Fostering Psychological Safety for Learning in Neurodiverse Software Teams

Darren Butler
ddbutler@andrew.cmu.edu
Carnegie Mellon University
Pittsburgh, Pennsylvania, USA

Abstract

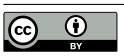
In software engineering, psychological safety is the shared belief that team members feel safe to take interpersonal risks in the workplace [2]. Psychological safety plays an essential role in communication, especially in tightly coupled team activities like mob programming (i.e., mobbing), in which three or more team members develop software together [17]. Mobbing requires members to play different roles while suggesting and digesting new ideas, which makes them particularly vulnerable to interpersonal risk. Autistic software engineers can struggle with mob programming, as they experience high levels of anxiety and stress when communicating with others due to their different cognitive and communication styles [7]. A collaborative space that allows autistic team members to flexibly communicate in neurodiverse teams can increase the psychological safety and accessibility of collaborative software development.

To identify tools and practices that foster psychological safety in neurodiverse collaborative mob programming, I will conduct a series of mixed-method, design-based studies. First, I conduct a survey and interview study to uncover the relationship between neurodivergent cognitive and communication traits and psychological safety in teams. Second, I generate design principles for psychological safety through the iterative design and evaluation of a neuroinclusive digital collaboration space. Third, I evaluate the impact of these design principles through an experiment with majority, minority and all neurodivergent teams.

My work makes the following contributions to accessible software engineering education and practice: 1) Novel descriptions of psychological safety relating to neurodivergent cognitive and communication attributes; 2) design principles for fostering psychological safety in collaborative software development teams; 3) a software development tool that scaffolds psychologically safe mobbing in neurodiverse software teams.

CCS Concepts

• **Human-centered computing** → **Empirical studies in HCI**; **Empirical studies in accessibility**; **Accessibility systems and tools**; • **Applied computing** → **Collaborative learning**; **Distance learning**; • **Software and its engineering** → **Programming teams**.



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collaborative learning, accessibility, neurodiversity, software engineering

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1 Motivation

Software engineering requires psychologically safe collaboration and interpersonal learning, where team members feel safe to take interpersonal risks such as asking for help [1, 9]. Psychological safety requires communication between team members. However, communication can break down between team members with different communication styles, such as autistic and non-autistic individuals [14]. For example, autistic people may experience alexithymia, which means they struggle to identify or describe emotions, leading to delayed reactions [5]. Teams couple technical tools with social safety strategies to promote psychological safety [12]. Therefore, socio-technical tools designed with autistic communication styles in mind could support psychological safety in teams with autistic and non-autistic individuals. Therefore, I ask following research questions.

RQ1 How do autistic developers experience psychological safety?
RQ2 What collaborative software design principles scaffold psychological safety for autistic software team members?
RQ3 How do collaborative software design principles scaffold psychological safety in majority, minority, and all autistic software teams?

2 Psychological Safety in Software Engineering

Psychological safety in software engineering is the shared belief among team members that it is safe to take interpersonal risks on the job [1]. Various constructions identify a psychologically safe environment, including comfort in communicating opinions, comfort in revealing mistakes, and the feeling of being valued by others [18].

Psychological safety has several advantages for software teams. Psychological safety fosters knowledge sharing, clarifies team norms, complements agile values, and supports a team's ability to pursue software quality. For example, Alami et al. [2] found that admitting mistakes and taking initiative help teams learn and invest their learning in future software quality decisions. Teams can pair technological tools and procedures with social strategies to promote software quality. Psychological safety also predicts self-assessed performance and job satisfaction of individual members [12].

Psychological safety in software teams requires that individuals cultivate an environment of no blame, openness, and collective decision making [1]. Human factor software engineering research has focused on mental health [21], but lacks in-depth descriptions of the relationship between common forms of neurodivergence and psychological safety in software engineering environments.

3 Autistic Students in Computing

Autism exists along the spectrum of neurodiversity. Autism is a lifelong neurological condition that affects an individual's communication and social abilities, along with restricted and repetitive behavior, interests, or activities [3]. There are over five million autistic adults in the United States of America [20]. During the next decade, up to 1.1 million young autistic people are expected to turn 18 and age out of the services provided under the federal Individuals with Disabilities Act (IDEA) [6]. 50% of autistic people lack an intellectual disability (possess average or above average intelligence); 16% will choose a field related to computer science [20]. This suggests that a large group of autistic adults will enter the job market and postsecondary education.

