program admission policies and procedures (e.g., entrance exams, scheduling, transportation, etc.) do not discriminate against student subgroups. Patterns of CTE program participation result from variation in students' interest and capability. Demographic composition of CTE courses is not significantly different than the demographic composition of non-CTE courses. Demographic composition also does not vary significantly across CTE programs within a school.

Note. Adapted from Benadusi (2001) and Meuret (2001b). CTE = career and technical education.

2009). From the standpoints of policy analysis (Bardach, 2009) and justice (Meuret, 2001b), it is important to define an ideal to serve as a goal and an evaluative benchmark.

Following Malin et al. (2017), we started from the definition advanced by Cook-Harvey et al. (2016). Equitable educational practices give “every student access to an education focused on meaningful learning—one that teaches the deeper learning skills contemporary society requires in ways that empower students to learn independently throughout their lives” (Cook-Harvey et al., 2016, p. 1). This definition encompasses the three standards of equity employed by Fiske and Ladd (2004): educational adequacy, equal treatment, and EEO.

TABLE 5*Equal educational opportunity in CTE*

Achievement	<p>Achievement outcomes (e.g., test scores, grades) are independent of CTE participants' background characteristics.</p> <p>CTE participants' achievement positions them for employment in a field that supports full-time labor at a thriving wage.</p>
Attainment	<p>Attainment outcomes (e.g., credentials and degrees earned) are independent of CTE participants' background characteristics.</p> <p>CTE participants' attainment positions them for employment in a field that supports full-time labor at a thriving wage.</p>
Social-emotional skills	<p>The magnitude of growth in social-emotional skills is independent of CTE participants' background characteristics.</p> <p>The nature of growth in CTE participants' social-emotional skills is transformative, responsive to their cultural backgrounds, and sustaining of their cultural assets.</p> <p>In ways that are culturally responsive and sustaining, CTE participants develop social-emotional skills that support their scholastic success.</p> <p>In ways that are culturally responsive and sustaining, CTE participants develop social-emotional skills that position them to thrive in the labor market.</p>
Labor market outcomes	<p>CTE participants' economic mobility (e.g., transition to the labor market, wages) is independent of background characteristics.</p> <p>CTE participants' status mobility (e.g., job prestige, social class) is independent of background characteristics.</p>

Note. Adapted from Benadusi (2001), Meuret (2001b), and Jagers et al. (2018). CTE = career and technical education.

Educational adequacy guarantees a minimum threshold of instruction necessary for citizens to develop basic competencies. Equal treatment means students have access to comparable or equivalent educational services, regardless of their background characteristics (Meuret, 2001b). Background characteristics are those ascribed at birth or in early childhood that indicate social class (e.g., parents' income, status of parents' occupation) or membership in demographic groups (e.g., race, ethnicity, gender, sexuality, disability status, geographic location, and linguistic background; Benadusi, 2001). EEO means "independence of scholastic output from background variables" (Benadusi, 2001, p. 54). EEO moves beyond examination of inputs (e.g., equal access to equivalent school environments, teacher quality, per pupil expenditure, etc.) to outcomes, such as achievement and attainment. This is essential because inequitable access to

educational inputs (adequacy and treatment) is inextricably related to persistent outcome disparities (Saunders et al., 2017).

Additionally, the persistence of disparate outcomes despite apparent adequacy and apparent equal treatment may signal systematic differences in treatment that are hidden and/or difficult to measure, such as teacher bias (Chin et al., 2020) or students' self-perceptions of competence (Gamoran, 1987; Merillat et al., 2018). Furthermore, the inclusion of outcomes can draw needed attention to health care, income, and status inequalities, as well as residential segregation, all of which contribute to gaps in educational outcomes that equalization of educational inputs can only partially ameliorate (Rothstein, 2015).

Educational Adequacy: "Sound Basic" CTE

Adequacy in CTE means all students receive a "sound basic education" that prepares them to meet the minimum proficiency levels defined by learning standards, to actively engage in citizenship, and to "compete effectively in the modern economy" (Rebell, 2009, p. 21). "Sound basic" CTE programs prepare students for postsecondary programs that help them fulfill their capabilities and for labor market positions that enable them to lead dignified lives. Under conditions of educational adequacy, schools have the basic resource inputs (e.g., funding, facilities, and qualified faculty) necessary to cultivate 21st-century skills (Rebell, 2009). This means that school systems are able to provide students at their constituent schools with access to CTE coursework that sufficiently constitutes multiple programs of study culminating in a range of certifications or endorsements. These CTE programs should, like schools overall, provide students with adequate facilities and a safe environment. Furthermore, CTE programs and teachers should adopt an educational justice stance, disrupting hegemonic power relations that perpetuate inequities and embracing "the political struggles of those oppressed in classroom settings" (Calabrese Barton & Tan, 2020, p. 433). Toward this end, teaching in CTE classrooms should be culturally responsive and sustaining, incorporating and building on students' cultural knowledge (Gay, 2002; Jordan, 2010; Paris 2012). This approach is foundational for psychological safety and academic achievement among students from historically marginalized groups (Chenowith, 2014; Ladson-Billings, 1994, 1995). Table 3 outlines the indicators of adequacy in CTE.

Equal Treatment: CTE Program Distribution and Access

Despite its name, the standard of equal treatment "does not require that educations be 'identical,'" but they should be of "equal worth" (Meuret, 2001a, p. 93). Worth is not simply measured in fiscal terms, but instead equal worth means having "equal effects" (Meuret, 2001a, p. 93). In the context of a deeply unequal society like the United States, "equality may in fact mean inequality; equal treatment may require unequal treatment" (D. Stone, 2011, p. 42). Some students, particularly those navigating poverty or those with disabilities, may merit more resource investment (Jordan, 2010; Kornhaber et al., 2014). It is just for those students to receive more resources, since a compensatory distribution of resources that leads to their success is advantageous for society as a whole (Rawls, 1999).

Additional resources are intended to be *equalizing* in their effects (Kornhaber et al., 2014).

Thus, the term *equal treatment* denotes equivalence along two dimensions: *program distribution* (across schools) and *program access* (within schools). Across schools, indicators of equal treatment in CTE relate to the distribution of programs of comparable *quantity and quality*. Quantity relates to the distribution of CTE programs available to students with respect to their number, length, and intensity (Meuret, 2001b). Quality refers to the distribution of “conditions of learning” and the “scholastic experience” (Meuret, 2001b, p. 153). This encompasses the distribution of program type, efficacy, and rigor relative to the urbanity and demographic composition of communities. Table 4 summarizes indicators of equal treatment in CTE.

Program Distribution

Under conditions of equity, the distribution of CTE programs across schools and districts is independent of the demographic composition of the student body and urbanization of the school community. In terms of quantity, the number of CTE programs available to a student and the features of those programs (e.g., whether they offer a concentration, special diploma, or industry certification) should not be significantly associated with their subgroup membership (i.e., their race, ethnicity, socioeconomic status, gender, linguistic background, disability status or other characteristics). In terms of quality, the distribution of program types should be independent of student body composition.² Any significant variation in the distribution of program types by school location should reflect the values and needs of local communities. Finally, CTE program quality (measured in terms of teacher training, access to technology and instructional materials, and other inputs) should be independent of school characteristics.

