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Equity Pedagogy and the 21st Century Classroom: A Scoping Review

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Abstract

The rapid integration of technology is transforming education, emphasizing the critical need to address inequities and implement effective equity pedagogy. While promising, ensuring equitable technology integration presents significant challenges. This scoping review synthesizes literature on equity pedagogy within technology-supported learning contexts, including frameworks such as Computer-Supported Agile Teaching (CSAT). The review explores the motivations, challenges, successes, and opportunities at this intersection, examining how technology can enhance equitable practices by focusing on issues such as access, implementation across modalities, and student support. Findings aim to inform effective and equitable technology integration in contemporary classrooms.

Keywords: educational inequities, equity pedagogy, technology integration, technology-supported teaching

1 Introduction

The field of education is continually evolving, seeking new ways to promote optimal teaching and learning environments for all students. In recent years, particularly influenced by the global pandemic and various social movements, this evolution has accelerated, fostering systematic efforts toward greater inclusivity and an emphasis on improving equity by addressing diverse student backgrounds and needs. While equal treatment may initially seem like the logical goal, providing identical resources does not resolve underlying disparities; equity, in contrast, offers differentiated support tailored to individual needs, fostering more effective educational outcomes.

The evolving landscape necessitates the continuous exploration of technology-supported practices. This research examines such approaches through the framework of Computer-Supported Agile Teaching (CSAT) [1], which integrates technology into student-centered pedagogies to address critical concerns like equity and student well-being. The COVID-19 pandemic significantly accelerated technology adoption, making digital tools integral, yet highlighting that effective implementation demands intentional, equity-focused strategies adaptable to diverse needs and modalities—a challenge apparent during the sudden shift to remote learning.

This scoping review investigates how equity pedagogy principles align with and can be implemented within technology-supported teaching frameworks such as CSAT, given their shared commitment to student-centered learning. Equity pedagogy provides a

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framework for creating environments that respond to students' diverse experiences, operating across institutional and classroom levels to ensure all students feel supported for success. The review aims to synthesize existing literature regarding motivations, challenges, successes, failures, and opportunities at this intersection.

In this scoping review, we first examine broad societal inequities, such as those related to race, gender, and socioeconomic status, and their impact on education. We then discuss specific educational inequities, including disparities between online and in-person learning environments, mental health challenges, and disruptions to traditional classroom structures. Finally, we review existing strategies for mitigating these inequities, including equity pedagogy and open educational resources, and analyze both the successes and shortcomings identified in the current literature.

2 Methodology

A comprehensive literature search was conducted between August and December 2024, primarily using keyword searches across several databases, including OneSearch, Scopus, and Google Scholar (accessed via institutional library services). Initial searches employed primary keywords such as "equity pedagogy," combined with terms like "computer science," "STEM," and "technology", using Boolean operators (e.g., "equity pedagogy AND technology"). An iterative search approach was adopted, incorporating additional relevant terms such as "ubiquitous learning," "educational disruptions," and "open educational resources," identified through preliminary scanning of sources to broaden the scope and deepen topic coverage. The search also included literature related to COVID-19 and education, to capture the pandemic's impact on technology use and equity.

First, titles and abstracts were screened for relevance to the review's focus on equity pedagogy within technology-supported educational contexts, with the full texts being further reviewed afterwards for relevance. Studies were included if they directly addressed issues of educational equity and technology integration.

To ensure relevance to the evolving educational landscape, the search was primarily limited to sources published from 2016 onward. This timeframe was chosen to reflect contemporary practices and technologies, encompassing developments before, during, and after the COVID-19 pandemic. However, select foundational works published before 2016, such as the earliest publication on equity by Bangs from 1995 [2], were included due to their significant contributions to the theoretical framing and core definitions of equity pedagogy.

3 Findings

Following the search and selection process, a total of 59 sources were included in this scoping review. The characteristics of these sources are summarized below.

3.1 Characteristics of Included Literature

3.1.1 Geographic Distribution

Sources were primarily concentrated in the United States (n=34). The next largest regional representation was from Asia (n=26), with specific mentions of East Asia (n=10) and South Asia (n=7). Europe contributed 7 sources, while Australia and Africa each contributed 2 sources. No sources from South America meeting the inclusion criteria were identified. All sources were published in English.

