

Interdisciplinary Learning in Computer Science

Students' Perceived Benefits and Challenges

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Abstract

Interdisciplinarity is important for Computer Science education because it prepares students to solve real-world problems and collaborate with different disciplines. Despite its benefits, computer science students struggle with interdisciplinary learning. Without understanding the students' motivations and struggles, it is difficult to design interdisciplinary courses that are beneficial and accessible. This research aims to understand how these students experience interdisciplinary courses, in terms of benefits and challenges. Seven computer science students were interviewed, and their transcripts were analysed using reflexive thematic analysis. Within interdisciplinary learning, the students experienced broadened perspectives and the communication of their ideas across disciplines. By understanding these experiences, faculty can better understand how to design courses centred around interdisciplinarity.

1 Introduction

Interdisciplinarity is becoming more and more important for undergraduate education (Gillis et al., 2017), yet it is often misunderstood (Morrison, 2015), becoming difficult to implement in practice (Feng et al., 2023). Interdisciplinarity is often used interchangeably with the similar term of multidisciplinarity (Feng et al., 2023), leading to confusion. Compared to disciplines such as healthcare or social sciences, research concerning interdisciplinarity in Computer Science (CS) is still an under-developed field (Heikkinen & Räisänen, 2018), especially for understanding students' experiences.

CS students could benefit from interdisciplinary learning, because it can help them find innovative solutions to solve real-world problems, design software for a real client, develop social awareness (Feng et al., 2023) and prepare them for their future careers. The workplace can be a highly interdisciplinary environment, because of working with colleagues of diverse academic backgrounds (Beemt et al., 2020), which can be difficult to adapt to with a monodisciplinary education.

This paper addresses the research question: *"What benefits and challenges do computer science students experience, when participating in interdisciplinary courses?"*. By understanding students' experiences, faculty staff could better design courses centred around interdisciplinarity. They could get in-depth insights on how students learn in interdisciplinary environments and the perceived benefits of these experiences. They could also understand how and why students are struggling with interdisciplinary courses, and provide support to them.

To answer this research question, seven semi-structured interviews were conducted on second and third-year students from the Computer Science and Engineering (CSE) Bachelor of TU Delft. Through reflexive thematic analysis, several themes were found in the data.

This paper is structured as follows. Section 2 is a literature review on interdisciplinarity. Section 3 focuses on data collection and data analysis procedures. Section 4 discusses the consideration of ethics and reproducibility. The emerging themes can be found in Section 5. Furthermore, the findings and limitations are discussed in Section 6. Finally, Section 7 provides a conclusion and recommendations for further research.

2 Literature Review

This section is a literature review of interdisciplinarity, discussing its definition, similar terms, its benefits and challenges, and the existing research gap.

2.1 Definition of Interdisciplinarity and its Application in Education

The definitions by Klein (2015, p. 15) can offer great insight: "Interdisciplinarity is typically characterized by integration of information, data, methods, tools, concepts, and/or theories from two or more disciplines or bodies of specialized knowledge." Klein also defined multidisciplinarity as the "juxtaposition of separate disciplinary inputs." The main difference with interdisciplinarity is that multidisciplinarity "does not synthesize or integrate the various elements of disciplinary knowledge into a cohesive whole" (Lattuca & Knight, 2010, p. 3). Lastly, "Transdisciplinarity transcends the narrow scope of disciplinary world-views through an overarching synthesis associated with new conceptual frameworks or paradigms" (Klein, 2015, p. 20). These are the definitions that I used throughout my research.

Beyond Klein's definition for interdisciplinarity, there are many other definitions. Similar terms such as multidisciplinarity and transdisciplinarity tend to be confused with interdisciplinarity, making its understanding difficult. Feng et al. (2023) made the conceptualizations of these words clearer, by interviewing faculty members in engineering education and gathering their experiences. Their findings showed that faculty members' conceptualizations were nuanced. They developed a typology of courses, based on the characteristics of multi-, inter-, and transdisciplinarity, with the goal to help educators design engineering courses with a focus on disciplinary integration. Interdisciplinarity could be summarized as a type of disciplinary integration which relates to how students solve problems through teamwork, how their backgrounds and their teachers' bring different perspectives, how teachers collaborate, and how course content is designed.