Program Access

Equity also requires equal access to programs (i.e., that there be no segregation) within schools. Under conditions of equity, the demographic composition of CTE courses does not significantly differ from the overall demographic composition of non-CTE courses. Demographic composition also does not vary significantly across CTE programs within a school. In cases where such differences are significant, they reflect alignment between student preferences and course assignment rather than the influence of staff perceptions related to student subgroup membership. Namely, under conditions of equity, students’ background characteristics do not influence staff decisions regarding students’ track assignment (CTE or otherwise) or evaluations of their academic progress (Meuret, 2001b). Patterns of program participation (including program type, length, and funding) should result from variation in students’ interest and capability, remaining independent of their background.

Equal Educational Opportunity: CTE Outcomes

Under conditions of EEO, CTE students’ outcomes are independent of their background characteristics. We separate outcomes of the educational system into

three categories: achievement, attainment, and social and emotional skills. Achievement outcomes include “criteria that reflect the quality of a student’s school performance (e.g., marks on report cards and test scores)”; attainment outcomes include “criteria that reflect persistence through the educational system to various certification benchmarks (e.g., high school dropout, college attendance, and college completion)” (Alexander, 2001, p. 175). Social-emotional skills include dispositions that contribute to academic success (e.g., self-efficacy; Beasley & Fischer, 2012) and noncognitive competencies (or soft skills) valued by employers (Meuret, 2001b).³

It is important for equity researchers to also look beyond the direct products of educational systems given the strong correlation between attainment and achievement outcomes and students’ life circumstances. The purpose of tracking results external to educational systems is to ask whether “groups of individuals have the same chances of using their acquired skills to realize” their goals after leaving school (Demuese et al., 2001, p. 70). For individuals, educational outcomes have salient consequences for labor market outcomes (e.g., employment status, earnings) and social mobility (e.g., prestige of occupation, class).⁴ Table 5 summarizes indicators of EEO. As we reviewed the CTE literature using the three indicators outlined above, we focused on outcomes for students from historically marginalized groups. We next discuss how this framework guided our literature review, and its role in delineating our findings.

Method

Given CTE’s roots in the vocational education programs of the 20th century and the history of inequity associated with those programs, this literature review examines extant research on CTE from an equity perspective. Our equity framework, described in the previous section, guided our literature search and identification of search terms. In our review, we focused on subgroups defined by ESSA (2015), including economically disadvantaged students, students from major racial and ethnic groups, students with disabilities, and English learners. Due to historic marginalization, we also investigated the association of CTE inputs and outcomes with students’ gender, sexuality, and community urbanization. In the tradition of sociological research on educational stratification, this review asks, “Who gets what and why?” (Lenski, 1966, p. 3), and the following research questions:

Research Question 1: To what extent do secondary CTE programs in the United States meet standards of educational adequacy?

Research Question 2: To what extent do students from historically marginalized groups receive equal treatment with respect to the quality and quantity of CTE opportunities and experiences, both within and across schools?

Research Question 3: What do observed differences in academic and social and emotional outcomes across student groups suggest about equality of educational opportunity in secondary CTE?

Research Question 4: How well does extant CTE research address issues of equity? What kind of research is still needed?

Literature Search

Following Petrosino and Lavenberg (2007), we used clear eligibility criteria and a wide array of search terms in six distinct searches across four EBSCO-hosted databases: Education Research Information Center (ERIC), Academic Search Premier, Education Full Text, and Social Science Full Text (see Figure 1). We limited our initial search to peer-reviewed articles published between 1998, when the American Vocational Association changed its name to the Association for Career and Technical Education, and 2019. First, we searched for CTE-related articles. A search for “career education” or “technical education” or “career and technical education” or “vocational education” yielded 20,512 hits. Second, we searched within this pool of CTE sources for equity-related articles using the terms “equal education” or “equity” or “equality” or “inequity” or “inequality.” We received 16,469 hits. In our third search, we added “race” or “socioeconomic” or “gender” or “disabilities” or “students with disabilities” or “English language learners” or “ELL” or “ESL” or “English learners” or “rural” or “Latino” or “Latinx” or “Hispanic” or “Black” or “African American” or “Asian,” which yielded 16,394 hits. We next added terms from our equity framework. Our fourth search included “academic achievement” or “academic performance” or “academic success,” which gave us 16,361 hits, and “attainment” or “educational attainment,” which also gave us 16,361 hits. Our fifth search added “social and emotional learning” or “character education,” which gave us 16,356 hits. In our sixth search, we included program type as defined in Perkins V. However, adding “comprehensive high schools” or “technical high schools” or “area technical centers” or “career academies” or “pre-apprenticeship programs” did not change the results.

Inclusion and Exclusion Criteria

Next, we applied a screening protocol (Torgerson, 2003) to these 16,356 articles to develop a sample of eligible studies. The inclusion criteria required that articles be: written in English, concerned with secondary CTE programs, and based at least in part on data from the United States (if an international comparative study; Alexander, 2001). As mentioned previously, international literature is outside the scope of this review.

We chose to focus on the United States for several reasons. While tracking is not unique to the United States, the comprehensive high school is a distinctly American institution (Wraga, 1998). Offerings such as the German dual model (which has been adopted in Switzerland, Denmark, Austria, Peru, China, and elsewhere) are largely based on an apprenticeship model in which the vocational track starts earlier than it does in the United States (Zhang & Schmidt-Hertha, 2020). This is just one example of how tracking in international contexts often occurs *between* rather than *within* schools (Garvik et al., 2014; Van der Meulen Rodgers & Boyer, 2006). This affects the ease of moving in and out of CTE courses, as well as the likelihood of CTE participation for students from marginalized groups, and complicates potential comparisons to the U.S. context through an equity lens. Furthermore, some countries have a much larger