3.1.2 Source Type and Methodology

Among the included sources, 23 were empirical studies, comprising 14 qualitative studies, 6 quantitative studies, and 3 mixed-methods studies. Nine sources were existing scoping or literature reviews. Additionally, 10 sources focused on designing or discussing educational frameworks, not based on empirical data collection within the paper itself.

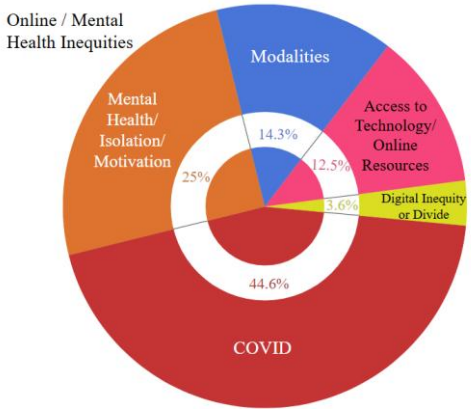

Figure 1: Online/Mental Health Inequities

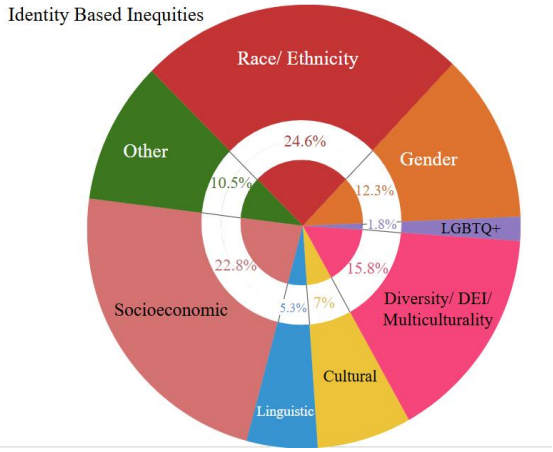

Figure 2: Identity-Based Inequities

3.1.3 Educational Level and Subject Focus

The included literature covered various educational levels, with 9 sources focusing on preservice teacher education, 11 on K-12 education, and 12 on college/higher education. In terms of subject area, 6 sources specifically discussed computer science, and 17 addressed class modalities or online learning environments.

3.1.4 Thematic Areas

Analysis of the included sources revealed several prominent thematic areas. The majority of papers (n=38, noting overlap as papers can cover multiple topics) focused on identity-based inequities, specifically addressing race/ethnicity (n=14), gender (n=7), and socioeconomic status (n=13), with a further 18 discussing broader educational inequities. The impact of COVID-19 was a common topic, discussed in 25 papers, with related themes including mental health effects (n=14) and access to technology (n=7).

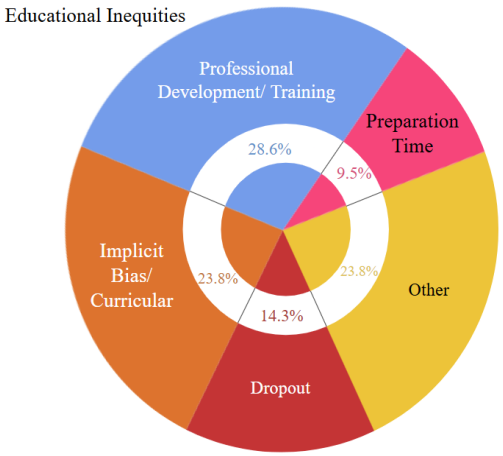

Figure 3: Educational Inequities

Table 1: Focus/Field Count of Sources

Focus/Field		Count
Education Area		**23**
	K-12	11
	College/Higher Ed	12
	Preservice Teacher	9
	Professional Development	4
Subjects		**13**
	Art	1
	STEM	3
	Computer Science	6
	Science	4
	Language	2
Online Learning/ MOOCs		**17**

4 Societal Inequalities

The literature reviewed highlights that societal inequalities are a critical context for understanding equity challenges in education, impacting students and teachers across various

demographics. This section synthesizes findings from the included studies regarding key societal inequalities and their manifestations within educational settings.

