

# Studying Our Inclusive Practices: Course Experiences of Students with Disabilities

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## ABSTRACT

Students with disabilities can experience difficulty in receiving an education; inclusive education is an educational practice designed to ameliorate these problems. This paper presents the design for a study of the current inclusive practices in computer science courses. Challenges in studying the experiences of disabled students are discussed, and a methodology using semi-structured interviews and grounded theory is developed to address these difficulties. A pilot study involving students taking their first computing courses is also described.

## Categories and Subject Descriptors

K.3.0 [COMPUTERS AND EDUCATION]: General

## General Terms

Human Factors

## Keywords

semi-structured interview, grounded theory, inclusion, disability, accessibility, accommodation

## 1. INTRODUCTION

Receiving an education is a fundamental right. Historically, though, individuals with disabilities, compared to those without disabilities, have faced greater difficulties in accessing learning opportunities at both the K-12 and university levels [2, 4]. In recent decades, civil rights efforts, education policy changes, and disability legislation have addressed this disparity by no longer segregating disabled students into separate schools and programs and instead including students of all abilities in all learning opportunities. This practice is known as inclusive education.<sup>1</sup> Despite crit-

<sup>1</sup>A complete review of the history and development of inclusive education is beyond the scope of this paper. Instead, the reader is referred to Clough and Corbett's seminal review of inclusion [2]. Important disability legislation to consider as well is the IDEA and ADA in the United States [4] and the SENDA and DDA in Great Britain [11].

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icism and skepticism, inclusion has been implemented successfully multiple times, due in part to its emphasis on good pedagogical practices: collaborative learning, peer teaching, multimodal instructions, and reflective teaching [2].

Although inclusive education was mostly developed for and implemented in K-12 education [9, 11], postsecondary education is beginning to embrace this practice. As more students with disabilities experience positive school experiences due to inclusive practices in their primary and secondary educations, they are more likely to decide to pursue higher education [12]. How to best service these students is a concern for universities, thus many schools have explored and implemented inclusive education to address this issue. These efforts have focused on various aspects of the university, including changes to pedagogy [1, 12], campus culture [14], and policy [17]. These efforts have mostly focused on higher education in general, but the differences among academic disciplines could uniquely impact a field's attempt at becoming inclusive.

Within computer science education, there have been a few studies about the experiences of students with disabilities. Cohen investigated ways to deliver graphical information for blind students taking a data structures course [3], and Egan developed pedagogical approaches for supporting students with Asperger's syndrome [6]. While beneficial, these studies have focused on responding to specific disabilities. Inclusion is about addressing all disabilities through a general approach [1, 9].

This paper is about studying inclusive practices in computing education. While the end goal is to determine ways to improve our inclusive practices, it is necessary to determine the current state of our practices. As will be shown in this paper, studying the experiences of disabled students in computer science courses poses several challenges for the researcher. The primary contributions of this paper are a discussion of these difficulties and the development of an interview-based case study using grounded theory [7, 15]. The challenges and methodology are discussed in detail in order to provide guidance for others interested in studying inclusive practices in computer science education. Additionally, a small ( $n = 2$ ) pilot implementation involving students early in their academic computing careers is presented. Preliminary findings and refinements to the methodology are discussed for future interviews.

## 2. RESEARCH CHALLENGES

Conducting research involving university students with disabilities can be difficult for a multitude of reasons. These

challenges can occur due to the legal and social aspects of disability as well as the population size.

## 2.1 Defining Disability

Disability is defined both medically and legally [4, 9]. However, an individual who is legally or medically disabled might not necessarily identify as having a disability. First, the term 'disability,' especially in the case of learning disabilities, can carry a negative connotation. An individual might not disclose about a disability out of fear of stigmatization. This stigmatization can come from internal perceptions [4] as well as from the negative reactions of others [5]. Secondly, an individual might not view a condition as being a disability. This can occur due to the person holding a more exclusive definition of disability (e.g., with depression and anxiety [16]) or cultural beliefs (e.g., deafness [13]).