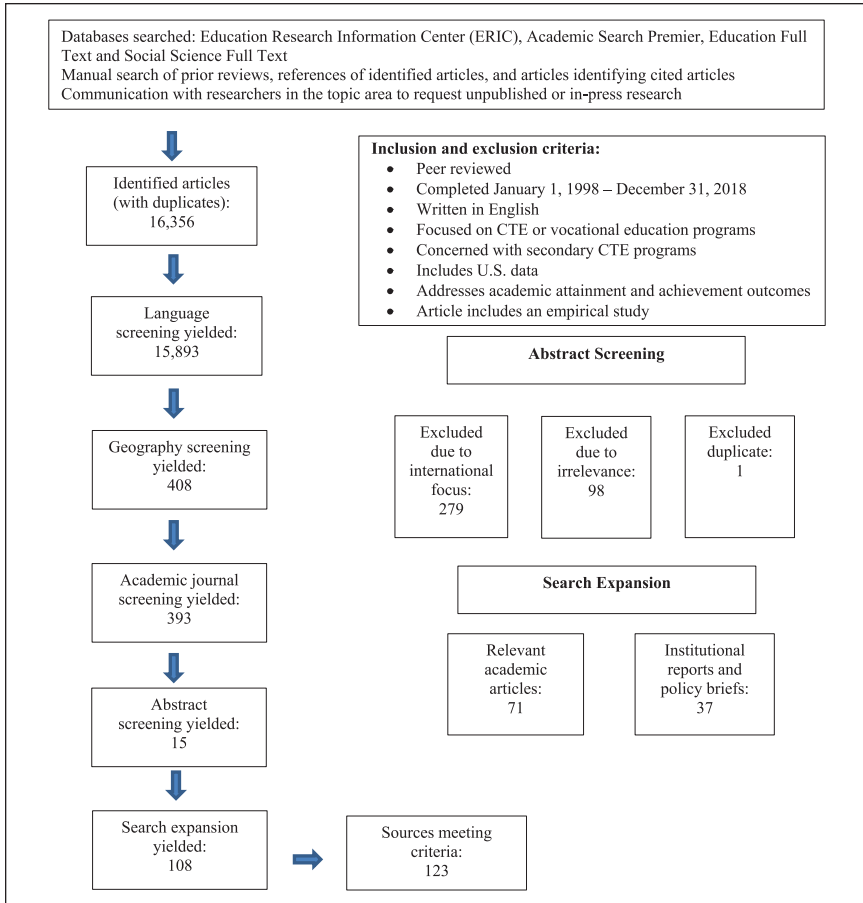


FIGURE 1. *Study selection process.*

proportion of students attending independent and religious schools (e.g., Australia; Gonski et al., 2011). Third, patterns of subgroup marginalization differ in other countries. In postcolonial contexts, systems of oppression may fall along ethnic lines (Anthias & Hoffmann, 2020). In European contexts, economic insecurity may be most concentrated among recent immigrants (Eugster, 2018). Thus, characteristics of other nations' education systems, as well as the distinct nature of socioeconomic and racial stratification in the United States, justify this narrow, single-country focus. However, overarching principles of the framework could be adapted for use in other countries through the selection of context-specific indicators.

For the “equity” results, the database filter removed non-English language studies, which left us with 15,893 articles, and non-U.S.-focused articles, which gave us 408. Of those, 15 were removed that were not from academic journals. After reviewing the abstracts of the remaining 393 articles, we removed 275 not focused on the United States and 98 not focused on secondary CTE, leaving us with 20 articles. For the “demographics” search, after eliminating non-English articles, we received 15,822 hits, and when we removed non-U.S.-focused studies, we had 406 sources. Once we eliminated articles not in academic journals, we were left with 382 articles. Of those 382, we removed 265 that were not focused on the United States and 97 that were not focused on the secondary level, leaving us with 20 articles. For the “academic outcomes” search, after we eliminated non-English articles, we were left with 15,791 hits and after eliminating non-U.S.-focused articles, we were left with 405 articles. Once we eliminated articles not in academic journals, we were left with 382—the same as in the demographics search. For the “attainment” search, after we eliminated non-English articles, we received 15,791 hits, and when we removed non-U.S.-focused studies, we received 405 hits. We also eliminated articles or reports that were not peer-reviewed, and again were left with 382 sources. For the “social and emotional learning” search, after we eliminated non-English articles, we received 15,786 sources and when we removed non-U.S. sources, we received 405 hits. We then removed articles not published in academic journals and were also left with 382 hits. For the “program types” search, after we eliminated non-English articles, we received 15,786 hits, and when we removed non-U.S.-focused studies, we received 405 sources. Once we eliminated articles not in academic journals, we also received 382 hits. Combining the articles resulting from each search (1: “CTE,” 2: “equity,” 3: “demographics,” 4: “academic outcomes” and “attainment,” 5: “social and emotional learning,” and 6: “program types”), we reviewed the resulting pool of 32 articles for duplicates and removed one.⁶ After this screening process, 31 articles constituted our initial data set. Upon further review, four were removed due to an international focus, leaving us with 27 articles.⁷

Search Expansion

Due to the limited number of relevant articles uncovered through the initial search, we next expanded our search to include academic articles and books cited in the reference sections of our initial sample. Many of them came from journals not represented by our initial databases. Using the same inclusion criteria, we retrieved 65 relevant articles. We also expanded our search to include articles focused on culturally responsive and sustaining education (CRSE) and CTE, as well as institutional reports and policy briefs. We reviewed 25 websites known to publish about CTE, yielding 31 reports dating from 1998 to 2019. After screening, 96 articles and reports constituted our data set. Combined with the initial 27, our total data set was 123 articles and reports—outlined in Figure 1 and Supplemental Tables S1 and S2 (in the online version of the journal).

Analysis

We analyzed our data in Dedoose starting with a priori codes derived from our research questions and equity framework, as well as the corresponding indicators.

Codes included learning standards, resource inputs, program distribution across schools, program access within schools, achievement, attainment, and social and emotional outcomes. We also coded for publication type and methodology. Through collaborative initial coding of a subset of sources, the authors developed emergent pattern codes for use in subsequent cycles of coding (Corbin & Strauss, 2008; Saldaña, 2009). Emergent codes included conditions of equity, program characteristics (arts integration, concentration, STEM), and program type (career tech, regional academies). In two rounds of triple-coding 10 articles, coding authors discussed instances of agreement or disagreement. Once interrater agreement reached 80%, each coded a portion of the dataset independently. Notes were compiled in a central spreadsheet and used for writing results.

Results

In this section, we discuss the results of our literature review in three subsections aligned to the structure of our equity framework: *educational adequacy*, *equal treatment*, and *EEO*. Our review of the academic and policy literatures in these areas found that the research base was limited, particularly for educational adequacy. Thus, although we report findings from each area, we focus mainly on equal treatment and EEO.

Educational Adequacy

In order to provide a minimum standard of quality, CTE programs should integrate academic and CTE content in a rigorous, authentic way and include small-group instruction (Moyer et al., 2017) and opportunities for real-world connections (Wright, 2011), as well as project-based learning (J. R. Stone, 2014). This review found only a handful of reports on the extent to which current CTE programs aligned with state and national learning standards. Furthermore, there was little mention of facility safety or funding adequacy. The most common area of educational adequacy in the literature was teacher quality, but there was very little on CRSE.

In terms of learning standards, the literature indicated that CTE programs have come a long way in terms of alignment, but room for improvement remains. A 2007 report by the National Research Center for Career and Technical Education (NRCCTE) found a great deal of variability in the design of state learning standards, with these differences explained by each state's unique philosophies, policies, and practices (Castellano et al., 2007). In this national study, teachers believed that CTE learning standards improved rigor, credibility, and parity with academic courses, and attracted higher performing students to their classes, but reported that CTE standards were not consistently implemented, likely because they were voluntary in some states (Castellano et al., 2007). Similarly, in an analysis of state CTE standards, the National Association of State Directors of Career Technical Education Consortium (NASDCTEc; 2013) found a significant mismatch between states' current CTE learning standards and the Common Career Technical Core.⁸ While most states have adopted the National Career Clusters Framework as a model for how they describe their CTE system, NASDCTEc (2013) found that few adopted the framework in a way that directly affected CTE instruction.