For instance, societal inequalities intersect to shape individual experiences, notably in fields like Computer Science and STEM education, which are dominated by white men, who benefit the most from societal power structures that oppress other people [3], and where minoritized student participation lags behind other fields [4]. Understanding how intersecting identities and statuses shape individuals' self-perception and how they are perceived by others is imperative, particularly within education and specifically in Computer Science and STEM environments.

4.1 Race and Ethnicity

Race and ethnicity emerged as prominent sources of inequality discussed in the literature, amplified by recent social movements, such as the Black Lives Matter movement [5][6], and further illuminated by the COVID-19 pandemic's impact on pre-existing educational disparities. The literature suggests that increased attention to inequalities and racial justice in the classroom enables instructors to develop more effective responses informed by equity pedagogy.

Building on the observation that Computer Science and STEM education remain predominantly male and white [3], the literature highlights challenges for minoritized students to break into the field and feel supported and prepared for a career in the technology industry. Beyond issues of encouragement and support, students are not always provided with the necessary opportunities for success during their education. "Just one-quarter of high schools with the highest percentages of Blacks and Latinos offered Algebra II. One-third did not offer chemistry" [7], illustrating a clear gap in support systems for students of color, particularly within STEM. Without adequate preparation, marginalized students face fewer opportunities than their peers post-graduation, perpetuating a cycle of marginalization. Addressing this is crucial for advancing equity, as similar issues are likely prevalent in other educational and professional fields.

4.2 Gender and Identity

Women have also been historically underrepresented in STEM fields, a disparity that persists in the largely male-dominated profession. The literature indicates that the challenge extends beyond opportunity; when presented with opportunities, women, particularly women of color, may experience feelings of exclusion due to perceptions of gender norms in academic and professional settings, leading to decreased participation or persistence [8].

It can also be harder for women to enter the field because men may express disbelief that there is a gender disparity and question the necessity of programs designed to support the success of women or gender non-conforming individuals in STEM fields [9]. This highlights a key principle of equity pedagogy: the crucial need for everyone, particularly those who benefit from societal power structures like men in STEM, to learn about and critically engage with these inequities.

The literature also emphasizes the importance of fostering a sense of belonging and efficacy among women and the LGBTQ+ community to encourage persistence and engagement in STEM. Strategies discussed include providing enhanced academic and financial resources, alongside extracurricular activities designed to build skills and

confidence [8]. This aligns with equity pedagogy's guiding principles of increasing understanding of societal inequalities and developing methods to counteract oppressive structures.

Conversely, the literature also indicates complex gender dynamics where biases may not always disadvantage women. For instance, studies suggest natural disasters can disproportionately affect boys' school attendance and learning [10], and some research points to potential biases where female teachers might favor girls [11]. This highlights the nuanced ways gender can intersect with other factors and underscores how equity pedagogy can address various forms of bias within the classroom to support all students, regardless of gender.

4.3 Culture and Religion

Beyond other marginalized groups, cultural and religious differences also contribute to inequities in STEM and Computer Science. Many students, especially international students, navigate educational environments where their cultural and religious experiences may differ significantly from dominant practices [12]. Unfamiliarity with the educational culture can lead to lower motivation, decreased confidence, and hesitancy to utilize resources, making the educational experience challenging.

Navigating a new educational culture poses significant challenges, particularly for refugee and immigrant parents, which directly impacts student success [13]. Effective cross-cultural communication and understanding are crucial, as feelings of discomfort and isolation can stem from both student and familial situations, necessitating consideration of parents' cultural perspectives. These cultural difficulties are relevant for both in-person and online learning, where issues like access to materials can be compounded by cultural or language barriers [14], highlighting where equity pedagogy must adapt.

4.4 Socioeconomics

Socioeconomic inequalities manifest as disparities in access to resources (e.g., internet, devices) and schooling quality. Students from higher socioeconomic backgrounds typically attend better-funded districts with greater resources and opportunities. Literature highlights the intersection of race/ethnicity and socioeconomic status in resource access [13]. Gichiru [13] observes that well-funded schools with ample resources often have a majority of white students, while underfunded communities are predominantly low-income African American families. These disparities underscore the necessity of equity to ensure all students receive resources for success.