Whether or not a person identifies as having a disability directly impacts the subject population for this study. As inclusive education is concerned with all disabilities, the study's participants should represent this diversity. Any call for participation will have to be carefully worded as to not accidentally exclude any disability groups.

## 2.2 Visibility and Accommodations

At universities in the United States<sup>2</sup>, students with disabilities must advocate for themselves by registering with disability services and requesting accommodations [4]. However, self-advocacy is problematic for some students. Cory [4] identified that students with invisible disabilities (e.g., learning disabilities, depression, anxiety, etc.) are likely to attempt to pass as non-disabled and delay disclosing about their disabilities until a crisis necessitates it. As an instructor is only informed about students who register with disability services, a class may contain more disabled students than indicated. Thus, participant recruitment should not be limited to only courses containing students registered as having a disability.

It is also worth noting that this lack of disclosure highlights a benefit of inclusive education. Inclusion is about managing resources and pedagogy to readily adapt to the diverse needs and abilities of the students. Instead of reacting to the needs students on an individual basis, most accommodations are proactively pre-built into the learning environment [1]. Although specialized assistance and accommodations might still be necessary (e.g., a signer for a deaf student), an inclusive classroom is designed to minimize the need for disabled students to request accommodations.

## 2.3 Population Size and Diversity

The available population size directly affects the choice of methodology. Due to the aforementioned disclosure issues, any population statistics will include inaccuracies. Nevertheless, the percentage of college freshmen with disabilities is estimated to be 9.3% [12], and slightly more than half of all postsecondary students with disabilities have learning disabilities [8]. While these numbers are promising, our focus is on students with disabilities taking computer science courses. Unfortunately, like women and some minorities, students with disabilities are underrepresented in computer science. An NSF report [10] indicates that although 11.3%

<sup>2</sup>Due to the location of the author's institution, the remainder of this paper will be U.S.-centric. Different research challenges may exist in other countries.

of undergraduates studied had a disability, only 7.2% majored in computer/information sciences. Furthermore, this 7.2% will likely represent a diversity of disabilities [8].

The takeaway here is that the population is both small and diverse. Any study we design is going to involve a small number of disabled students or will require multiple courses or terms to gather a large population sample. The choice of methodology should thus work well with small numbers, longitudinal efforts, and/or differing educational settings.

## 3. STUDY DESIGN

With these challenges identified, the task is to develop a study design that provides data on current inclusive practices in computing education. This section describes the study design in detail as to aid others researching this topic.

### 3.1 Data Collection

Recognizing that this study is about collecting descriptive data about inclusive practices, a qualitative approach was chosen: the illustrative case study. This form of case study involves studying a few instances of a phenomenon in depth with the intent of illustrating what is occurring [7]. Specifically, the study will focus on the course experiences of a few students with disabilities. Given that the participant population is projected to be small, this approach will generate rich, detailed data despite the lack of subjects. Like with most phenomenological data, the data will be used to develop theories of current inclusive practices that can be explored or manipulated through further studies [15].

For gathering this data, a one-on-one, semi-structured interview approach is used [15]. In this form of an interview, the set of questions acts as a guide for the researcher and is mostly used only to promote dialogue at the beginning and low points in the interview. Primarily, the subject drives the interview by talking about whatever he or she views as important. The researcher can always interject for clarification or to probe an idea further, but it is the participant's own perspective that is of interest.

It is worth noting that case studies and semi-structured interviews have been used successfully in previous disability research. Edwards [5] used this method to study the educational experiences of students with dyslexia, and Cory [4] conducted a similar study on college students with invisible disabilities. The methodology has also been used to study the intersection of disability and queer identities [16]. The approaches and questions used in these studies directly influenced the design of this study.