Of articles addressing the adequacy of CTE program resource inputs, most focused on *teacher quality* or *funding*. While we did find normative arguments about the importance of safe and well-equipped facilities (e.g., Toglia, 2009; West, 2018; West & Motz, 2017), we found only one evaluation of the *safety* of American CTE facilities or the alignment of available equipment with program objectives. A 2005 study found “inconsistent emphasis” on occupational safety and health information or training in CTE (Schulte et al., 2005, p. 404).

High-quality teachers are critical to the educational adequacy of CTE programs (Castellano et al., 2007; Gentry et al., 2011; Stringfield et al., 2011; J. R. Stone, 2017). According to the National Center for Education Statistics (Snyder et al., 2009), almost 80% of secondary CTE teachers nationwide were considered *highly qualified* (meaning they had a bachelor’s degree, had full certification, and demonstrated competency in their subject area) compared to 90% of academic teachers. Secondary CTE teachers averaged 14 years of teaching experience versus 13 years for academic teachers (National Center for Education Statistics, 2008; Snyder et al., 2009).

Despite relative similarities in qualifications, research has found CTE *teacher preparation* lacking in some critical areas (Drage, 2010; Gordon, 2009). This may explain, in part, why CTE teachers reported higher levels of stress than academic teachers prior to issuance of their professional license (Kerlin, 2002). A 2009 study showed CTE teachers often came from industry backgrounds and more than a quarter went through alternative licensing programs (Snyder et al., 2009) that might not cover all the training they need, including training for working with students with disabilities (Casale-Giannola, 2012). Such training can increase CTE teachers’ knowledge about and positive attitudes toward students with disabilities, especially in rural areas (Hall, 2007). Recruitment also matters, particularly for a more diverse teaching staff who are culturally proficient and able to examine their own biases (Conchas & Clark, 2002).

As reflected in Table 1, Perkins V requires CTE teachers to participate in “high quality, on-going and classroom-focused” PD to prepare them for integrating rigorous academic skills into their technical curricula (Sturko & Gregson, 2009, p. 34). However, the literature showed CTE teachers still need more high-quality PD opportunities, especially those supporting the integration of academic content into CTE curriculum and working in communities of practice with non-CTE teachers (Asunda et al., 2015; Gregson & Sturko, 2007; NRCCTE, 2010). One study from Illinois further showed a need for PD on the use of technology for instruction and on developing students’ critical-thinking and problem-solving skills. Sturko and Gregson (2009) found that structured courses and teacher study groups could both be effective learning environments for CTE teachers.

Very few studies focused on CRSE in CTE. Two studies in our sample offered case studies of CRSE, describing practices that were successful with Black and Latinx students. The first, a qualitative study of a vocational high school, illustrated how a Black teacher who had grown up in the local community incorporated community connection, language, and music into his culturally responsive and sustaining curriculum (Irizarry, 2007). The second, a qualitative study of an afterschool CTE program, found that strong relationships with teaching staff, especially those from similar backgrounds, were important to Latinx students

(Perry & Calhoun-Butts, 2012). Although these studies offered valuable insights for practitioners, they did not broadly assess the prevalence (or absence) of CRSE as an element of educational adequacy across CTE programs. Only one study in our sample did so. Dyar (2018) investigated CTE teachers' use of the Center for Research on Education, Diversity, and Excellence standards to meet the cultural needs of Latinx students in southern states, and found that teachers needed additional training in contextualizing lessons in a way that would help students connect educational content with their life experiences.

The literature illustrated that CTE has been plagued by funding issues since its inception, which can have significant effects for schools. The total Title I allocation under Perkins IV was \$1.1 billion, and while Perkins V funding grew from 2018 to 2020, it did not keep pace with inflation and persistent underfunding over the past decade (Perkins Collaborative Research Network, 2018). Furthermore, the 2020 budget request to Congress included additional cuts to education and workforce development programs. An analysis of U.S. state funding systems found that more than half of states allocated some level of funding for CTE but with wide variations across program type (Verstegen, 2016). Gray and Lewis (2018) found that 50% of districts reported lack of funding as a barrier to offering high school CTE programs. Furthermore, as federal funding has been tied to rates of program completion, patterns of noncompletion have become self-reinforcing (Reed et al., 2018).

Equal Treatment

As noted in the Equity Framework section, there are two indicators of importance: program distribution and program access. Equal treatment means students have access to educational services that are comparable in terms of both *quality* and *quantity*, regardless of their background characteristics. However, the literature showed that even when a wide variety of high-quality CTE programs were available, *barriers to access* existed particularly for girls, students with disabilities, and BIPOC (Black, Indigenous, and people of color) students.

In terms of quality, this review found almost no literature addressing the distribution of program types across and within schools and very little research on the distribution of program quality. However, this literature review did find some research addressing what works in the CTE classroom for students from historically marginalized groups. For example, studies showed that the components of effective CTE programs, such as support for ethnic identity development, asset-based attitudes about bilingualism, and community-based meaning-making practices, were particularly beneficial for BIPOC students (Perry & Calhoun-Butts, 2012; Wright, 2011). For students with disabilities, CTE courses of study can “naturally lend themselves to differentiated instruction” (Casale-Giannola, 2012, p. 40), motivating and engaging students, supporting their strengths, and building positive relationships and self-confidence (Cardon & Scott, 2000). We did not find, however, any studies that showed the extent to which students from different demographic groups had access to these types of instruction.

The little we did find on the distribution of CTE program efficacy was focused not on instructional techniques but rather on program climate and a sense of belonging in the context of the career academies model (Hoachlander, 2008;

Kemple & Wilner, 2008). Career academies often operate as a “school-within-a-school,” combining a college prep curriculum with a career theme, work-based learning, and industry partnerships (Fletcher et al., 2018; Hughes et al., 2006). Through these partnerships, CTE students receive hands-on experience in the workplace (Hernandez-Gantes et al., 2018; Pierce, 2012). Results of research on school culture and community-building in career academies have been mixed. In one study in Florida, Black students felt a strong sense of community in their academy (Fletcher & Cox, 2012). Another identified a sense of belonging as one of the main contributors to success for participants (Dixon et al., 2011). Similarly, a case study from California career academies found that a sense of community can strengthen relationships between students and teachers, and contribute to students’ optimism about their futures (Conchas & Clark, 2002). However, the study also found variations in the academies’ student populations and school cultures that produced significant differences in students’ educational experiences (Conchas & Clark, 2002). These mixed findings suggest a need for additional inquiry.

