The Landscape of Disability-Related K-12 Computing Education Research

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ABSTRACT

Correcting the under-representation of people with disabilities in computing and computing-related careers will require a research base that enables equitable computing education (CE) for all students. For this study, we analyzed research papers in order to better understand the landscape of CE research as it relates to students with disabilities. Of the 771 papers reviewed from 12 major CE venues over the last decade, very few (n = 14) specify student participants' disability status; this <3% rate is under-representative, given that about 15% of students in the US have a disability. Studies that do specify disability status tend to involve students who are in the middle grades, in the United States, and/or are participating in elective activities. Demographic factors (e.g., gender and race) are specified about half of the time and analyzed about half as often as they are specified. A small cadre of researchers (51 from 22 different institutions) are responsible for the studies specifying disability status. Studies – whether they specify disability status or not – most commonly use block-based programming, which may present accessibility issues for some students. Advancing equity for all students will necessitate much more research on the computing experiences of students with disabilities, including reporting factors such as demographic data that make it easier to determine whether and how the research applies in a given context. More research focused on accessible tools and languages for learning computing is also needed to further understand promising practices for teaching students with disabilities.

CCS CONCEPTS

• **Social and professional topics → K-12 education**; **People with disabilities**.

KEYWORDS

computing education research, disability, equity, accessibility

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1 INTRODUCTION AND BACKGROUND

There is a moral imperative to ensure that students with disabilities, who constitute more than one out of ten K-12 students in the United States [4], have equitable access to computing education (CE). But, currently, people with disabilities are underrepresented in computing [3] and emerging technologies – including those used in education, criminal justice, health care, and workplaces – often discriminate against people with disabilities [2].

Remedying these inequities is a multi-faceted process, one part of which is ensuring that the CE research base adequately represents the experiences of students with disabilities. Historically, CE research has not often specified demographic information about study participants [5], making it difficult to determine how and whether findings apply to all student groups; this phenomenon is particularly true for students with disabilities since even when equity issues are addressed, disability is rarely one of the dimensions of diversity taken into consideration. Researchers sometimes do not collect data on student disability because it is difficult to collect and interpret [1]; thus, there is little data on CE students with disabilities [8].

This project seeks to answer the question, *What gaps in computing education research exist that may be contributors to the lack of equity for students with disabilities?*A better understanding of these gaps will provide the CE research community with insight into what future research is needed.

Other barriers to the full participation of disabled students in computing includes false perceptions about their abilities, gaps in teachers' knowledge about how to support students, lack of accessible curricular materials, and a lack of data about student needs [7]. Previous research has found that accessibility problems in K-12 CE exist in five different areas: computer input (e.g., requiring students to use a mouse), computer output (e.g., creating charts), infrastructure (i.e., back-end technologies), curriculum accessibility, and inclusion (specifically, the inclusion of people with disabilities in CE materials) [6].

2 METHODOLOGY

A publicly available dataset of K-12 CE research exists that vets and then curates relevant articles from over a dozen venues that publish CE research. The inclusion criteria require that articles (1) describe or assess a computing activity, (2) focus on K-12 students and/or their instructors, and (3) focus on an activity whose goal is teaching a computing or computational thinking concept. Using the manually curated data for each of the 1200 papers published between 2013 and 2022 inclusive (consisting of over 40 variables, including participant demographics), we analyzed the 771 research

studies on disability-related factors. We considered factors associated with quality research (e.g., specifying a research question), with contextualizing findings (e.g., students' racial background), and with other aspects of studies that might impinge on their ability to reflect the experiences of students with disabilities (e.g., use of potentially inaccessible programming languages and tools).

3 RESULTS

Even in contexts where it was applicable (i.e., there were student study participants), students with disabilities are rarely specified in studies and, even more concerning, there are even fewer studies that study interventions and their impacts specifically on students with disabilities, with only 2.6% of studies (14 articles) in the entire data set of 771 papers specifying student disability status. This percentage has been increasing slightly over the past decade. A total of 51 authors from 22 different institutions contributed to these studies.

There was a roughly even ratio of quantitative (5 studies), qualitative (5 studies), and mixed methods (4 studies) research. Table 1 shows the percent of studies specifying and analyzing various characteristics where applicable to the study.

Factor	Percent	Notes
Study Characteristics		
Was activity required?	42%	4:1 ratio of elective:required
Research question(s)	86%	
What concepts taught?	82%	
Participant Count	75%	Most common: 26 - 50 students (3 papers) and 101 -500 students (3 papers)
Student Characteristics		
Geographic location	69%	67% in the US 33% outside of the US
Socioeconomic status	54%	29% analyzed SES
Gender	54%	36% analyzed gender
Race	43%	20% analyzed race or ethnicity
Ethnicity	23%	20% analyzed race or ethnicity
Age	46%	Most common: 10 - 12 years old
Grade level	76%	Most common: 6th and 7th grades
Prior computing experience	31%	

Table 1: Percent of studies specifying various characteristics (where applicable).

Of those specifying whether an activity was required, four studies involved elective activities and just one a required activity. Because some student populations (e.g., girls) are less likely to know about and/or to participate in elective computing activities [10], the prevalence of elective activities may present a barrier to equitable CE research.

The programming language used in studies may present another barrier. For the articles that specified student disability, the most commonly referenced language was Scratch (in 6 of the 14, or 43%, of the studies). Across all research studies (n = 771) in the data set, Scratch was also the most common language, and four of the most cited papers in this set concern block-based programming. But visually-based languages are not easily accessible for users with cognitive impairments [11] or, especially, limited vision [9].

4 DISCUSSION AND CONCLUSION

The most significant finding of this study is that CE research that considers student disability status is quite rare; more research is clearly needed. Of the research that does exist, some factors (e.g., specification of research question(s) and what topics were taught) are frequently specified. Others, however, such as whether an activity was required or student demographic characteristics, are included much less often. This lack of specificity can make it more difficult to determine whether and how research applies in various contexts. Further, research tends to focus on students in the middle grades, implying a need for more studies with elementary or high school students. Finally, the prevalence of block-based programming languages in CE research may present an obstacle to studying the experience of students with disabilities.

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