Teacher And Student Empathy Interviews As An Instrument For Considering More Inclusive K-12 Computing Pathways

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***Abstract*—This paper presents the development and use of empathy interviews at Iowa City Community School District (ICCSD) which is the fifth largest school district in the state. At this district, equity challenges have arisen as the city has grown rapidly over the past decade, shifting from a rural and predominantly White college town to a burgeoning tech sector with a significant influx of Latinx families. During the first two years of participation in the Developing Inclusive K-12 Computing Pathways Research Practice Partnership (CT Pathways), the district developed a computing pathways document to guide schools and teachers in the integration of computer science (CS) and computational thinking (CT). After a year piloting their pathway, an Inclusive CT Pathways Committee was formed to review the existing pathways document and ensure it was ably addressing the district's overall equity goal of better serving students from Black and Latinx communities. As an orientation step to personalize this goal and understand it within the context of their own classrooms and schools, teachers on the Inclusive CT Committee conducted empathy interviews to learn more about the computing experiences of their students. Teachers reflected upon the structure of the interview protocol, the insights they gained, and the potential opportunities the approach afforded them to address misconceptions about computing. They described the interviews as opportunities to learn more about designing supports, on-ramps, and more inclusive computing opportunities for students.**

Keywords—computing pathways, computational thinking, empathy interviews, inclusive computing

I. Introduction

Developing Inclusive K-12 Computing Pathways for the League of Innovative Schools is a medium-sized NSF CSforALL project (#1837386) that leverages the researcher-practitioner partnership (RPP) model [1] to co-design computing pathways with school districts. For ICCSD, the RPP team chose to answer the questions*: Under what conditions is your district's existing CS/CT pathway serving its students?*; and *What improvements need to be made to strengthen the pathway to reach Black and Latinx students?*

This paper focuses on the work done at Iowa City around equity and the role of empathy interviews as a tool to bridge student and teacher perspectives. ICCSD is increasingly aware of the equity challenges within its own schools associated with STEM participation, which correlate with the changing demographics of the wider community.

II. Iowa City: District Perspective

Once a rural and predominantly White college town, Iowa City has become a burgeoning tech sector with shifting demographics. Table 1 shows a comparison of demographics of students enrolled in computer science electives compared with the demographics of the total population of the district that year. There is underrepresentation of females, Black, Latinx, students receiving free and reduced lunch (FRL), as well as students designated as English-language learners (ELL).

TABLE I. Demographics Of Iowa City Students Enrolled In Computer Science Electives Compared With All Students.

	17-18 CS	17-18 District	18-19 CS	18-19 District	19-20 CS	19-20 District
Female	20.6%	48.5%	21.8%	49.1%	26.6%	48.6%
Male	79.4%	51.5%	78.2%	50.9%	73.4%	51.4%
Black	7.2%	20.3%	7.3%	19.9%	7.9%	20.4%
Latinx	3.1%	11.5%	5.5%	11.8%	5.0%	12.3%
Asian	13.4%	6.6%	24.5%	5.8%	26.6%	5.7%
Multiracial	5.2%	5.3%	2.7%	5.6%	5.0%	5.7%
White	71.1%	56.4%	60.0%	56.6%	55.4%	55.0%
FRL	8.2%	37.4%	10.0%	38.9%	12.2%	37.7%
Non- FRL	91.8%	62.6%	90.0%	61.1%	87.8%	62.3%
ELL	0.0%	9.1%	0.0%	8.8%	0.7%	11.3%
Non-ELL	100%	90.9%	100%	91.2%	98.6%	88.7%

A. Developing & Refining An Inclusive CT Pathway

During the first two years (2018-20) of the CT Pathways grant, a team of teachers and administrators at Iowa City designed and piloted a

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computing pathway intended to ultimately provide consistent and cumulative access to CT and CS learning opportunities for all students. Their computing pathway document focused on three CT practices: algorithms; data; and systems and computational models. In February 2020, Iowa City took initial stock of their efforts through their participation in the Digital Promise-sponsored "Equity in the Driver's Seat" convening that took place in San Mateo, CA [2]. Researchers, practitioners, and other experts from the field discussed practitioner-identified, equity-centered problems of practice, one of which was centered on developing more equitable access to CS/CT learning opportunities. The driving question arising from Iowa City's district challenge was "How can we gauge the equity of CT programs to ensure specific needs of students from marginalized backgrounds are being met?" (p. 24). During that time, the Iowa City team took a hard look at their course enrollment data, including demographic breakdowns (see Table 1). Upon examining the ecosystem in which the computing pathway is embedded, it became clear that there remain conditions leading to systemic inequities in the experiences of historically minoritized students including disparities in course offerings and computing teacher availability in schools within the district.