In terms of quantity, we found some literature on the *number* of CTE programs available across schools but none on the *length* or *intensity* of those programs. This is important because research has shown that CTE concentrators are much more likely to demonstrate positive future outcomes (Dougherty, 2016; Kreisman & Stange, 2017; J. R. Stone & Aliaga, 2005). In addition, the quantity of programs is not necessarily related to the size of a school or district. One study using data on public comprehensive high schools found that the scope of CTE offerings did not increase along with school or district size, even after controlling for the number of grade levels (Stull et al., 2000). However, schools with strong leadership in innovation, school climate, and cooperation offered more CTE options than schools that were weak in these leadership dimensions (Stull et al., 2000).

Several articles in our sample focused on the challenges rural and blue-collar areas face in offering a wide array of CTE concentrations and program types in terms of number, length, and intensity. A national study found that blue-collar communities tended to offer more CTE programs geared toward blue-collar occupations and fewer advanced college preparatory courses (Sutton et al., 2016). Furthermore, schools in rural areas often struggled to offer workplace experiences because there were few industries nearby with the capacity to provide them. Rural schools also had fewer colleges as potential partners, so offering dual-credit courses was more difficult (Swisher, 2016). To mitigate this, many schools in rural areas relied on online dual enrollment, but challenges with internet connectivity limited students’ access (Advance CTE, 2017). Limitations in rural offerings in areas particularly disadvantaged high school girls, who were less likely to be employed in the blue-collar sector after high school (Sutton et al., 2016).

Under conditions of equity, student background characteristics do not influence CTE course placement—*enrollment and admissions policies and practices* do not discriminate against any group. Instead, patterns of participation should result from variation in student interest and ability. However, this review revealed that CTE participation varied significantly by subgroup and program type. Although some studies found no consistent evidence of disproportionate participation in CTE programs by disadvantaged students (Dougherty, 2016; Giani,

2017; Hamilton et al., 2015; Kreisman & Stange, 2017), the majority of research revealed significant racial, economic, and gender disparities in CTE participation resulting from *barriers to access*.

A mixed-methods evaluation of secondary CTE enrollment in 12 states found that girls were less likely to enroll in nontraditional areas such as STEM, manufacturing, architecture, and construction, even in more urban or white-collar areas (Reed et al., 2018). In another study, while girls were still overrepresented in historically feminine fields such as health sciences and human services, boys were 1.3 times more likely than girls to take gender-nontraditional courses in CTE (Fluhr et al., 2017). This is noteworthy, as nontraditional program areas corresponded to jobs with higher salaries (Eardley & Manvell, 2006; Fletcher, 2012a, 2012b). The authors emphasized that “addressing girls’ under-representation in non-traditional courses was a key component to ensuring the effectiveness of secondary career and technical education in improving the career prospects of all students” (Eardley & Manvell, 2006, p. 414).

Fletcher and Zirkle (2009) utilized the 1997 National Longitudinal Survey of Youth to predict participation, degree attainment, and earnings potential based on high school curriculum tracks. They found that Black students were almost twice as likely to participate in the CTE track as White students (Fletcher & Zirkle, 2009). Similarly, in an evaluation of career academies in Florida, White students and girls were significantly more likely to participate in more rigorous programs (Evan et al., 2013). Additional studies found the same pattern for students from high-income families (Cox et al., 2015; Fletcher & Cox, 2012).

A recent technical report on CTE in California found that pathway completers were more likely to be male and from low-income backgrounds than non-CTE students (Reed et al., 2018). In addition, the report found significant differences in the proportion of low-income individuals, English language learners, and students with disabilities who completed CTE pathways across industry sectors (Reed et al., 2018). Similarly, a study of seven high schools supported by an area career technical center found that the typical CTE student was more economically disadvantaged than non-CTE students (Bierlein Palmer & Gaunt, 2007). The report also found disparities in participation in opportunities provided by industry partnerships, such as internships and mentoring (Cox et al., 2015; Dixon et al., 2011; Evan et al., 2013). The cost of certification exams associated with CTE programs has also been shown to exclude low-income students (Castellano et al., 2005).

As mentioned above, the literature demonstrated that girls were less likely to participate in CTE in general, particularly in career pathways where women have been historically underrepresented (Fluhr et al., 2017). These lower levels of participation have been due, in part, to discrimination and barriers to access, including failure to address sexual harassment by teachers, counselors, or peers; perpetuation of gendered stereotypes about girls’ abilities; allowing boys to monopolize equipment or teacher attention in CTE courses; or otherwise treating boys and girls differently in class (Eardley & Manvell, 2006).

The literature also indicated barriers to access for students with disabilities. For example, a qualitative study suggested that teachers may lack understanding of special education laws and knowledge of inclusion strategies (Casale-Giannola,

2011). Other studies found that students with disabilities did not always participate in more rigorous CTE offerings due to lack of awareness about (Unger & Luecking, 1998) and limited access to such programs (Gilson et al., 2018). In some cases, school administrators, teachers, and guidance counselors steered students with disabilities away from these opportunities (Unger & Luecking, 1998).

Equal Educational Opportunity

Within our equity framework, EEO comprises educational outcomes (i.e., *attainment, achievement, social and emotional skills*) and labor market outcomes such as *individual social mobility*. Most of the literature on CTE focused primarily on the direct outcomes of attainment and achievement and less on social and emotional skills. We do not report on labor market outcomes because they were covered in a previous review (Dougherty & Lombardi, 2016).

The literature reviewed on CTE coursework and academic achievement was mixed. In one study, CTE students demonstrated increased math achievement compared to their own achievement levels prior to enrollment (Bozick & Dalton, 2013). Results were robust for students from all socioeconomic backgrounds, though Black and Asian students demonstrated higher achievement gains than their White peers (Bozick & Dalton, 2013). Other studies suggested that the academic benefits of CTE may be less inclusive. A study commissioned by the National Assessment of Career and Technical Education (2014) found that CTE participation had little or no statistically significant relationship with students' academic achievement in math and reading comprehension. In contrast, a comparative study found that adults' literacy and numeracy skills in the United States tend to be less equal than in other countries but that participation in CTE in secondary school can have a mitigating effect (Green & Pensiero, 2016). Furthermore, CTE students have been shown to perform on par with academic track students in literacy but not in math (Green et al., 2015). However, another comparative study found that greater emphasis on CTE was positively related to numeracy skills and that gains were larger for lower performers (Heisig & Solga, 2015).

The literature suggested that program type may also be an important predictor of achievement. For example, in a study by the NRCCTE, although student achievement varied by district, CTE students outperformed their peers on the number of credits they earned in STEM and Advanced Placement classes while also earning higher overall GPAs (Castellano et al., 2014). However, these studies did not investigate potential disparities in outcomes among CTE students across demographic groups. In one study that did such an investigation, positive results were found for academic outcomes, particularly for those from higher socioeconomic backgrounds (Aliaga et al., 2012). Students in California who completed CTE pathways in STEM fields performed similarly, or slightly better, on both English language arts and math assessments than their peers but tended to be young White or Asian men (Reed et al., 2018). These were the only two studies in our sample that investigated whether STEM course-taking had differential effects for students from historically marginalized groups.