2.2 Benefits and Challenges of Interdisciplinarity

I defined benefits and challenges, drawing from the Cambridge University Press (n.d.), to determine whether a quote described a benefit or a challenge during thematic analysis. Throughout this research, I used the word 'benefit' as something that could improve the students' skills or affect their future in a positive way. The word 'challenge' is not the opposite of benefit, as it doesn't have to affect the students in a negative way. To the contrary, students might need to have challenging experiences in order to earn the benefits of interdisciplinarity. A challenge, in the context of this study, is considered as a circumstance that might cause a student to struggle or test their skills.

Interdisciplinary learning has been shown to be beneficial to students in multiple aspects. Interdisciplinarity can improve students' problem solving skills (Chettiparamb, 2007; Richter & Paretti, 2009), contribute to innovation and personal growth (Chettiparamb, 2007), and even life-long learning skills (Jones, 2010). Richter and Paretti (2009) showed that it's important for engineers to learn to collaborate in an interdisciplinary environment.

Furthermore, within interdisciplinary CS education, it has been shown that teamwork and collaboration skills can develop (Paredes-Velasco et al., 2023). The researchers conducted an experimental study, in which CS students, who had worked together with preservice teachers, were compared with ones that had not. The students with the interdisciplinary experience reported they had developed better learning outcomes, including social and teamwork skills. Paredes-Velasco et al. (2023) also described how these skills could be valued both in students' future careers and parts of academia.

Even though an interdisciplinary environment has many benefits, some students find it difficult to adapt. Richter and Paretti (2009) introduced negative relatedness, which is when students are unable to connect interdisciplinary knowledge with their own background. They

also described negative perspective as struggling to see a problem from different points-of-view or to see their contribution in a broader context. Furthermore, they defined disciplinary egocentrism as "the cognitive barriers engineering students facing when moving into interdisciplinary context" (Richter & Paretti, 2009, p. 38).

Another challenge that is common with interdisciplinary learning are disorienting dilemmas from the transformative learning theory (Mezirow, 1991). Though the theory was originally a framework on how adults change through learning, it has been adapted to be used within interdisciplinary learning research (Feng et al., 2025). A disorienting dilemma is an experience that occurs in an interdisciplinary environment, and differs from the subject's personal experiences to the point that it clashes with their beliefs. Within this context, Feng et al. (2025) states that there is a limited understanding on what causes these dilemmas and how students deal with them. The research gap is further discussed in the next section.

2.3 Research Gap on Interdisciplinary Learning

Engineering education has extensive research on interdisciplinary learning. Beemt et al. (2020) did a qualitative review on 99 empirical studies on Interdisciplinary Engineering Education (IEE). Beemt et al. (2020) described that IEE is important because it trains engineers to solve real-world problems by considering other disciplines, and it makes them aware of their social and environmental impact.

Even though there is a lot of research on IEE, there is not as much on interdisciplinary learning of computer science. Without further research on this field, CS students might remain disciplinary experts. If that was the case, they would find it difficult to adapt to interdisciplinary environments in their future, as they would have to collaborate with people across disciplines, such as healthcare (Paredes-Velasco et al., 2023), art, business and more. Real-world problems and innovation require computer scientists to think beyond their own discipline. Chakraborty (2018) described that the field has become more prevalent, by conducting a quantitative analysis on research between 1960 and 2010. His results showed that there is gradually more interdisciplinarity within computer science.

The field is mostly composed of research on curriculum construction, while there is limited research on the educational value and students' experiences. An example is by Barr et al. (2023), who detailed how to construct interdisciplinary curricula for Computer Science. A paper that focused on educational value is by Roberts (2011), who wrote a survey on the challenges of multidisciplinary education in CS. A key difference to this paper is that he did not focus on student experiences, rather, he analysed students' performances. Performance is not necessarily the best way of evaluating students' learning experiences, because it might not fully capture their learning process, motivations and difficulties. More research is needed in order to understand in-depth how students experience learning through interdisciplinary curricula and how to support students better.

To conclude, there is a significant research gap regarding interdisciplinarity and computer science, when it comes to analysing students' experiences. This paper can reduce it by going into depth on these experiences.

3 Methodology

This section describes the methodology used to conduct this research, the Bachelor's interdisciplinary courses, sampling techniques, interview process and details regarding the thematic analysis.