After reviewing relevant research on defining and articulating CS/CT [3][4] alongside district artifacts, the ICCSD team reached a more nuanced understanding of the enrollment gaps and the need to address their equity challenge. The ICCSD team opted to form an Inclusive CT Pathways Committee and established the following shared equity goal:

"It is our desire to reach the specific population of Black and Latinx students in an effort to broaden their participation in computing…. These students face many barriers...At the secondary level only 60% of Black students and 68% of Latinx students are proficient in math compared to 91% of our White students."

Teachers selected for the Inclusive CT Committee had previously self-identified an interest in the design of equitable computing pathways. At the outset, the Inclusive CT Committee conducted empathy interviews to listen to the experiences of students in their district. The next section describes the use of an empathy interview protocol that was developed in collaboration with Digital Promise's Center for Inclusive Innovation and modified for use at Iowa City.

B. *Student Voice With Empathy Interviews*

The development and use of the empathy interview protocol is grounded in the empathizing techniques and protocols from the equityXdesign [5] and Liberatory Design [6] Frameworks, which guide the overall structure of the Inclusive CT Committee's work. In addition, the protocol draws on the work of Freire [7] and Design Justice [8]. The protocol was developed over iterative cycles by our research team. With each iteration, the protocol was further refined and additional framing was added for teachers to better understand the purpose behind empathy interviews and have a guide through the process. For access to the complete protocol, visit: http://bit.ly/EmpathyCTPath. The ICCSD Inclusive CT Committee used the questions in Figure 1 as their sample interview protocol. Some teachers designed surveys for students with these questions instead of interviewing them.

As we design inclusive opportunities for students to engage in computer science, we need to understand the perspectives of students and community members that we hope to engage in CS work. Before our next meeting, take about 30 minutes to interview a student or parent from Iowa City's equity subgroup (Black, Latinx) about computer science. Here are some possible interview questions:

- How has this year of transition and remote learning going for you?
- How would you describe your background knowledge of computers?
- When you hear the word computer science what comes to mind? What are some examples?
- Do you see yourself as a computer scientist?

Optional Who does computer science?
Optional What makes you interested in computer science?
Optional Why are you not interested in computer science?

- Are there things you would like to learn about computer science that you currently do not learn?

Fig. 1. Communication with Iowa City Teachers Regarding Empathy Interview

III. METHODS

All seven of the Inclusive CT Committee members interviewed or surveyed students. Three high school teachers conducted a total of six interviews and 67 surveys, a middle school teacher conducted five interviews, and three elementary school teachers conducted a total of two interviews and 15 surveys. The research team connected with the Inclusive CT Committee over the course of four hour-long reflection meetings between November 2020 and February 2021. The first meeting was an

opportunity for introductions and for the committee to reflect on inequalities they had observed and/or experienced as individuals in the educational system. At the second meeting committee members reflected on a vignette about a teacher as an illustrative example of inclusive CS/CT pedagogy [9]. At this meeting, teachers and district leaders were prompted to interview or survey students from the equity subgroup they identified (Black, Latinx, and ELL). The third meeting in January 2021, included mixed grade-band teacher and consisted of teachers sharing anonymized survey results and summaries of student interviews. At the fourth meeting, in February 2021, teachers began identifying opportunities for improving the pathway. All meetings were led by the district curriculum leader; the research team observed and asked clarifying questions.

Additionally, five committee members completed an anonymous three-question pre-survey that asked about the strengths and opportunities of the pathway as well as example of a real or imagined inequity in their classroom. Finally, one 30-minute interview was conducted with a White male high school teacher who conducted surveys of all of his AP Computer Science students, 42 total as well as four individual interviews with young women (3 Asian, 1 White) in his AP Computer Science Principles class who were also his advisees. The other six teachers were asked for interviews but declined to participate citing lack of time as a result of COVID-related challenges.

IV. Results

A. *Encouraging Participation in CS*

All seven committee members shared that within their district, students were exponentially likely to pursue CS classes when they had friends, family members, and/or teachers encouraging them to do so. Student surveys and interviews revealed that teachers are more influential than counselors in encouraging students to pursue computing courses and that students' success in middle school CT and their perceived strength in math can encourage participation in computing courses. Another high school teacher described one middle school teacher in her district as someone "who's a real go-getter and encourages them to do CS." However, the same teacher lamented that students coming from less affluent middle schools did not get the same opportunities. Committee members agreed that librarians in the district played a significant role in encouraging students to participate in computing courses and identified working with them to recruit students to computing as an opportunity. One high school teacher noted that "parents and peers are big influencers on what courses they're taking." Furthermore, the teacher acknowledged being "sensitive to gender issues but [there are] also the racial issues" and that "they are such big issues...how do you focus on just one?"