Despite technical aptitudes for computing [4], autistic people face considerable challenges in education and employment. Autistic people experience an 85% rate of unemployment and underemployment in the United States due to social stigma [16]. The unemployment rate for autistic people is significantly higher than in any other disability group, including learning disabilities, intellectual disabilities, or speech-language impairment (47% for other disability groups) [6]. In higher education, autistic students can experience higher rates of burnout, poor mental health symptoms, and thoughts of dropping out of college [7]. These findings highlight the need for interventions to support autistic education and employment.

The Double Empathy Problem is a theory that refers to mutual challenges in communication and understanding that occur when autistic and non-autistic individuals, interact with each other [14]. Software engineering courses tend to involve projects that rely on communication and collaboration between students, such as pair programming [19, 22] and stand-up meetings [15]. These communication practices tend to be implicitly adopted by non-autistic students, yet create hurdles for autistic students who struggle to identify implicit social cues [3].

4 Methods

Participants. I recruit participants from an online career development program designed to prepare autistic community college students in the United States for careers in AI-integrated software development. Participants are 18 years or older, have passed college classes in programming, and mathematics courses such as statistics, calculus, and linear algebra.

RQ1: Autistic Experience of Psychological Safety Neurodiversity contains a diverse range and categories of cognitive, social, and emotional characteristics. Diverse mental profiles contribute to different preferences, abilities, and interpretations in social settings. Thus, understanding how neurodivergent individuals interpret the characteristics of social environments as psychologically safe is a step toward tuning collaborative tools and processes to individuals in a team.

I survey participants on their neurodivergent traits using the Deenz neurodiversity scale [8], which requires participants to rate agreement with questions such as 'I sometimes struggle to understand when someone is joking.' Participants share their experience with psychological safety in collaborative work using the Edmonton Scale for Psychological Safety [9] with additional open-ended questions. For example, the requires participants to rate their agreement with statements such as 'It is difficult to ask other members of this team for help.' I follow up with semistructured retrospective interviews with participants to explain their responses to surveys explaining in more depth and providing more context to their experiences. I repeat the psychological safety scale and the retrospective interview protocol before, midway, and after the program to understand how the experience of psychological safety develops with repeated collaboration.

RQ2: Identify Design Principles for Psychological Safety. Adapted from an industrial practice, Online Mob Programming (OMP) is a technique in which a group of 4-6 students collaborate online through a structured process to solve programming tasks [17]. This process involves taking an interpersonal risk, in which participants suggest and digest new ideas, and requires psychological safety to initiate. The aim is to identify design principles to foster psychological safety in tools and processes collaborative software development using mob programming as a case study. The principles of universal learning design provide general guidelines for accessible learning environments [10]. For example, people who process speech at slower rates may feel more included when teammates visually represent their ideas. Using principles of universal design for learning, I iteratively design a collaborative visual space using a digital whiteboard to scaffold the collaborative practice of mob programming. In each iteration, I collect observations and self-reports of how participants use and talk about the design of the call to safely communicate ideas towards a shared solution to the programming problem [11]. This data is then used to refine the initial conjectures about psychological safety in collaborative software development and produce new designs that will ultimately test such hypotheses.

RQ3: Impact of Design Principles in Teams of Different Neurodiversity Compositions. Team composition may affect relationships and productivity [13]. Using the design principles and prototype resulting from RQ2, I conduct a follow-up quasi-experiment with a new cohort of majority, minority, and all neurodivergent teams to assess differences in feelings of psychological safety. The three teams will receive the tool and a mob programming ask. Their expectations of psychological safety will be measured before the tasks. After the task, participants will reflect on the psychological safety they experienced during the task through a post-survey and individual retrospective.

5 Conclusion

My work makes the following contributions to accessible software engineering education and practice: 1) Novel descriptions of psychological safety relating to neurodivergent cognitive and communication attributes; 2) design principles for fostering psychological

safety in collaborative software development teams; 3) a software development tool that scaffolds psychologically safe behavior in neurodiverse software teams.

I am on track to complete my dissertation by Spring 2027. The aim is to propose the described work in Spring 2026. I appreciate guidance on methodology, feedback on proposed contributions, and connections to relevant work and people to inform my approach to research.

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