3.1 Research Context: Interdisciplinary courses in CSE

TU Delft's Computer Science and Engineering (CSE) Bachelor is divided into three years. The first year courses focus on the fundamentals of CSE. In the second and third years, some courses are interdisciplinary, while other courses are focused on CSE. Each year ends with a 15EC project. Lastly, half of the third year is dedicated to the Minor Program, which the student can choose.

The most interdisciplinary courses are Software Engineering Methods (SEM), mostly because of the Opening Presentations unit but also the course as a whole, the Software Project (SP) and Research Project (RP), though they depended on which topics the students had chosen, Human Computer Interaction (HCI) and the Minor Program. Courses with some interdisciplinary aspects are Computer Graphics (CG), mainly because of its 3D art assignment, Introduction to Quantum CS and Embedded Systems. The logic and mathematics courses are too close to CS so they are not the focus of this research.

3.2 Participants

To answer the research question, I conducted seven interviews with second- and third-year CSE students from TU Delft. The reason I chose these students was because they have taken most of the courses of the Bachelor and have the most experience with interdisciplinarity. Most of the interdisciplinary courses happen either in the second or third year. Second year students remember their year's courses better, which is why I interviewed students from both those years.

In order to recruit the participants, I used multiple types of sampling techniques (Bhardwaj, 2019). The first one is purposive sampling, choosing participants with characteristics related to my research question. Such characteristics include having taken interdisciplinary courses or an interdisciplinary minor. The participants were recruited through the personal network due to the project's time limitations, which is an example of convenience sampling. Lastly, I used snowball sampling, asking each participant for other possible CS students that could participate, some of which I interviewed.

3.3 Interviews

Interviews are a great way to gather qualitative data, which this research aims to analyse. Patton (2014) describes that interviews can offer in-depth data and that direct quotations on the participants' experiences are valuable. They provide data that cannot be directly observed. I chose interviews for collecting the students' experiences instead of other qualitative research methods, because interviews are great for gathering people's thoughts, experiences and feelings (Milena et al., 2008). One-on-one interviews also give more space for sharing personal perspectives and experiences than focus groups. Other data collection techniques such as surveys and experiments are better suited for gathering quantitative data (Ghanad, 2023), so they were not chosen. Even though interviews are time-consuming, they can offer in-depth information that is difficult to gather with other qualitative research methods.

The average interview lasted 43 minutes, with the shortest one taking 34 minutes and the longest one 50 minutes. The interviews were semi-structured, meaning an interview guide with questions was prepared in advance. Follow-up questions were asked on the spot, allowing me to diverge from the main questions depending on the participants' responses. Unstructured interviews are difficult to navigate and structured interviews might not give

enough in-depth data. Semi-structured interviews are more focused on the research goals, and are more flexible than structured interviews (Alsaawi, 2014).

I prepared the interview guide according to Patton (2014), who discussed the best ways to conduct an interview and how to prepare the right questions, with the goal of making the participants feel comfortable enough to be honest. Furthermore, I did a practice interview with a teammate from the research group, in order to prepare for the semi-structured format. After the practice interview, I revised my questions.

The interview structure was as follows. First, I got to know the participants by asking which interdisciplinary courses they took. Then, I asked them about their interdisciplinary experiences within the program, along with benefits and challenges. Lastly, I asked them about positive or negative experiences within their Minor, as well as how to improve interdisciplinarity in the program. Some question examples I asked during the interviews are "What benefits do you see on having interdisciplinary courses in CS?", "What is a moment during your Minor that you found challenging, because of interdisciplinarity?", and, "How was it working with people from other disciplines?".

3.4 Thematic Analysis

After the interview process, I conducted Reflexive Thematic Analysis (RTA) on the interview transcripts using ATLAS.ti, which is the iterative process of coding patterns within the data and identifying the themes (Braun & Clarke, 2021, p. 47-48). Reflexivity is about being aware of how the researcher can shape the research process.

I used three coding techniques in the six phases of Braun and Clarke (2021):

1. Open coding (also known as inductive coding): create the codes based on the participants' experiences and perspectives (Braun & Clarke, 2021, p. 100).
2. Review the codes
3. Focused coding (also known as deductive coding): relate the codes to the existing literature and theory. This step also divides the codes into categories.

Because RTA is an iterative process, my open coding had deductive coding elements, and the third round was not purely focused on the literature. I also reviewed the codes throughout the whole process, creating categories and breaking down codes, that were too general, into sub-codes.