### 3.2 Interview Questions

The questions developed for this study are listed in Appendix A. One of the first design decisions for this study was to conduct multiple interviews with each participant. Although participant fatigue was a concern, a potential benefit actually motivated this decision. As the impact of a disability can change over time due to changing workloads and time demands [4], staggering the interviews across the academic term will potentially capture this phenomenon. Thus, the questions were designed with the idea of conducting 2–4 interviews during the academic term.

The first interview is semantically distinct from later interviews in that it focuses more on the participant's background than on current course experiences. While some questions inquire about the student's background and prior

programming experience, many of the questions focus on the student's disability and his or her usage (or not) of accommodations. The following two questions strongly reflect the goals of this study:

- Assuming that your instructor(s) knew about your disability, how would you want them to respond to you as a student?
- How do you think your disability will affect you in this course?

The later interviews focus on the student's current experiences with their disability in the course. Many of the questions do not specifically mention disability, however. Instead, the questions ask the student to talk about how the course is managed, interactions with teaching staff, coursework, software, etc. If their disability significantly impacts any of these items, the student is likely to mention it without prompting. If not, the interviewer can always probe for details. Part of the theory of inclusive education is to focus on teaching and not disabilities [9]. Structuring the interview this way reflects this theoretical perspective.

Overall the questions are designed to be open-ended and descriptive. However, it is important to remember that they are used only as a guide by the researcher. During the interview, the researcher must attend to the discussion and probe for clarification and details from the interviewee [15].

### 3.3 Analysis

Given the usage of qualitative methods, a grounded theory approach is used for analyzing the data. In grounded theory, the goal is to inductively develop hypotheses, concepts, and theories from the data and not to test the validity of a priori hypotheses [15]. For example, the end goal of this study is to produce a descriptive model of student perceptions of inclusive practices in computer science education. Results will potentially include identifying best pedagogical practices, values held by students with disabilities, or models of support systems.

For identifying these themes, a standard coding approach is used. An interview transcript is read, and utterances are labeled with category descriptors. These categories are dynamic and can be created, merged, or removed. Multiple passes are typically completed. Various tests exist for determining the reliability of the coding. The reader is referred to Taylor and Bogdan's seminal book on qualitative analysis for details [15].

Once these themes are identified, they can be explored in greater detail. Importantly, some of this exploration will take place within this study. In phenomenological approaches such as the one here, data collection and analysis are conducted in parallel [4, 15]. Thus, when a theme is identified, it can be explored further in later interviews to determine its pervasiveness.

### 3.4 Summary

The methodology chosen for studying current inclusive practices in computing education is to perform an illustrative case study by interviewing students with disabilities. Each student is interviewed multiple times during an academic term, and this interview is coded and analyzed using a grounded theory perspective.

Most importantly, these choices help address some of the challenges discussed in Section 2. Case studies require only a few participants [7] to produce a description of a phe-

nomenon, thus addressing the challenge of having a small population size. Moreover, the interviews can be conducted in different courses and academic terms. This ability allows for a larger, more diverse description.

The methodology does not, unfortunately, address the challenge of recruiting individuals who do not directly identify as having a disability. This has to be addressed in the call for participants (see Section 4.2).

## 4. PILOTING LOGISTICS

The first iteration of the above methodology was implemented in the fall of 2006. This section describes the logistics of this pilot study.

### 4.1 Courses

For this study, participants were recruited from a CS1 and a CS2 computing course. These courses were selected for several reasons. First, these courses are traditionally large, having on average 400 and 200 students, respectively, at the start of the term. This increases the chances of students with disabilities taking the course. Moreover, these courses are taken by students both interested in majoring in computer science as well as students interested in other fields. Thus, the diversity of backgrounds and interests of the students is potentially increased. Finally, the underrepresentation of undergraduates with disabilities in computing departments could be due to poor experiences in early courses. Focusing on these introductory courses provides an opportunity to potentially observe this.

### 4.2 Recruitment and Participants

As mentioned in Section 2.1, not all people with disabilities identify as having a disability. To address this, the following call for participation was used:

Do you have a physical, mobility, psychiatric, or mental disability OR are you Deaf or hard of hearing?

