

Creative Technology Research Lab

View this link in an accessible format online at
CTRL.education.illinois.edu/TACTICal



Project TACTIC: Teaching All Computational Thinking through Inclusion and Collaboration

TACTICal Teaching Brief

**Helpful Strategies for Peer
Collaboration during K-12
Computer Science Instruction**



Introduction

Research on collaborative learning has shown that, when done well, it can promote cooperation and improve academic achievement for a broad range of learners in K-12 classrooms (Barkley, Cross, & Major 2014). Computer science (CS) education is often highly collaborative because of the focus on creativity and finding solutions to ambiguous or ill- defined problems. Thus, the K- 12 Computer Science Framework counts collaboration as one of the core computing practices (K-12 CS Framework, 2016).

In engaging our students in collaborative learning within CS education, we seek to promote the following behaviors:

- Maximize interactions so that students reach their desired learning goals.
- Promote opportunities for interdependence where each member’s efforts are valued.
- Provide explicit supports and strategies to encourage individual accountability.
- Set up the classroom environment to be conducive to student interactions.
- Model and encourage interpersonal and social group skills for students with varying communication and collaboration strengths and challenges.
- Facilitate group processing to reflect on the collaboration as well as the CS education content.



Figure 1. Computing Practices (K-12 CS Framework, 2016)

Scenario

Mr. Gibson is a 3rd grade teacher who has integrated CS education into his classroom core curriculum. Three students with disabilities are included in his 3rd grade class. Ms. Robbins, a paraeducator, provides support for these students during these CS education lessons.

- *Rachel* has a learning disability related to math;
- *Roberto* has a social communication disorder that kept him from verbally expressing his needs; and
- *Connie* has an emotional behavior disorder as well as a speech/language impairment and often does not interact with her peers.

Mr. Gibson noticed that each of these students had different challenges related to collaborating with their peers during the CS activities. He also noticed that some of the students without disabilities also struggled with collaboration.

- Although *Rachel* does collaborate with her peers, that collaboration often is not productive because she is often taken out of CS class to receive her IEP-related services and misses a great deal of content.
- *Roberto* has significant challenges with communication and often becomes frustrated when he cannot express his need for help or confusion about the CS content.
- *Connie* has strong CS skills due to a personal interest in computer science and video games. However, because she typically sits in an assigned seat that is away from her peers, she does not often have opportunities to interact with others. Consequently, even though she has a great deal of knowledge and experience in CS, her lack of interpersonal skills keep her from having more productive interactions with her peers.

Ms. Robbins suggested that Mr. Gibson meet with Ms. Gomez, the special education teacher, as well as Ms. Hightower, the speech/language pathologist to help address the challenges described above. With the support of these professionals, Ms. Robbins and Mr. Gibson hope to capitalize on the strengths of these students to help them collaborate more effectively during the CS education activities.

Do any of these challenges sound familiar?

Can you relate to any of these?

Common Challenges

- Paraeducators are often “assigned” to working with some students. These students are frequently seated together in the back or side of the room, away from their peers, and have limited access to collaborative opportunities.
- Many students consistently ask their peers for help, leaving them stuck in the disempowering role of constant help seeker.
- Some students with and without disabilities want to collaborate with their peers but lack the understanding of how to engage in productive discourse (such effective help seeking), leading them to either avoid collaboration or become overly frustrated.
- Students who seek help from or collaborate with others, lack the knowledge of how to do so effectively, leading to continued frustration..
- Often, student collaboration veers off topic or becomes unproductive.

Strategies for Encouraging Peer Collaboration

1. Create a classroom environment conducive to collaboration.

- Consider the arrangement of the classroom, how students are seated, and classroom rules in regards to where and how students work. For example, desks placed in rows inhibit movement necessary for productive discourse with anyone other than immediate peers. Additionally, students “seats” do not have to be permanent. They can move based on activity and collaborative preference.
- Place anchor charts with “rules and roles” of collaboration in prominent places.

2. Explicit teach and model collaboration (Initially, collaboration maybe a distinct learning goal and not just a means to an end).