After I made the code categories, I used Axial coding, which is finding how the different categories relate to each other. Therefore, I found the main themes (see Section 5).

4 Responsible Research

This section details the ethical considerations, AI usage, reproducibility and bias mitigation strategies applied throughout this study.

4.1 Ethics

This research required the collection of human data, which is why it was of utmost importance that the process was ethical. The research was approved by the TU Delft Human Research Ethics Committee[1] prior to conducting any interviews. I also prepared a consent form that described my research, how the participant data was used, as well as any possible

[1] https://www.tudelft.nl/over-tu-delft/strategie/integriteitsbeleid/human-research-ethics

ethical concerns. The interviewees could withdraw their data within two weeks in case they decided they did not want to be part of the research. To ensure confidentiality and keep the participants' personal opinions and thoughts private, all personally identifiable information was omitted from the results and participant quotes.

During the interviews, the participants were audio-recorded with their permission. Their data was first stored locally and moved to the private TU Delft approved drive[2]. Their audio-recordings were transcribed using Microsoft Transcribe[3] and anonymized before analysing them. Their consent forms and transcripts were also uploaded to SURFdrive. All of the participants' data will be deleted when the research is complete. The thematic analysis was conducted using an offline version of ATLAS.ti, with its AI tools disabled, in order to ensure the participants' data would not be uploaded for training purposes.

4.2 Statement on GenAI

AI was used in only the following stages of the research. Microsoft Transcribe was used for the transcription of the interviews (see Section 4.1). Elicit, NotebookLM and Mendeley were used for surveying and summarising papers, solely to get a grasp of their content and check if they were worth reading. AI was not used to write the report or replace critical thinking.

4.3 Reproducibility

Reproducibility is possible by explaining in detail my methods, from recruiting, to conducting a good interview, to code analysis (see Section 3). The interview structure and a sample of the asked questions could also be to reproduce the research. Although I cannot share the transcripts, Table 1 in Section 5 showcases which codes resulted in their respective themes.

Regarding the literature, I opted for peer reviewed papers. I chose key papers that were published in either acclaimed journals or conferences. Any information I gathered from other sources, either paraphrased or quoted, was properly cited within the report.

4.4 Bias

This research deals with personal data and opinions, which means there is bound to be bias involved. I took many measures to mitigate it, an example being how I sampled the participants (see Section 3). During the semi-structured interviews, I remained professional and used an interview guide to ask similar starting questions to each participant.

Thematic analysis can be a process that is highly intuitive and subjective, thus there can be a lot of bias involved. I used a well-known iterative process to code the transcripts (see Section 3). I also focused on the codes that were mentioned by the most participants, based on salience, and created the themes based on those codes. Definitions for complicated concepts, such as interdisciplinarity, were researched thoroughly (see Section 2), to avoid making unfounded conclusions on difficult concepts.

[2]https://surfdrive.surf.nl/

[3]https://support.microsoft.com/en-us/office/transcribe-your-recordings-7fc2efec-245e-45f0-b053-2a97531ecf57

5 Results

After the thematic analysis, I found two emerging themes, which are "Broadened Perspectives as Opportunities and Struggles" and "Communicating across Disciplines as Opportunities and Struggles". These are illustrated in Table 1 and explained in this section.

Theme	Categories	Codes	Quote Examples
Broadened Perspectives as Opportunities and Struggles	broadened perspectives	considering others' perspectives	
		innovative solutions	
		perspective shift	'It's useful to [...] broaden that vision rather than be very narrow-minded.'
		stepping out of comfort zone	
		thinking outside the box	
		motivation to make a real-world impact	'I considered all of these applications, how can they be helpful in the real world?'
Communicating Across Disciplines as Opportunities and Struggles	social skills	better listener	
		communication	'The underlying skill of communication, that's always necessary for interdisciplinary thinking, is always going to be applied.'
		poor communication	
		presentation skills	
		teamwork	
	career impact	collaboration with colleagues from different disciplines	'A real working environment where you're not just working with computer scientists.'
		communicating with clients	
	other	ability to communicate with people from different backgrounds	
		lack of shared knowledge	'Anything I said, related to programming or tech [...] I had to tone down.'
		work division based on backgrounds	

Table 1: The two emerging themes, their code categories, codes and student quotes.