This phrasing is similar to the one used by Whitney [16] and is intended to cover the full spectrum of disability. This call was posted to the courses' mailing lists and online discussion boards.

A total of four students responded to the call for participation. One was ineligible due to not being 18, and the other never responded to replies. The remaining two were chosen to participate.

Seth<sup>3</sup> is an 18 year old male in his first year of college and was enrolled in CS1 with the intent on majoring in computer engineering. Seth is effectively deaf in his left ear and subsequently has difficulty filtering out background noise. He was not registered with disability services.

Alan is a 26 year old male majoring in visual arts. He has a developmental disability that impacts his short-term memory and reading and writing speed. He is currently registered with disability services and uses books-on-tape and note-takers as accommodations. Alan was not enrolled in either introductory course. Instead, he was taking an interdisciplinary course in computer animation, which was also his first computing course. He heard about the study and contacted the author express interest in participating.

### 4.3 Conducting Interviews

All interviews were held in private, closed areas that were convenient for the student. The students were asked if any

<sup>3</sup>All names have been changed to protect student privacy.

accommodations were necessary; none were requested. The author was the interviewer for all sessions.

Each participant was interviewed twice. The interviews were intended to take about one hour. Seth's interviews averaged 40 minutes, while Alan's interviews usually lasted 60 minutes. During these interviews, all questions shown in Appendix A were covered, and most were preemptively discussed by the student without prompting from the researcher. When asked, both students felt that they had said all that they could about their course experiences.

All interviews were audio-recorded and later transcribed.

## 4.4 Compensation

As this study involved two sessions spaced over time, it was important to encourage participants to remain in the study. Towards this goal, the participants were compensated for each interview completed. If he or she completed all interviews, then bonus compensation was awarded as well.

## 5. FINDINGS AND REFLECTIONS

One of the advantages of using a phenomenological approach is that by conducting data analysis along-side data collection, the research process is allowed to evolve as interviews are conducted and data is collected [15]. Essentially, the study is constantly being piloted as the data influences the direction of the study. In this section, some initial themes in the data are identified. Also, identified improvements to the methodology are mentioned.

### 5.1 Developing Themes

At the time of this writing, formal coding of the interviews transcripts is still underway. However, certain themes do appear in the data analyzed thus far and are described briefly here.

#### 5.1.1 *Emphasis on Self-Advocacy*

One of the first themes to arise out of the data was that these students viewed that it was their responsibility to manage the effects of their disability. Both Alan and Seth discussed proactive efforts they make and have made in seeking out accommodations. Since middle school, Seth has been the one to ask his teachers for support. Now in college, he makes sure to choose seating and study locations such that hearing will not be a problem. Similarly, Alan is rigorous about contacting disability services and his instructors before the term begins in order to discuss accommodations. However, due to delays and mismanagements this quarter, several of his accommodations were not fully provided. This caused him undue stress, and eventually his parents intervened. Alan expressed some feelings of failure in regards to how it all played out.

#### 5.1.2 *Emphasis on Multimodal Communication*

Alan and Seth both recognized that it was extremely helpful when instructors both wrote and said aloud what they were doing. For Seth, this attenuated any hearing difficulties. The written record was a resource for Alan, although too much written text could be problematic.

#### 5.1.3 *Emphasis on Accessible Artifacts*

Both participants also expressed the importance of being able to access materials from class lectures. In the CS1 course, the course text, assignments, and classroom examples were all available online. Seth commented that this was

particular helpful, especially if he had missed anything during lecture. This was true in his other courses as well (see Section 5.2.2).

Alan, on the other hand, lamented the lack of such artifacts. Most lectures in the animation course were tutorials on how to use the animation software. Due to his short-term memory issues, recalling the tutorial was difficult, and note-taking was only moderately helpful. He would have preferred for the tutorials to have been videotaped. Interestingly, a set of DVD tutorials were available to the students, but these were only available for use in the computer lab when a teaching assistant was present. This greatly limited their availability, thus causing further frustration for Alan.

