



Exploring Equity, Diversity, and Inclusion in Computer Science Undergraduate Curricula

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ABSTRACT

One of the less explored approaches to foster equity, diversity, and inclusion (EDI) in Computer Science (CS) is through changes to the curriculum. Despite sporadic work on the adoption of Culturally Responsive Computing (CRC) and Universal Design for Learning (UDL), the inclusion of equity-minded courses, or modifications on specific elements of the curriculum such as introductory programming courses, there has never been a wide exploration or adoption of a successful equity-minded undergraduate CS curriculum.

In this work, we explore undergraduate CS curricula, with a special focus on upper division, lower division, and service courses (courses offered to non-CS students). For each group, we examine the design and adoption of successful equity-minded approaches, exploring fair access, motivation, engagement, and rigour.

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Computer Science, Curriculum, Equity, Diversity, Inclusion

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EDI-CENTERED CS CURRICULUM

Recommended approaches to achieve equity, diversity, and inclusion (EDI) in undergraduate CS programs [2, 9, 11] suggest that the best way to achieve diversity and inclusion in CS programs is through culture change. At the same time, other research evidence suggests that curriculum structure and changes [9], especially in introductory courses, can play an essential role in attracting and retaining historically marginalized students in CS. EDI considerations in the CS curriculum include introducing equity-minded courses by integration of inclusive-design [10], using equitable grading techniques [6], establishing multiple entry pathways to eliminating barriers [4], designing equitable entry courses [9], and adopting retention-oriented interventions [3].

Recent findings [8] underscore the negative impact of curricular complexity on achieving a more inclusive and equitable environment, highlighting the need for curricular change to broaden participation in computing education. Existing equity-minded approaches include Universal Design for Learning (UDL) and Culturally Responsive Computing (CRC) [5]. UDL is a holistic approach to educational design providing guidelines for course and curriculum design to accommodate the widest range of learners, including students with disabilities [12]. CRC aims at engaging students by adopting content more appealing to their specific cultural background. To increase the participation of students from historically marginalized backgrounds, CRC examines the cultural relevance of the curriculum and promotes equity through culture-inclusive teaching practices. Teaching faculty are increasingly adopting UDL and CRC and are mindful of equity-minded teaching practices [1], including steps to guarantee both relevance and rigour of course content, transparency of expectations for success, support and scaffolding to facilitate learning, and use of the right tools and platforms.

However, the research on EDI considerations in CS curricula has a few shortcomings. First, most UDL and CRC efforts in CS curricula currently focus on K12 education, with limited research on undergraduate adoption. Second, most work on undergraduate CS curricula focuses on Human-Computer Interaction (HCI) courses [7] or lower-division courses, specifically on content, student self-efficacy, and sense of belonging in entry-level programming courses [9], but not on promoting equity. Third, we suspect many valuable efforts and experiences in this domain may not have been published because in their early stages. Consequently, existing literature lacks guidelines for a holistic, EDI-centered curriculum design, considering the race, gender, ethnicity, age, access needs, and socioeconomic backgrounds of student populations. There is a pressing need to explore the design of an equity-minded CS curriculum and to determine an effective approach to achieve it.

In this study, we investigate existing efforts on equity-minded curriculum design in undergraduate computer science programs and examine their effectiveness in providing access, motivation to enroll, cultural relevance, engagement to retain, and rigour. We ask:

RQ1: What are examples of equity-minded curriculum design efforts in undergraduate computer science programs?

RQ2: What are the outcomes of these equity-minded curriculum design efforts?

RQ3: How can undergraduate computer science programs adopt equity-minded curricula?

To answer these questions, we plan to explore undergraduate computer science programs worldwide (emphasizing North America) that have shown relative success in attracting and retaining women and historically marginalized groups. With a special focus on upper division, lower division, and service courses (courses offered to non-CS students), we will examine successful equity-minded approaches to curriculum development. Throughout the analysis of curriculum efforts in the selected institutions and the diversity of their student populations, we will assess the effectiveness of these efforts. Data sources include publicly available information on degree requirements, offered courses, course information, syllabi in relevant programs, experience reports, and public reports

of student populations in these institutions. Qualitative and quantitative analysis of the data collected and identifying main patterns and indicators answer **RQ1** and **RQ2**. A comprehensive literature review, comprising experience reports and scholarly publications, will complement this analysis and facilitate the identification of the factors influencing the efficacy of curriculum approaches in fostering EDI in CS programs.

To answer **RQ3**, we aim to integrate the knowledge from the literature and analysis of institutional data through surveys and interviews to understand better the students' perspectives and their observations on curriculum effectiveness. By surveying students, we hope to gather examples of efforts that helped to raise their interest, engage them in their program, or motivate them to pursue CS studies. Students' responses will be paired with the information provided by the literature to identify and propose recommendations for best practices in equity-minded curriculum design.

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