5.1 Broadened Perspectives as Opportunities and Struggles

Broadened Perspectives refers to the students' experiences with a variety or change of perspectives within interdisciplinary courses. Related codes include "considering others' perspectives", "innovative solutions", "thinking outside the box" and "stepping out of comfort zone".

Many participants saw broadened perspectives as having important benefits for both their academic life and careers. Some students had a perspective shift that significantly changed their way of thinking and seeing life. They experienced growth as individuals and learned to think outside the box. One of the students, when having to interact with non-computer scientists, said,

> *"I really strongly would say that this was a really important benefit, is when you have the experience of thinking one thing and then speaking to another person who's thinking something completely different."*

Another student emphasized how important it is to consider others' perspectives, *"learning something more environmental, human-centred, cultural, would all help with strengthening these ethical considerations of people."* Some students that experienced very interdisciplinary minor programs found the motivation to make a real-world impact with computer science. A student said,

> *"Previously, I thought that it's kind of dull, computer science [...] But then when I saw more about the human-centred side, I considered all of these applications, how can they be helpful in the real world? And I really felt motivated to do something with that, that it's going to have a good impact. Then computer science, it suddenly seemed like a tool that I can use for something I care about."*

However, experiencing a perspective shift was a challenging process for some students. Stepping out of their comfort zone to learn interdisciplinary material or to collaborate with interdisciplinary students was difficult, *"And for me it was really a learning experience, but I was also seeing that a lot of people actually are so technical that they have such a focused vision"*. Another student mentioned, *"I didn't really have a reference frame for legitimacy the way that I would like working within my own field. So it was difficult to know what things are more or less important to learn."*

Thinking outside the box is challenging, but also important for problem solving. It allows people to come up with innovative solutions, especially when experiencing different perspectives beyond those of computer scientists. To earn broadened perspectives, one must be willing to step outside of their comfort zone. In order to receive the benefits of interdisciplinarity, computer science students need to overcome the challenges of change.

5.2 Communicating Across Disciplines as Opportunities and Struggles

This theme concerns how students were able to communicate and present their ideas within an interdisciplinary environment. I analysed their experiences in terms of the opportunities they mentioned and how they struggled to learn or use these skills.

I found that students associated the presentation of their ideas with having an impact on their future careers and the development of social skills. Presentation and communication skills are also important for good teamwork within an interdisciplinary environment. This

theme is related to the "career impact" and "social skills" code categories. Related codes include "communicating with clients and managers", "lack of shared knowledge", "presentation skills", "communication" and "work division based on backgrounds".

Being able to express their ideas within an interdisciplinary environment is very important for computer science students. For their future career, many students stated the importance of being able to communicate and present their work to future clients or managers, who might not have a CS background, *"if you're talking to a physicist or a doctor, your client, they're immediately going to have different expectations for how to solve a problem"*. They also discussed how important it is to be able to communicate with their colleagues and classmates when participating in interdisciplinary projects, and to establish good teamwork. Another student said, *"the purpose is to be able to interface with someone on a different axis because they have different training and because they have different skills"*.

Besides being able to communicate their ideas, students also reported that they were able to become better listeners through interdisciplinarity. Some students said that they were willing to understand people from different disciplines better, after getting a chance to work with them.

Some students also mentioned that the social skills they learned through such projects were "life skills", that could be useful beyond computer science, skills that they use every day. A student mentioned, *"the underlying skill of communication, that's always necessary for interdisciplinary thinking, is always going to be applied"*.

However, many students struggled to acquire those social skills, such as during the presentation or writing parts of courses of the Bachelor. Some CS students believed they still had not achieved good communication skills, while other students had been working on their communication throughout the whole Bachelor program.

Lack of shared knowledge also made it challenging for some students to participate in group assignments during their minor program, *"I had to keep in mind that the other people essentially don't have a computer science background. So anything I said, related to programming or tech, [...] I had to tone down."*

Some students managed to overcome this issue by dividing the work based on their backgrounds, while other students learned from each other and tried to fill-in their knowledge gaps with good teamwork and communication. A student said, *"I had to think of solutions on how to help them more and how to make it more easy for them to work on, to do programming related tasks so that they can finish their work"*.

Even though most students struggled with communicating within an interdisciplinary environment, the social skills that were required were deemed crucial for their individual growth, academic life and future career. An interdisciplinary environment where they got the chance to work with people from different disciplines was seen as important in order to acquire or strengthen their communication skills. Lastly, even if the students were within a monodisciplinary environment, they said they were able to apply the social skills they had learned.