### 5.2 Refinements to the Study

Overall, the methodology was successful. The response to the call for participants was small, but the poor response could have been due to the lateness in the term. More importantly, the two who did participate were comfortable and expressive about their disabilities and course experiences. A rich amount of data was collected. Still, several refinements to the study were identified.

#### 5.2.1 *Revisions to the Call for Participation*

As mentioned previously, the call for participation had to reflect the many definitions of disability held by the populace. The current phrasing was mostly successful, but two points of clarification were identified. First, the two who responded but were not interviewed both asked for clarification on what was meant by having a disability. One asked about ADD/HD, and the other asked about depression and anxiety. These conditions were intended to be covered by "psychiatric and mental disability." Furthermore, one of the course instructors asked, out of curiosity, about the difference between a mental and a psychiatric disability. "Mental" disabilities were meant to refer to learning disabilities, but this connotation was conveyed poorly, if at all.

To make the definition of disability clearer in future iterations of this study, the following revised call for participation will be used:

Do you have a physical, mobility, psychiatric, or learning disability?

Are you Deaf or hard of hearing?

Do you have ADD/HD, depression, or anxiety issues?

The changes reflect the feedback. Specifically mentioning depression and anxiety is important as they are not always viewed as being a disability [16].

#### 5.2.2 *Revisions to the Interview Questions*

As the interviews were semi-structured, the students were the primary drivers of the conversation. In doing so, they sometimes hit on topics not covered in the interview guide. One example came from Seth when he commented that the lectures in a psychology course he was taking were recorded and available online as podcasts. The following discussion was a rich compare and contrast between his experiences in the psychology and computing courses. Because of this, an interview question was added that asks the student to compare their course experiences with those from other courses.

A similar question was also added regarding the role of family. Both Alan and Seth mentioned spontaneously the support they've received from their parents and others. The question was added to help insure that similar data is collected in future interviews.

## 6. FUTURE WORK AND CONCLUSION

At the time of this writing, the data from the first set of interviews are being analyzed, and new interviews are underway. Further data collection and analysis will help expand the understanding of current inclusive practices in computing education. For now, this paper is a first step on this path. The design of the study presented here was described in detail to support research on inclusion in computing education, and the author encourages others to explore inclusive practices using the methods presented.

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## APPENDIX

### A. INTERVIEW QUESTIONS

#### Initial Interview:

- Gender? Age? Full-time or part-time student? Major?
- What disability(ies) do you identify as having? Describe what it means [to you] to have this disability.
- When and how were you diagnosed?
- How does your disability affect your education?
- Have you ever been embarrassed due to your disability?
- Are you registered with Disability Resources for Students? Why or why not?
- What accommodations have you used / currently use / plan to use for your disability?
- How has your family responded to your disability? \*
- Have you or are you planning to inform the instructor and/or your TA about your disability? Why?
- Assuming that your instructor(s) knew about your disability, how would you want them to respond to you as a student?
- What are your reasons for taking this course?
- Do you have prior programming experience? Describe.
- How do you think you will do in this course?
- How do you think your disability will affect you in this course?

#### Follow-up Interviews:

- How is the course going for you? What do you like/not like?
- Have you considered changing the level of disclosure about your disability? Why?
- Have you told more people [instructors, students, etc.] about your disability? Why?
- Have you changed or thought of changing any accommodations you use for the course? Describe.
- Describe how the instructor runs class. What do you like? What would like the instructor to do differently?
- Describe how the TA runs section. What do you like? What would like the TA to do differently?
- Do you attend office/lab hours? Describe.
- Describe your experiences using any course resources [textbook, e-mail, course web, etc.].
- Describe your experiences with the assignments.
- Have you had difficulties using the suggested software for the course? Explain.
- Do you regularly talk or meet up with students from the class?
- Have you disclosed about your disability to them? Why?
- Compare your experiences in this course with other courses. Are there things that you wish were present in this course? Describe. \*

\* Question added during the course of the study.