Educational attainment is measured by outcomes such as *high school graduation, postsecondary enrollment, and earning postsecondary credentials* (i.e., diplomas or certifications). Much of the research on CTE student attainment did

not disaggregate educational outcomes by demographic group and thus did not explicitly address EEO. The few studies that did so found positive effects but less so for historically underrepresented groups. Participation in a high-quality CTE program has been found to boost the probability of on-time high school graduation by 3 to 5 percentage points for higher income students and 7 percentage points for their lower income peers (Dougherty, 2018). Students who concentrated (took three or more credits in one area) in CTE subjects have been found to graduate at higher rates, on average, than non-CTE concentration peers—an effect particularly notable for historically disadvantaged groups (Dougherty, 2016; Kreisman & Stange, 2017). In one study, career academy enrollment was found to increase the likelihood of high school graduation and college enrollment for boys but not girls (Hemelt et al., 2019). However, effects on attendance and industry-relevant certification at least partially mediated the overall high school graduation effect (Hemelt et al., 2019). In another study, boys attending CTE high schools were approximately 10 percentage points more likely to graduate from high school and had quarterly earnings that were approximately 31% higher, but the same was not true for girls (Brunner et al., 2019).

For students with disabilities, a significant positive effect has been found for those participating in a concentration of occupationally specific CTE courses in their first two post-high school years (Wagner et al., 2016, 2017). Additionally, students with disabilities who attended a regional CTE program in high school were nearly 70% more likely to graduate in 4 years than similar peers who enrolled in traditional high schools (Dougherty et al., 2018). Compared with peers with similar disabilities who did not participate in CTE, students with disabilities in CTE programs performed comparably on standardized measures of student achievement but had higher probabilities of graduating from high school on time or earning industry-recognized certificates (Dougherty et al., 2018). In addition, specialized services such as counseling and tutoring, in conjunction with CTE, have been shown to be a stronger predictor of high school graduation and employment for students with disabilities than CTE coursework alone (Eisenman, 2003; Wolffe & Kelly, 2011).

Literature also suggested that for students in aggregate, CTE can reduce dropout rates. In one study, the odds of dropping out declined as the proportion of students' high school experience devoted to CTE courses increased (Castellano et al., 2007). Another showed that reduction in dropout rates was more pronounced when courses were taken in later years (Gottfried & Plasman, 2017). However, few studies addressing high school graduation disaggregated outcomes by student groups. One study found that a mix of CTE and academic course-taking (a ratio of three CTE units to four academic units) sometimes lowered the risk of students' dropping out, particularly among those at risk due to low grades or test scores (Plank, 2001). A recent study found that students with disabilities who participated in CTE courses in the 12th grade were more likely to graduate than those who did not (Theobald et al., 2017).

Social and emotional (or noncognitive skills) are of increasing value to employers (Deming, 2017; Stringfield & Stone, 2017), and research has shown that these “softer” skills can contribute to academic achievement (Hamedani et al., 2015). However, there was minimal literature about the intersection of

CTE and social and emotional outcomes. Similar to our search results in attainment and achievement, little work on this topic took the additional step of comparing outcomes among different student groups. For example, a study by the American Enterprise Institute found that CTE participants were more likely to exhibit soft skills at school, such as exerting more effort on routine tasks and attending class (Cheng & Hitt, 2018), concluding, “This belies the image of these students as slackers. And thus, it should belie the stereotype that CTE programs recruit substandard students” (p. 6). Research by Kelly and Price (2009) suggested that students derived positive psychological benefits, such as improved self-worth, from the success and engagement they experienced while enrolled in CTE coursework. Thus, CTE programs may play a role in improving student self-efficacy, along with educational and labor market outcomes. Self-esteem and self-determination may be critical factors to employment for students with disabilities (McNally & Harvey, 2001).

Feelings of self-efficacy in math and science may also be directly related to self-efficacy in career decision-making (Austin, 2010). Sublett and Plasman (2018) examined disaggregated outcomes with respect to social and emotional outcomes, finding that applied STEM coursework led to both math and science self-efficacy—except for girls and students with disabilities. An MDRC report argued there are additional equity concerns at the intersection of social and emotional outcomes and CTE as underfunded schools are less able to provide students with mentoring or training in soft skills (Rosen & Molina, 2019). This evidence suggests that there is more work to be done on equality of educational opportunity in this area. In the next section, we discuss the implications of these findings in greater detail, and offer specific recommendations for this future work.

Discussion

As mentioned in the CTE Legislation and Equity section, the ESSA (2015) and Perkins V provide a window of opportunity to stress equity in current and future CTE policy, practice, and research. Our focus here is to highlight CTE program characteristics associated with enhanced equity that emerged from our literature review and to recommend key areas for further inquiry. We organize this discussion around our research questions, originally presented in our Method section. We integrate our fourth research question, which asks how well extant CTE research addresses issues of equity and what kind of research is still needed, throughout our discussion. We end this discussion with a focus on the need for a greater variety of methods in future CTE research.

The Extent to Which Secondary CTE Programs in the United States Meet Standards of Educational Adequacy

We mainly found literature on *teacher quality* and CTE but very little on *learning standards*, *safety*, and *funding*, suggesting numerous opportunities for future research with a focus on equity. In terms of instructional techniques, the research is clear: CTE programs that integrate academic and CTE content in rigorous, authentic ways and include small-group instruction (Moyer et al., 2017), opportunities for real-world connections (Wright, 2011), project-based learning (J. R. Stone, 2014), and CRSE (Dyar, 2018; Irizarry, 2007; Perry & Calhoun-Butts,

2012) show promise for equity. Furthermore, research on CTE programs has established that *high-quality teachers* are essential to the successful implementation of CTE (Castellano et al., 2007; Gentry et al., 2011; Stringfield et al., 2011). However, researchers have identified a shortage of BIPOC CTE teachers (Conchas & Clark, 2002; Kantrov, 2017) and those who are able to integrate academic content with CTE. Such integration, moreover, has been established as a key component of high-quality CTE programs (Gordon, 2009; Snyder et al., 2009). In addition, professional development for CTE teachers focused on effective inclusion of students with disabilities (Haber & Sutherland, 2008) and use of technology (Sturko & Gregson, 2009) as well as anti-bias training and instruction in the use of CRSE (Sturko & Gregson, 2009) is important.

The research, albeit limited, indicated that the alignment of CTE programs with federal and state *learning standards* is critical, but there were inconsistencies in how CTE standards were designed and implemented (Castellano et al., 2007). Not all states adopted secondary CTE learning standards, and even when they were adopted, they were not fully aligned with postsecondary systems and the Common Career Technical Core (NASDCTEc, 2013). In addition, the National Career Clusters Framework was not always implemented in a way that directly affected CTE instruction (NASDCTEc, 2013).

In general, we found very little empirical research on *safety* and *funding* for CTE. We do know that CTE program elements, such as basic facilities and equipment as well as compliance with safety standards, must be monitored more closely (Schulte et al., 2005) but that research is still limited. Furthermore, despite its bipartisan support, CTE is plagued by funding issues (Gray & Lewis, 2018; Versteegen, 2016), but little is known about how that affects equity and CTE.