6 Discussion

This section further discusses the results and compares them to the relevant literature. It also examines the implications and limitations of this research.

In Section 5.1, it was found that the students experienced broadened perspectives within their interdisciplinary courses. In Section 2.2, the disorienting dilemma was discussed in relation to interdisciplinarity. This directly links to my first theme's findings (see Section 5.1).

The disorienting dilemma is similar to the struggles that students experienced from broadened perspectives. Stepping outside of their comfort zone and thinking outside the box were seen as challenges by the students, which they experienced within their interdisciplinary courses. A perspective shift, even though it is required for change, was seen as a challenge and it can be a disorienting dilemma for many students. Thus, the students experienced disorienting dilemmas in the process of broadening their perspectives.

Furthermore, Richter and Paretti (2009) discussed that students can experience a negative perspective (see Section 2.2). The challenges of broadened perspectives are connected to this concept, as seeing a problem from different perspectives requires thinking outside the box, and seeing their contribution in a broader context is about recognising the real-world impact. Some of the students were able to realise their societal impact because they acquired the motivation they needed.

In order to help students understand the impact of their work, Richter and Paretti (2009) suggested active discussions in the classroom where students can reflect on what their discipline contributes to specific problems. This could help reduce their negative perspective, help them practice thinking outside the box, and consequently lessen their struggles with broadening their perspectives.

As discussed within Section 5.2, the students found the ability to communicate across disciplines valuable, though they struggled to learn the required social skills. Paredes-Velasco et al. (2023) stressed how students learn good teamwork and communication skills and why these skills are important for the students.

Though, lack of shared knowledge was reported to be a major difficulty when communicating with different disciplines. Learning and effectively communicating interdisciplinary knowledge to each other was seen as a challenge, which could relate to digital egocentrism Richter and Paretti (2009). The researchers described that this could make it difficult for students to collaborate and learn from each other.

Faculty staff could support students better with learning communication skills, by introducing interdisciplinary courses in the first year of their studies, such as the writing and presentation courses. Barr et al. (2023) suggested that early exposure could help with the students' motivation and associating interdisciplinary material better.

The students were asked how they could add more interdisciplinarity to the CSE program, to which most argued that there was not enough interdisciplinarity. They expressed that there were limited opportunities to interact with people from different backgrounds to theirs. Being able to work more in an interdisciplinary environment could help improve their teamwork skills and prepare them for their future career, as it was described by Paredes-Velasco et al. (2023). I believe that giving more opportunities to students, to collaborate with different disciplines, would ease their adaptation to interdisciplinary environments.

6.1 Limitations

There are many limitations with this research, because of the small project length of ten weeks. Seven participants is a small sample size, which could influence the results. The participants were students of TU Delft, which doesn't represent the whole CS student population well. Due to the time constraints, I was not able to interview students from different universities.

Despite these constraints, I took some measures for delimitation. I recruited diverse individuals who had chosen a variety of interdisciplinary courses and had different interests, backgrounds and demographics. The goal was not to generalise the findings or represent the

entire population, but rather to get insights into different individual experiences. Furthermore, during the interviews, I focused on follow-up questions that were about the hows and the whys, as well as their personal opinions and thoughts on their experiences.

7 Conclusions and Future Work

This paper analysed what benefits and challenges CS students experience through interdisciplinary courses. This section provides a conclusion and suggestions for further research.

Students experienced broadened perspectives within their interdisciplinary courses. They learned to consider the perspectives of people from different backgrounds, and experienced their own perspective shift. Though, this shift along with stepping outside of their comfort zone were seen as challenging.

Within interdisciplinary environments, the students also reported that they learned to communicate better with CS students as well as people from diverse backgrounds. Though, the lack of shared knowledge between them was seen as a struggle. Furthermore, the students expressed they had a difficulty learning and achieving good teamwork and communication.

Faculty staff could take measures to reduce the students' struggles with interdisciplinary learning by understanding in-depth how these students experienced it. CS students with a stronger interdisciplinary background could excel at collaborating with any discipline, finding innovative solutions, and solving real-world problems while understanding their societal impact.

7.1 Recommendations for Future Research

Future research could interview more students, because the low number of participants was one of the main limitations of this research. Interviewing students from different universities would be good practice to avoid bias, as well as including postgraduate students to the research. Furthermore, a quantitative study based on this research could be conducted with the aim to generalize the findings, such doing an experiment or a survey.

