



First Years Students' Impressions of Pair Programming in CS1

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Motivation

- Using Pair Programming in CS1 has quantitatively good effects on students
 - McDowell finds that when students use PP switch to solo in CS2, they outperform students who solo in CS1 (pass CS2 the first time)
 - In CS1
 - More confident in their work
 - More likely to complete CS1
 - More likely to stay in or select a computing major
 - Gender gap in confidence and retention rates decreased



Motivation

- Using Pair Programming in CS1 has qualitatively good effects on students
 - Melnick and Maurer
 - “I personally like pair programming”
 - “I believe pair programming improves software quality”
 - VanDeGrift
 - “enjoyed working with a partner”



Methodology

- Interviews with 11 students who used PP in CS1 and solo in CS2
 - During or near end of CS2
 - 30-60 minutes, semi-structured
 - What is PP?
 - What's valuable and unsatisfactory about PP?
 - Compare PP and SP experience
 - Describe your valuation of PP versus SP
- Read through transcripts for statements of interest
- Developed set of themes – in part guided by our knowledge of the literature and expectations as instructors



Outline

- Motivation and Related Work
- Methodology
 - What is PP?
 - What's valuable and unsatisfactory about PP?
 - Compare PP and SP experience
 - Describe your valuation of PP versus SP
- *What Did They Say?*
- Thematic Findings
 - Comparisons
 - Difficulties
 - Learning
 - Social Aspects
- Considerations for Institutions Considering PP in CS1



SP is more frustrating

- “I got stuck. I sat there for hours trying to figure out what was happening, and then somebody noticed some small error that I had, and I fixed it, and everything worked. And I just sort of sat there and cried for a little bit.”
- “It’s a lot more stressful, harder because you don’t have that extra person to help you think about what’s wrong.”

I get stuck more or find it harder to get unstuck when SP.

- "... was more brainstorming before when we did PP. It was like, "Oh, we want to do x, y, and z." Well, when I do it solo... It's in the back of my head [but he doesn't do that as much]... then when it gets stuck, I'm like, "I don't know what to do."
- "I probably get stuck more frequently. I've just been sitting at the computer too long, so my brain had stopped working through it. And I didn't know how to go any further."



I explore more ideas or solutions with PP.

- “[Pairing] I was more apt to explore a lot of different solutions than just go with the first one that I came across. ... there was also the willpower and the drive to explore different options and now sometimes I just want to get the assignment done.”
- “[L]ooking at it from a different angle, and figure out a different method to solving the problem and vice versa.”
- “[H]ard to figure things by yourself, so have another person to help you and get ideas from each other, different ways to solve a problem.”



SP may or may not take less time.

- Difficult to judge because assignments in CS2 were “bigger” and “more complex.”
- SP is faster because “it’s just me and I don’t have to explain an idea or get a consensus or something.”
- PP is faster because “[SP] you have to do all the thinking. ... You just have to keep on going and pushing yourself. When you can’t figure out things, it just – it takes a toll on you.”



A big problem with PP is scheduling.

- “The only thing I can really complain about is I guess are the times we were unable to meet.”
- “Since now I’m on my own schedule [with SP] I start it whenever I feel like it.”
- “The disadvantage is then you have to meet up with your partner and set up a time and everything...”

When to get started on SP assignments differs.

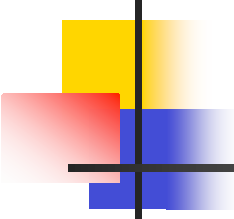
- "I'm embarrassed. Yes I procrastinate more [with SP]."
- "Whereas now [with SP] it really depends. Since now I'm on my own schedule I start it whenever I feel like it. I usually plan it out like two or three days before. And work on it every day."
- "I maybe start a little bit earlier on these assignments [SP], just because I can."

PP is a good way to learn programming in CS1.



- “Programming in pairs helped me a lot, so when it came time to program by myself, I was ready.”
- “I think it was a good way to start. I didn’t feel like I was totally alone in the lab. The first assignment we ever got – like I don’t remember exactly what we had to do. I just remember a whole bunch of jargon being thrown at me. And I felt like the whole rest of the class understood what was being instructed, and I was the only one in there that did not. And it turned out that everybody was kind of just as lost as I was.”

Theme: Learning



Students feel that they understand their programs better when they work by themselves.

- “[I] learn more because I have to do it myself and I can’t like lean on him if I don’t understand it.”
- “[Y]ou just have a better understanding of the code and Java overall.”

Students get a feeling of pride from completing programs by themselves.

- “[Y]ou solve things yourself, and there is that self-satisfaction like, oh, I finally figured the damn thing out.”
- “I like the high, I guess, you when you solve something.”
- “I guess more or less you feel more accomplished 'cause it's like, 'Oh, hey, I did this all by myself.'”

PP is a good way to meet my fellow CS students.



- “[Y]ou could build a relationship with a person, that you could grow together.”
- “I like to teach people. So with pair programming, I feel like I’m already contributing.”
- “[Y]ou’re not alone sitting at your computer.”
- “[M]eet more people.”
- “It’s helped build a group of people that I do know, of other students that I can go to for help or feel comfortable asking questions to.”

Solo students get lots of help from other students.



- “Well, even though it's called solo programming, I don't much [think?] people really did it themselves. There was a lot of asking other people for help and stuff.”
- “I ask my friend to look over the code before asking the TA.”
- “[T]here's always one or two students who finish the code a lot faster than everyone else so you just ask them, 'Hey, can you help me out?'”



Considerations for Institutions Considering PP in CS1

- Ease the transition from PP to SP
 - Final assignment in CS1 solo
- Formalize other students as resources
 - Provide structure for the natural seeking of advice
- Find ways to encourage individual understanding when PP
- Address scheduling issues
- Find ways of instilling pride in group success



Questions?



What did students say?

- What is PP?
 - How did you do it? What are the roles? How does it impact getting stuck?
 - They did seem to experience and engage PP as we instructed them to.
- What is useful about PP?
 - “Easier”, “handy”
 - Specific conditions for utility (“struggling”)
 - Partner as a resource
 - Usefulness in debugging or being stuck
 - Social and Career benefits



What did students say?

- Experiences when PP is satisfying
 - Positively influences learning (seeing different types of answers, learning good processes)
 - Interacting
 - Leaning on your partner
 - Social impacts (staying motivated)
 - Getting unstuck, getting assignments done
- Experiences when PP is unsatisfying
 - Differences in ability level
 - Creative differences
 - Being stuck together
 - Scheduling



What did students say

- Comparing PP to SP
 - Procrastination
 - Coding, Getting Stuck, Getting Unstuck
 - Time to Complete Assignments
 - Social Impacts
- Valuation of PP versus SP
 - Understanding of code greater in SP
 - PP benefits:
 - SP benefits: scheduling
 - Confidence higher with SP
 - PP as preparation for SP