Areas for Further Research: A number of questions emerged from our review of literature on educational adequacy and CTE with a focus on equity particularly for student subgroups such as girls, students with disabilities, and BIPOC students. For one, more research is needed on CRSE and CTE as it is an emerging area with important implications for equity. What are the most effective CRSE practices within CTE classrooms, how are they best implemented, and how do we ensure that students from marginalized groups feel a sense of “rightful presence” within CTE classrooms (Calabrese Barton & Tan, 2020)? Second, more descriptive research is needed in order to track whether programs are furnishing the basic facilities, equipment, and supplies required for student learning. What does a safe CTE classroom look like and how safe are current American CTE classrooms? Third, additional research is needed on funding for CTE and how it varies between states, districts, and municipalities, which leads us to ask, How much funding is needed for an effective and equitable CTE program and how is current CTE funding being used?

The Extent to Which Students From Historically Marginalized Groups Receive Equal Treatment With Respect to the Quality and Quantity of CTE Opportunities and Experiences, Both Within and Across Schools

We found that even when a wide variety of high-quality CTE programs were available, *barriers to access* existed particularly for girls, students with disabilities, and BIPOC students. The literature showed that high school girls were less

likely to participate in CTE. This was particularly true in careers in which women were historically underrepresented (Fluhr et al., 2017), due in large part to discrimination and barriers to access (Eardley & Manvell, 2006). These barriers, and the related underrepresentation, also existed for students with disabilities (Casale-Giannola, 2011; Gilson et al., 2018; Unger & Luecking, 1998). In these cases, legal remedies, such as strong enforcement of Perkins accountability provisions, were necessary to increase equity in the participation of girls (Eardley & Manvell, 2006) and students with disabilities (Dieterich & Smith, 2015). The research suggested that outreach for district- or county-wide programs (e.g., open houses, fairs, mailings) might begin in middle school (Kantrov, 2017; Warner et al., 2015) as well.

In terms of the *quality* of offerings, research on CTE programs with strong school-industry partnerships (e.g., career academies) demonstrated they were effective in facilitating job placement for students (Fletcher et al., 2018; Hughes et al., 2006; Kemple & Wilner, 2008). In view of this finding, CTE policies might support robust school-industry partnerships to encourage engagement and feedback from potential employers, particularly in rural areas (Simmons, 2018). The Perkins V requirement for local needs assessments in an effort to better align local industry with CTE curriculum is an important step in this direction (Strengthening Career and Technical Education for the 21st Century Act, 2018).

With regard to the *quantity* of CTE offerings, researchers concluded that access to work-based internships and apprenticeships is distributed inequitably across students (Cox et al., 2015; Evan et al., 2013; Fletcher & Cox, 2012). In addition, CTE program offerings need to be better aligned with the labor market so that they connect students with higher paying jobs (Sublett & Griffith, 2019) and match employer demand (Mezera & Suffren, 2018). Furthermore, an emerging trend of CTE programs relies solely on GPA and test scores for admissions, and this trend serves as a barrier to access for underrepresented groups (Gerwetz, 2017).

Areas for Further Research: There are a number of areas for further research with regard to equal treatment and CTE. First, more research is needed on barriers to CTE for underrepresented groups as well as sharing timely information about students' and families' rights related to CTE and the Perkins Act. Similarly, there is a need for more research on CTE program outreach to underrepresented student groups (Kantrov, 2017), leading us to question, What are the most effective ways that educators and administrators can break down barriers to access to CTE and provide outreach about student rights and program offerings? Second, additional research on the mismatch between program offerings and labor market trends is necessary. Research could also foster understanding of the potential role of school-industry partnerships in improving labor market alignment, including students' readiness for employment. How can we ensure that CTE programs are well aligned with the needs of the local economy? What features are most effective in school-industry partnerships so that they can best contribute to this alignment and meet the needs of underrepresented groups? Third, more research is needed to understand how program characteristics affect the enrollment of students from underrepresented groups, particularly how admissions and enrollment criteria shape the demographic composition of more rigorous CTE

programs. How might admissions and enrollment criteria pose barriers to under-represented groups in CTE and how might they be reformed so that they are more inclusive and equitable?

What Observed Differences in Academic and Social and Emotional Outcomes Across Student Groups Suggest About Equality of Educational Opportunity in Secondary CTE

Much of the research on educational outcomes from our search highlighted practices related to improvements in *achievement and attainment* but very little on *social and emotional outcomes* and CTE. For example, studies showed that CTE programs with well-defined career pathways, aligned core academics, and students placed in smaller learning communities (e.g., career academies) had the most positive educational outcomes (Brunner et al., 2019; Advance CTE, 2017; Castellano et al., 2014; Dietrich et al., 2016; Giani, 2017; Gottfried & Plasman, 2017; Kemple & Wilner, 2008; Reed et al., 2018). This was especially true for CTE courses taken later in high school (Gottfried & Plasman, 2017) and when students concentrated in CTE (Dougherty, 2016; Kreisman & Stange, 2017). In addition, students in CTE programs of study (Castellano et al., 2014; Castellano et al., 2017) and those who completed pathways in STEM fields outperformed their peers (Reed et al., 2018).

In addition to highlighting enrollment disparities among subgroups of students, our review found inequities in CTE pathway completion rates (Bierlein Palmer & Gaunt, 2007; Reed et al., 2018). These differential outcomes suggest unequal treatment, but few research articles addressed the underlying mechanisms (Rose, 2012). The literature also suggested that schools that focus on supporting all CTE students in completing their pathway or program requirements, through flexible scheduling, transportation, and wraparound services (e.g., child care, counseling; Thessin et al., 2017), show promise for equity.

In general, there was little research on the intersection between CTE and *social and emotional outcomes*. Research during the era of vocational education showed that placement in the vocational track was often stigmatizing and was associated with lower academic self-efficacy (Alexander & McDill, 1976; Oakes, 1985). Psychological research has shown that low academic self-confidence (stemming from marginalization and related stereotype threats) is negatively associated with academic outcomes (e.g., Beasley & Fischer, 2012). Our review found limited research on academic self-efficacy among CTE students, which is a missed opportunity for identifying micro-level, racialized, and gendered processes driving outcome disparities.

Areas for Further Research: Little research explicitly addressed equality of educational opportunity by comparing outcomes for different groups of students, missing an opportunity to speak to equity (or the lack thereof). More research is needed on school culture and community-building within CTE programs and within schools offering CTE (Conchas & Clark, 2002; Dixon et al., 2011; Fletcher & Cox, 2012; Kantrov, 2017). What kinds of practices might ensure that students, especially those from marginalized groups, feel a sense of belonging, support, and “rightful presence” (Calabrese Barton & Tan, 2020) in CTE classrooms? It is also important to consider the role of teacher implicit bias as part of inequitable

treatment. What are the most effective ways to train teachers and administrators to confront their own biases in order to deliver CRSE within the CTE context? In general, more research is needed on the intersection between CTE and social and emotional outcomes. However, it is important to consider how social and emotional outcomes are defined and measured in order to ensure that it is culturally responsive and sustaining rather than simply maintaining the dominance of White middle class cultural norms. How might social and emotional outcomes for CTE be defined so that they are culturally responsive and sustaining?