Beyond resources, socioeconomic status influences interactions with institutions. Gichiru [13] notes that "middle-class young adults had more knowledge than their working-class poor counterparts on the cultural norms of institutions and how to successfully navigate the culture of schools." This implies higher socioeconomic students may possess greater familiarity with educational cultural norms, understanding success requirements. Conversely, lower socioeconomic students may have fewer opportunities to learn these crucial skills, creating a 'cultural capital' gap that equity pedagogy aims to bridge.

4.5 Access to Technology

Access to technology is a critical dimension of inequity, particularly in Computer Science, where it's fundamental. The COVID-19 pandemic significantly increased reliance on technology, simultaneously exposing and exacerbating existing barriers to course materials, remote classes, support systems, and the capacity of under-resourced schools to provide equitable learning. Many technological barriers include a lack of compatible devices and internet connection, sharing with family members, and inexperience with technology and apps [15]. Additionally, factors like sound quality and connection strength can hinder online learning even with device access [16]. These factors complicate teaching and learning, especially remotely. Ultimately, societal inequities are intersectional, affecting individuals differently across various dimensions.

5 Educational Inequalities

Educational inequalities are disparities that materialize within classrooms and educational systems, encompassing how disruptions unequally affect learning, their types, and response differences. The literature also examines how educational and administrative responses (e.g., online learning during COVID-19) impact student and teacher mental health, well-being, and performance, ultimately affecting students' educational experiences and development.

5.1 Disruptions in Education

Disruptions to education are inevitable globally, as cautioned by Cannon et al. [17]. Understanding effective response strategies is crucial for maximizing learning opportunities, necessitating examination of system responses and available resources. This requires recognizing that every student deserves a high-quality education and that access to tools varies across institutions [18]. Technology-supported education showed potential during COVID-19 to continue despite major shifts [1], but equitable handling is vital. Adequately handling disruptions necessitates professional learning to adapt curriculum and pedagogy, exploring the skills and training needed for teachers, students, staff, and families [19].

The COVID-19 pandemic lockdown provides the most significant recent example, forcing an abrupt shift to remote learning that fundamentally changed environments, teaching, and learning, presenting numerous challenges [20][21]. This involved rethinking pedagogical goals for virtual assignments [22]. Challenges included a lack of preparation time and isolation, the latter requiring new engagement methods given higher dropout rates in distance learning [23]. Material preparation and addressing isolation became defining factors. Even perfectly trained teachers can be inadequate without sufficient administrative support [24], highlighting disparities like the urban/rural divide in resource/training access [25]. Equitable access to training and support must be considered.

5.2 Effects Across Class Modalities

Shifting classroom modalities influence pedagogical structures and the learning environment. The literature investigates how pedagogy and environment affect inequities, how disruptions impact people across modalities, and how inequity is shaped by different modalities.

A challenge in online learning is difficulty identifying/helping struggling students, raising dropout potential [26]. Methodologies stress continuous assessment [26], but instructors lacking interaction must rely on grades, which may not fully represent knowledge, struggles,

belonging, or intervention needs. This highlights an effect of typical remote learning - increased dissatisfaction, poorer outcomes, higher dropout - linked to a lack of relationship, feedback, participation, and interaction recreation. Similar in-person issues are mitigated with greater attention [27].

The COVID-19 online shift underscored mental health's importance. Assessing/supporting student mental health is harder without in-person interaction, raising questions on remote learning's impact and modality suitability for well-being. Pandemic challenges decreased student positive emotions [28], understandable given isolation in online environments hindering peer connections, discussing issues, accessing support, and minimizing distractions [29]. Isolation concerns affect learners [23]; stress/anxiety leads to exploring tools like Chat-GPT [30] and procrastination harming online effectiveness [31].

Rahiem [15] identifies factors contributing to online success: positive attitude linked to challenge, enthusiasm, self-determination, goal satisfaction, and religious devotion, fostering perseverance. Rahiem [15] also notes the supportive role of social circles/families and home atmosphere for motivation. Self-determination was another motivator. Recognizing that teaching strategy should use multiple approaches helps all students, as in-person [32]. However, these positive experiences were not the majority; many struggled, highlighting equity. Without motivation, online participation/completion is harder. Considering effective motivators and disparities in access to them (e.g., a supportive home) is important. Despite distance, remote learning should strive to facilitate student-teacher connections.