When participation was encouraged in high school CS for all students, teachers noted that they needed to make adjustments to their instructional practices. In a survey, one high school teacher noted that they "did have to differentiate the curriculum to reach all my learners, which was a challenge, but it made me grow as a teacher. Being able to break down the curriculum into terms and concepts that can be understood by various groups was rewarding and tough."

B. *Sense of Belonging and Representation*

One teacher was surprised to find that "a lot of the other even White kids didn't feel like they belonged." A Black middle school teacher who uses they/them pronouns pointed out that there was not enough exposure and representation of diversity in the computing field and that African American students need to be able to "find individuals that look like them." They went on to say that the middle school years—sixth, seventh, and eighth grades—are crucial points for students to get exposure to high quality computer science instruction. One teacher identified having moderate success exposing younger students to CS/CT concepts by introducing computing vocabulary but said that even so, she was surprised that the survey data "was not glowing as something they want to go into"—in other words, even with exposure to computing vocabulary, students still did not want to take more computing courses.

One high school teacher said that the students that came to her from one wealthier middle school were more likely to participate in CS courses because they had had one particular high school teacher who encouraged their participation in computing. All three high school teachers were surprised to learn that most of their students did not

feel like they belonged in computing. One high school teacher exclaimed "a lot of the other, even White kids didn't feel like they belonged." Another teacher reflected: "What surprised me the most is that I know this student is really good at problem solving and trial and error, but she thinks that she would NOT be good at CS. But, she doesn't even know what computer science is or what a computer scientist actually does!"

C. *Expanding Empathy Interviews*

All seven of the Inclusive CT Committee members recognized the value of the empathy interviews or surveys and agreed that they wanted to expand on the empathy interviews in the future. When asked what he would do differently if he conducted another empathy interview, the teacher who was interviewed described wanting to collect more empirical data. The teacher also acknowledged needing "to incorporate more African Americans in the survey" since he "only incorporated those who were already enrolled [in AP CS Principles]." The teacher went on to describe "the evidence I've gathered is that these discussions aren't happening with the counselor—maybe the librarians are doing this, but the 42 kids I surveyed didn't associate the librarians with CS." Furthermore, "these empathy discussions would be valuable to talk to kids about what's stopping them from taking CS and what their fears are."

Iowa City teachers saw the empathy interviews and surveys as an opportunity to dispel myths about CS and mitigate stereotype threat especially for their older students. This also created an opportunity for them to listen to their students and for their students to be heard. Teachers who interviewed students described the interview process as an opportunity to learn more about their students and in some cases clear up misconceptions about what computing is and who can pursue computing. Teachers described being grateful to work in a district that has acknowledged and is working to improve computer science course enrollment demographics to more closely reflect those of the district. They saw empathy interviews as a first step in understanding students' needs.

V. Discussion

Our findings highlight how various teachers enacted empathy interviews across three different grade bands. In general, the empathy interviews and surveys brought up questions for teachers about their instructional practices as well as their pedagogical approaches. Teachers wondered what they could do to support their district's equity goal of reaching Black and Latinx students in an effort to broaden their participation in computing through both curriculum offerings as well as equitable teaching approaches.

The early use cases of empathy interviews within Iowa City suggest three main takeaways. First, the wider teacher and administrator perceptions about what may impact minoritized students' participation in computing programs were not always in alignment with what the students, themselves, identified. For example, students who are strong in math and problem-solving, might feel like they belong in computer science. Second, student voices provided important insights into factors that may impact participation in CS/CT programs in Iowa City. Third, going forward, listening to student voices within the district is an essential feature of inclusivity efforts—and a priority that may very well need to occur at the outset of any such an initiative.

This final point of course speaks back to the structure of the overall CT Pathways RPP, which prioritized teacher and administrative buy-in over Years one and two before only explicitly turning to student perspective in Year three. Of course, some of this delay incorporating student voice and perspective ties back to the wider pandemic which significantly disrupted Iowa City piloting their pathway in the classroom over Year two. In this regard, the formation of the Inclusive CT Committee at Iowa City during Year three provides an opportunity for the district to deliberately and collectively assess participation in computing among Black students, Latinx students, and students designated as English-language learners.

The empathy interviews and surveys administered at Iowa City helped teachers listen to their students and made them more curious and aware of some of the challenges faced by students. Moving forward, we are continuing to develop the protocol and will bring it to more districts so we can further explore the connections between listening to students and developing inclusive computing pathways for those students.

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