References

Alsaawi, A. (2014). A critical review of qualitative interviews. *European Journal of Business and Social Sciences*, *3*(4).

Barr, V., Brodley, C. E., Gunter, E. L., Guzdial, M., & Libeskind, R. (2023). *Cs + x: Approaches, challenges, and opportunities in developing interdisciplinary computing curricula* (tech. rep.).

Beemt, A. V. d., MacLeod, M., der Veen, J. V., de Ven, A. V., van Baalen, S., Klaassen, R., & Boon, M. (2020, July). Interdisciplinary engineering education: A review of vision, teaching, and support. https://doi.org/10.1002/jee.20347

Bhardwaj, P. (2019). Types of sampling in research. *Journal of the practice of cardiovascular sciences*, *5*(3), 157–163.

Braun, V., & Clarke, V. (2021, November). *Thematic analysis*. Sage Publications Limited.

Cambridge University Press. (n.d.). Cambridge dictionary. Retrieved July 4, 2026, from https://dictionary.cambridge.org

Chakraborty, T. (2018). Role of interdisciplinarity in computer sciences: Quantification, impact and life trajectory. *Scientometrics*, *114*, 1011–1029. https://doi.org/10.1007/s11192-017-2628-z

Chettiparamb, A. (2007). Interdisciplinarity: A literature review. *Southampton: University of Southampton*.

Feng, X., Sundman, J., Aarnio, H., Taka, M., Keskinen, M., & Varis, O. (2025). Towards transformative learning: Students' disorienting dilemmas and coping strategies in interdisciplinary problem-based learning. *European Journal of Engineering Education*, *50*(2), 428–450.

Feng, X., Ylirisku, S., Kähkönen, E., Niemi, H., & Hölttä-Otto, K. (2023). Multidisciplinary education through faculty members' conceptualisations of and experiences in engineering education. *European Journal of Engineering Education*, *48*(4), 707–723.

Ghanad, A. (2023). An overview of quantitative research methods. *International journal of multidisciplinary research and analysis*, *6*(08), 3794–3803.

Gillis, D., Nelson, J., Driscoll, B., Hodgins, K., Fraser, E., & Jacobs, S. (2017). Interdisciplinary and transdisciplinary research and education in canada: A review and suggested framework. *Collected Essays on Learning and Teaching*, *10*, 203–222.

Heikkinen, K.-P., & Räisänen, T. (2018). Role of multidisciplinary and interdisciplinary education in computer science: A literature review.

Jones, C. (2010). Interdisciplinary approach-advantages, disadvantages, and the future benefits of interdisciplinary studies. *Essai*, *7*(1), 26.

Klein, J. T. (2015). *Interdisciplining digital humanities: Boundary work in an emerging field*. University of Michigan Press.

Lattuca, L., & Knight, D. (2010). In the eye of the beholder: Defining and studying interdisciplinarity in engineering education. *2010 Annual Conference & Exposition*, 15–710.

Mezirow, J. (1991). *Transformative dimensions of adult learning* (Vol. 350). Jossey-bass San Francisco, CA.

Milena, Z. R., Dainora, G., Alin, S., et al. (2008). Qualitative research methods: A comparison between focus-group and in-depth interview. *Annals of the University of Oradea, Economic Science Series*, *17*(4), 1279–1283.

Morrison, D. (2015). *The underdetermination of interdisciplinarity: Theory and curriculum design in undergraduate higher education* [Doctoral dissertation, University of Glasgow].

Paredes-Velasco, M., Arnal-Palacián, M., Urquiza-Fuentes, J., & Martín-Lope, M. (2023). Improving soft skills through an interdisciplinary approach in a realistic context between education and CS students in an HCI course. *IEEE Transactions on Education*, *66*(6), 579–590.

Patton, M. Q. (2014). *Qualitative research & evaluation methods: Integrating theory and practice*. Sage publications.

Richter, D. M., & Paretti, M. C. (2009). Identifying barriers to and outcomes of interdisciplinarity in the engineering classroom. *European Journal of Engineering Education*, *34*(1), 29–45.

Roberts, F. S. (2011). The challenges of multidisciplinary education in computer science. *Journal of Computer Science and Technology*, *26*, 636–642. https://doi.org/10.1007/s11390-011-1164-1