5.3 Mental Health During Class

Inequity effects often manifest as mental health difficulties for students/teachers, arising from societal inequities or classroom issues like pedagogy or administrative support. Student mental health/academic success is influenced by teacher perceptions like deficit thinking linked to low expectations [7] or differentiated instruction framing students from a deficit perspective [33]. Educators' subjective assumptions about abilities can translate into inequitable teaching.

Lack of adequate teacher support limits student potential, potentially perpetuating academic inequity. Addressing negative perceptions is crucial for mitigating inequitable teaching. Beyond crises, supporting mental health is ongoing [34]. Classroom materials/practices are important, and maintaining school friendships also helps mental health, motivation, and reduces dropout [35].

Teachers also experience support issues, like feeling overwhelmed without sufficient administrative help or resources. Overwhelmed teachers are less able to perform equitable practices or facilitate connections [10]. This was pronounced during COVID-19, where rapid shift stress contributed to educator burnout [36]. Adequate teacher support creates a supportive learning environment, helping students succeed.

6 Implementing Equity

Equity Pedagogy is a framework developed to address educational inequities. Its implementation uses curriculum strategies fostering discussion and awareness of inequities, within content and larger systemic issues. The pedagogy is acutely aware of inequities, responsive to needs, and supports student success based on unique abilities, contrasting with

standardized tools. Merely acknowledging problems is insufficient; underlying causes must be studied [37]. Approaches include utilizing open educational resources, adapting materials, using discussion/group work, and integrating technology for enhanced research, varied mediums, and online tools.

6.1 Equity Pedagogy

Banks [2] introduced equity pedagogy as teaching strategies/environments helping diverse students attain knowledge/skills for a just, democratic society. Their proposed curriculum must enable critical questioning of societal systems, fostering democratic participation. Growing from this definition, equity pedagogy is a broader framework increasing understanding of how inequities affect students and the importance of addressing them in class. It helps students learn about peers' inequities, fostering helpful responses [38].

Teacher preparation is key; Chin [39] highlights that understanding the rationale for equity drives action. This includes familiarity with terminology [40] and nurturing teacher creativity/perspectives [41].

Methodologies significantly impact outcomes. Banks further warned that pedagogies must critique, not just fit within, societal structures to build a just society [2]. Without this critique against oppressive structures, pedagogy fails to be truly equitable, normalizing existing systems. Critical acknowledgment, study, and advocacy are core pillars.

This critical stance applies across all subjects, including STEM/CS. It involves a strong student-centered focus, emphasizing relationships and reflection [42], with discussion/reflection central to deep understanding [43][44]. Culturally relevant curricula and connecting materials to communities foster empowerment [45]. As Safir and Dugan note, "what is measurable is not the same as what is valuable" [46]. Connecting classroom learning to community engagement deepens understanding of content and real-world issues.

6.2 Open Resources

Open Educational Resources (OER) and Practices (OEP) align with equity pedagogy, offering new perspectives. OER (freely available materials permitting reuse/adaptation [23], citing UNESCO) improve access for financially disadvantaged users [47] and allow diverse perspectives. Despite potential, a lack of professional development (PD)/training contributes to hesitancy [48]. A key implementation challenge is guidance on effective OER integration, as they differ from traditional materials. Continuous, responsive PD integrating technology and equity pedagogy is needed [49].

OEP is a broader term for teaching/discussion methods alongside OER. Huang and others discuss OEP in online COVID-19 learning, suggesting open collaboration/assessment alongside OER for motivation [23]. Social Annotation utilizes OEP [50].

Resources are only useful based on implementation [51]. OER and OEP must go hand in hand. Keeping student perspectives in mind generates feedback on effectiveness and addresses inequities, empowering students to take responsibility and bring their experiences to the forefront.

