# Equity Versus Equality: A Proposed Study of Issues of Justice in Computer Science Education

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## Abstract
Computer Science is lacking in diversity. To combat the derth of equal representation, there are a myriad of interventions aimed at the classroom level to increase participation of underrepresented individuals. We propose a study to explore issues of equity and equality within interventions in the computer science education classroom. These issues are critical within social justice and thus directly relate to ideas of justice and fairness within the classroom. The results of this study could help provide guidelines for designing a just curriculum and interventions for computer science.

## Author Keywords
equality, equity, education, justice, curriculum

## ACM Classification Keywords
K.3.2 [Computer and Information Science Education]: Curriculum.

## Introduction
A myriad of efforts in computer science seek to broaden participation and increase diversity within the field. They include female-only or female-centered groups, similar groups for race and sexual orientation, as well many other factors that can minoritize a group [1, 8]. These efforts have developed from research that indicates a distinct lack

of these minoritized groups in the field, as well as growing research on the obstacles that such groups face in computer science [8, 6]. It is clear that the playing field in computer science is not level for all students and that something should be done if we want a just and fair learning environment for computer science.

While there are initiatives to promote and create a fair environment in computer science, there is a divide in the research between those that are equitable as opposed to those that are equal. Equitable interventions are aimed at minoritized groups to give them the same opportunities to learn and grow that their peers are given. An example of an equitable intervention would be the Project Rise Up 4 CS and Sisters Rise UP 4 CS movements at Georgia Tech [3, 4]. Equal interventions are broader in focus by giving the same treatment everyone which could have an effect of encouraging minoritized groups to gain ground in the field. In short, equal interventions take an "rising tides lift all boats" mentality. One such equal intervention is Hour of Code, which seeks to increase the number of students interested in or simply trying computer science by having a global week dedicated to locations hosting "Hour of Code" events. A visual representation of the differences between equity and equality can be found in Figure 1.

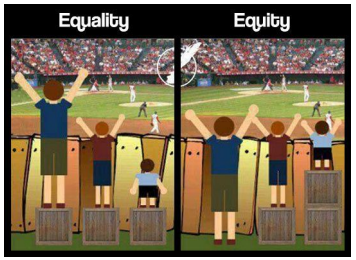


**Figure 1:** Equality represents all individuals receiving equal treatment, resources, and opportunities, whereas equity represents individuals receiving some treatment that results in equality for all individuals.

This research seeks to understand the differentiation between equal and equitable environments in the existing literature. This study does not seek to claim whether one or the other is better. Rather, this is aimed at taking the first steps to understanding existing difference between issues of equity and equality in the computer science classroom.

## Research Question

**Do equal or equitable interventions benefit students more?**

This is one of the first questions in a study that will investigate how to mitigate issues of privilege in the computer science classroom. The results from this study will be joined with others centered around faculty's and students' perceptions of privilege in the classroom and what impact awareness of privilege and issues thereof has in the computing classroom and beyond. Together, these studies will create guidelines for future curriculum and interventions in computer science.

## Connection to Social Justice Theories

The issues of equality and equity can be grounded in social justice theory, with a theory to support each option. After discussion of these theories, a situated example of equity in a computer science classroom is explored.

Regarding equality, John Rawls and his theories around the veil of ignorance offer theoretical support for this issue. Rawls, in his essay, "On Justice as Fairness," introduces the idea of a veil of ignorance. This veil allows people to make decisions on what is fair without knowing any background information about the people the decisions would affect [9]. This results in equal treatment to all people, regardless of what their standing is in society or their background. Although the treatment of the veil of ignorance is a prime example of equality, it is very difficult to put into action with the classroom. A teacher or intervention designer can not simply strip the students of all their identity, or make decisions without knowing some knowledge of the makeup of their students. However, it is always difficult to move from theory and thought experiments to practice without some loss of generality.

Regardless of the exact nuances of applicability, Rawls' theories of justice support the claim to equal interventions.

In terms of equity, Paulo Freire was a nominal voice in arguing for equitable environments in the classroom. His book, "Pedagogy of the Oppressed," created the ideas of Critical Pedagogy, or a way of teaching and learning such that (sometimes subtle) oppressive habits and tendencies are called into question in order to promote further learning and in a safe environment for all students [5]. The ideas of critical pedagogy bring to light the blurred boundary of equality and equity; through an equitable environment, teachers can begin to treat students as equal. In order for an equal environment to be reached, the key is to create the equitable environment first. In addition to the ideas of a critical pedagogy, Freire also introduces concepts of a culture of silence and a hidden curriculum. A culture of silence is one where students are taught through materials in the class to remain silent, submissive, and oppressed. An example of this would be a student of color in a history class learning about America with example of white individuals leading the country throughout the years. The student is silenced from believing other events occurred or that they themselves can lead this country. A hidden curriculum is the idea that a lesson may have unintended learning outcomes. This could be as subtle as a student having only white, male teachers for mathematics class and learning, or believing, that only white males can teach mathematics. A hidden curriculum can combine with a culture of silence to create unintended learning consequences and an oppressive classroom environment. Both of these Freirian ideas, in addition to the ideas of critical pedagogy, highlight how an un-level playing field may exist in the classroom and how equitable interactions could begin to correct the situation.

Situating these Freirian ideas in a computer science classroom is Jane Margolis, who has explored issues of gender and racial equity in computer science. Her book with Allan Fischer, *Unlocking the Clubhouse*, discusses a study of gender in computer science, specifically highlighting how females do not feel welcome in computer science or do not want to continue into the field [8]. In *Stuck in the Shallow End*, Margolis conducts similar studies but in regards to access and race in three high schools in the Los Angeles area [7]. Through these works, Margolis has explored the propagation of inequality in education, specifically in the computer science classroom. Her studies begin to ground theories that Freire wrote about, as she explores issues of hidden curriculum and cultures of silence. She promotes ideas of a critical pedagogy by beginning to question why some students are not afforded the same opportunities or experiences that others have.

Based on these theories, the previously stated research question can be re-worded to be more situated in the theories as follows:

**Do Rawls-ian or Freire-ian interventions benefit students more?**

## Methods

This study would be comprised of two main stages: data gathering and data analysis. This section provides an outline of the methods used within those stages.

In gathering data for this study, researchers will draw from scholarly databases (such as Google Scholar or Microsoft Academic Search), searching for published papers on interventions in Computer Science. The researchers will search based on a pre-decided set of keywords. These keywords will be decided from a proof-of-concept study,

but could include things like "broadening participation," "gender," "underserved," etc. Each paper will need to mention the type of intervention (equal or equitable) and the target audience of that intervention (middle school students, undergraduates, etc.).

All papers matching these requirements will be stored for data analysis. Regression analysis will be used on the variables available in the papers in order to better understand the relationship between them. Variables for consideration include, but are not limited to, type of intervention, target population, number of papers per category, success rate, retention, and citations.

## Summary

This proposed study and the results it would provide is the first of its kind in the realm of computer science education. Papers detailing interventions are published every year, at many different conferences. However, there has not been an examination of these papers for how these interventions treat students differently in regards to issues of equity and equality. This type of study is critical to think meta-cognitively about *why* interventions work or fail, instead of blindly designing for "what is best." The results could show whether one intervention type is more effective than the other, which will guide further interventions. Alternatively this study could show that a middle ground should be reached when intervening in a computing classroom, such as having the students design the intervention [2]. Figuring out which intervention might be the most effective could, in turn, could promote a level playing field in the computer science classroom.

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