The Effectiveness of Extant CTE Research in Addressing Issues of Equity and the Kind of Research That Is Still Needed

Our review also revealed a strong need for more rigorous methodologies in CTE research. Notably, this review relied heavily on institutional reports and policy briefs, as peer-reviewed literature was limited. Although there were some comparative international studies that included the United States, almost all of the articles identified in our search focused on single states, cities, or even programs. We also found few studies that compared districts, municipalities, or states within the United States. As a result, we found little research on the associations between the types of career clusters and programs that schools offer and their student body composition and location.

In order to address this gap in extant literature, researchers might conduct more large-scale studies that are broader in scope (e.g., Kreisman & Stange, 2017). Variations in school systems and CTE programming across states (combined with limited data collection at the federal level) make national studies somewhat infeasible, but comparative studies with careful purposive sampling of districts or states could address whether and how the federalized education system in the United States contributes to inequity in CTE. Ultimately, a national database of CTE programs and participants would be beneficial. Longitudinal studies using experimental or quasi-experimental methods would also be valuable (Clark, 2002), and are needed to examine temporal trends in program disparities within and between districts and states. Meta-analysis (e.g., Oh-Young et al., 2018) is another valuable but underutilized technique.

Overall, existing research rarely disaggregated findings by student subgroup. Taking this additional step, where possible, is necessary for bringing inequities to light. The use of statistical techniques for isolating the effects of student and school characteristics (e.g., Borman & Dowling, 2010) is essential. In particular, creation and tracking of disparity ratios using logistic regression is a promising technique (e.g., Benadusi, 2001; Hout et al., 1993; Mare, 1980). Oversampling might be employed where appropriate to ensure that sample proportions of students from historically marginalized groups are representative of overall populations (e.g., Fletcher et al., 2018). Finally, researchers might adopt intersectional and antiracist methodologies, such as using an assets-based approach to qualitative study of students (Wright, 2011), employing validated metrics of racialized practices (Knowles & Hawkman, 2020), and uncovering overlapping systems of power driving observed inequalities (Matsuda, 1991). Similarly, the development of unbiased measures of social and emotional outcomes that capture cultural

assets is another important area for future work (Jagers et al., 2018). Measurement of academic self-confidence and attitudes is also critical for equity.

Since states are ultimately responsible for enacting CTE systems and policies, there is also a critical need for more robust state accountability systems to monitor equity in outcomes across demographic groups and among urban, suburban, and rural schools. While ESSA requires states report extended cohort graduation rates, it does not mandate disaggregation by CTE participants or programs. Therefore, it is not surprising that many states have not yet linked K–12, postsecondary, and workforce data for long enough to adequately assess disaggregated CTE program outcomes (Dougherty, 2016). Due to persistent underrepresentation of girls in STEM courses and disparities in CTE access for rural students, future federal accountability subgroups should include gender and level of urbanization. Collection of gender data might also move beyond the male/female binary. Since LGBTQIA+ (Lesbian, Gay, Bisexual, Pansexual, Transgender, Genderqueer, Queer, Intersexed, Agender, Asexual, and Ally) students have historically faced discrimination in many aspects of schooling (Savage & Schanding, 2012), sexuality might be added as a federally defined subgroup, and studies could examine whether and how those students may experience discrimination in CTE.

Conclusion

Our systematic literature review highlights the dearth of research addressing CTE and equity in the United States, particularly with respect to outcomes for BIPOC students and students navigating poverty. As the field of CTE evolves, the wall between academic and career preparation may be beginning to crumble. To wit, state accountability systems nationwide are relying on CTE coursework to contribute to students' college and career readiness, even more so now in the era of ESSA. Interested parties should pay particular attention to how states are using increased federal flexibility to encourage equitable practices within CTE at the school and district levels. We predict that academic and CTE pathways will become more integrated such that high school students will increasingly take a combination of academic and CTE coursework that will be best characterized as individualized instruction, rather than strictly academic or CTE, perhaps relieving students of making a choice in middle school of whether they are preparing for college or career. This critical shift is an opportunity to reduce educational inequalities that contribute to racial and economic injustice in the United States. However, the evidence in our review suggests that reducing this bifurcation of career and college pathways is likely a necessary but not sufficient condition for achieving educational equity.⁹

This article serves as a reminder to researchers, policymakers, and CTE educators to center equity in their work, especially considering the shifting policy landscape and growing proportion of high school students participating in CTE (Levesque et al., 2008). It is important to remember that additional CTE programs alone will not necessarily increase opportunities for historically marginalized populations (McCowan, 2016), nor will it necessarily guarantee program quality (Rosen & Molina, 2019).

Finally, we hope our equity framework provides a helpful starting point for explicitly defining and robustly measuring equity in CTE. We believe that this pilot

of the framework with indicators specific to the United States illustrates its value and potential for adaptation to other contexts. Our review highlighted the pitfalls of a one-dimensional conception of equity—equating the participation of particular students with greater equity or emphasizing access without attending to quality. While some have charged that “addressing educational disadvantage” with compensatory measures designed to increase equality reduces the efficacy and efficiency of education systems, “the OECD [Organisation for Economic Co-operation and Development] and others” have shown that centering equity in the pursuit of educational improvement is necessary; in short, “there can be no effectiveness without equity” (Demuese et al., 2001, p. 87). A system that does not work for everyone is not a system that works. Practitioners, researchers, and policymakers must remember this as we move forward in a rapidly transforming landscape.

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Notes

¹ Notably, the landmark report *A Nation at Risk* was released around this time, increasing national attention on the poor quality of American education.

² In general, when schools are less segregated, it is more likely that this will be true. Segregation is, of course, incompatible with equity and justice (Meuret, 2001b; Orfield & Lee, 2005; Rothstein, 2015).

³ It is important to note that instruction and assessment in the area of social and emotional learning has been fraught with issues of cultural hegemony; addressing this is an important area of work moving forward (Jagers et al., 2018).

⁴ Note, however, that we do not examine labor market outcomes in this review. Dougherty and Lombardi’s (2016) review in this journal offered a comprehensive look at labor market outcomes.

⁵ Since some scholars only recently began using the term “equity” in their work, we also used “equality,” “equal education,” and “inequality” at the start of our search.

⁶ It is worth noting that the databases we used automatically removed duplicates, and many of the hits within each search were identical.

⁷ Examples of excluded studies include Wang and Guo (2019) and Akor et al. (2015) because they were wholly focused on international contexts; Carmo (2015) and Popov et al. (2014) because they were not from academic journals; and Bragg and Durham (2012) and Chase (2011) because they were not focused on secondary CTE.

⁸ The Common Career Technical Core is a state-led initiative to establish a set of rigorous, high-quality standards for Career Technical Education. The standards have been informed by state and industry standards and developed by a diverse group of teachers, business and industry experts, administrators and researchers.

⁹ To the extent possible, without addressing access to health care and wealth inequality.

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