6.3 Ubiquitous Learning

Ubiquitous Learning, technology-facilitated learning across contexts/times beyond the traditional classroom, is increasingly relevant post-COVID due to technology integration into daily life. It implies learning anytime, anywhere. Aljawarneh describes it as seamless material availability, facilitating digital/physical interaction [52].

Ubiquitous learning models offer personalized experiences (anytime, anywhere, at pace), supporting equity by providing flexible catch-up opportunities [53] and fostering community regardless of location/modality [54].

Supporting diverse learning styles, ubiquitous learning offers flexibility [55]. While aligning with equity pedagogy, benefits are maximized with multicultural approaches [56].

7 Critiques

While equity pedagogy and technology hold potential, the literature reveals significant critiques and gaps. The COVID-19 pandemic highlighted issues like equitable technology access [57], where societal inequalities hampered online learning despite increased STEM research [58]. A notable gap is the limited focus on supporting specific student demographics, such as international and ESL students, whose unique challenges (e.g., cultural adjustments, travel) were often overlooked in pandemic responses. Similarly, cultural and religious diversity in classrooms, through an equity pedagogy and technology lens, remains underexplored, especially in STEM/CS [59].

7.1 Remote Learning and Lockdown

COVID-19 lockdown challenges and opportunities are extensively explored, informing approaches to online and tech-infused learning. Mental health and isolation emerged as critical concerns due to less effective online communication, spurring related research and mitigation efforts. Key challenges included lack of preparation time and isolation, demanding new engagement methods given higher distance learning dropout rates [23]. However, explicit teaching of online/ubiquitous learning skills received less emphasis, exposing digital literacy gaps. Educator training on effective, safe, and intentional digital tool use is crucial, as is incorporating responsible digital citizenship for students to foster equitable preparedness.

7.2 Other Disruptions

A significant literature gap exists regarding responses to disruptions beyond COVID-19 (e.g., natural disasters, social conflict). While pandemic analysis offers insights, these may not apply to other unique challenges. Natural disasters, for instance, demand immediate safety prioritization, considering compromised physical access and broader well-being. Curricular adjustments are also needed, yet research on continuity in these distinct contexts is sparse. Similarly, literature on managing direct impacts of conflict or social unrest on schools is limited. While COVID-19 offers adaptation examples, equitably leveraging evolving tech tools for diverse disruptions remains an under-researched area requiring future attention."

8 Conclusion

Societal awareness of inequality has amplified the discourse surrounding equity pedagogy. While educators have developed strategies for promoting equity, this scoping review reveals significant work remains to ensure all students feel supported, comfortable, and achieve success. The COVID-19 pandemic and subsequent social disruptions further underscored the necessity of fostering understanding and providing equitable resources for student well-being and success.

Beyond the pandemic, technology will increasingly revolutionize education, demanding strategies to maximize its equitable potential. Addressing the effective and fair use of technology, while mitigating misuse, will be a defining challenge. Continued investigation into its successes and pitfalls is crucial to inform policy and practice, ensuring technology acts as an equity tool, not a barrier. Digital access must align with desired learning outcomes [64] and foundational digital literacy [61].

Artificial intelligence (AI) will undeniably influence classrooms, making equity a central factor. AI can facilitate personalized learning [61], and machine learning (ML) can identify inequities and biases in educational data. Ultimately, equity in education should prioritize the overall well-being and success of students, teachers, families, and communities, rather than solely individual academic outcomes [63].

9 Future Work

Drawing from this scoping review's conclusions, especially regarding student support for success, our future research will primarily investigate student experiences and well-being in the 21st-century classroom and how instructors can effectively respond. The literature, particularly during the COVID-19 pandemic, underscored student mental health and well-being as essential for academic success, necessitating direct attention. While our previous Computer-Supported Agile Teaching (CSAT) studies touched on equity and well-being, future research will explicitly target these topics. This review provides a foundational synthesis, followed by two articles detailing existing CSAT work as a basis for these new efforts.

A second gap identified in the literature is the prevalence of qualitative data. To address this, our future work plans to leverage learning management systems (LMS) for quantitative studies on pedagogical strategies. We also aim to improve LMS usability and functionality in line with equity pedagogy, enabling larger-scale data gathering and analysis than qualitative methods alone.

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