- Encourage collaborative dialogue that provides students with language to assist them in seeking and giving help.
- Model this language and the productive interplay between peers (e.g., effective ways of asking for help and giving support in ways that promote independence). This is essential in assisting students with disabilities to articulate a problem and receive aid constructively.
- Teach specific language and prompts to use as part of this process. Students often benefit from helper language, such as sentence stems, that enable them with linguistic tools to unpack a problem as they search for its solution with a peer.

3. Explore different models of collaboration to best meet the needs of all students.

- Implement different collaborative models. Some students work better in less structured help seeking/supportive collaborative models. Others work better with more structured, assigned roles. If using assigned roles, be sure to vary the roles regularly so that students are not repeatedly performing the same task.
 - For instance, if utilizing pair programming, a timer can be used to signal students in the dyad to switch at regular intervals from working as the driver or navigator.
- Consider the individual strengths and needs of students when assigning collaborative tasks, and monitor to make sure the student is involved and contributing.
- Evaluate how individual work can be balanced with collaborative problem solving to meet the needs of students resistant to encourage in collaboration.

Strategies for Encouraging Peer Collaboration

- 4. Remind students to use the collaboration strategies introduced in class and offer feedback on the use of those strategies.**
 - Use priming phrases, such as, “remember that your friends are helpers too!” or “Please ask for help from a friend before coming to me.” These initial reminders are sometimes necessary to help students see opportunities for collaboration.
 - Prompt students to cue the students to use taught strategies such as “Remember to use the Collaboration Discussion Framework” (Lash & Park, 2014).

- 5. Utilize anchor charts and other aids to help scaffold collaborative behaviors.**
 - Display anchor charts with prompts and helper language prominently and reference when modeling the collaborative process.
 - Integrate checklists for individual roles into assignments or give them to students to use as a reference or self-monitoring strategy. Checklists also keep students moving forward in meeting all goals for the lesson.

- 6. Empower and encourage situations where students independently begin and maintain effective collaboration through specific feedback and praise.**
 - Encourage students to share their CS experiences. These conversations can spark ideas or result in further productive conversation and innovation.

- 7. Consider engaging your students in cross-age collaborations or peer tutoring.**
 - Cross-grade collaborations, often referred to as buddy classes, have long been used to as a type of peer tutoring for reading, allowing older students to work with and model for younger students (Newell, 1996).
 - Encourage opportunities for students to reinforce their own learning, while engaging in the development of supportive relationships with individuals possessing diverse perspectives, skills and personalities. The personal nature of these partnerships can result in a high degree of engagement.
 - Consider student strengths, likes and needs when forming dyads.

Collaborative Discussion Framework (CDF) is one such tool:

What are you trying to do?

- Do they have or understand the purpose?

What have you tried already?

- Restate in steps what they have already done

What else do you think you can try?

- Brainstorm, encourage students to take a chance.

What would happen if....?

- Come up with some possible solutions and hypothesize the outcomes. Test each hypothesis.

Celebrate & Share!!

- Take charge of celebrating one's excitement.

The CDF with helper language may be found at: <https://goo.gl/JzusYW>

Summary

After working with the instructional team, Mr. Gibson is beginning to see major shifts in the collaboration among students while they work on CS education projects.

Ms. Robbins has moved students, including Connie, from a table in the back of the room and is working with them as they are heterogeneously grouped with their peers. They now have greater opportunities for interaction and to work collaboratively.

Although Rachel is still pulled from class to receive her IEP-related services, when she returns, she can still benefit from the many classroom anchor charts posted around the room related to collaboratively working on CS education projects. Mr. Gibson has also made arrangements with Rachel and her partner so that they can continue project work in their flex time.

Roberto is collaborating more effectively due to the entire instructional team's commitment to modeling collaborative language and behaviors. While collaboration is still challenging for him, the use of the Collaborative Discussion Framework has provided him with the tools to productively engage with his peers around CS education activities.

Citations

Barkley, E. F., Cross, K. P., & Major, C. H. (2014). Collaborative learning techniques: A handbook for college faculty. San Francisco, CA: Jossey-Bass

Israel, M., Wherfel, Q., Pearson, J., Shehab, S., & Tapia, T. (2015). Empowering K-12 students with disabilities to learn computational thinking and computer programming. *TEACHING Exceptional Children*, 48(1), 45-53.

Newell, F. M. (1996). Effects of a cross-age tutoring program on computer literacy learning of second-grade students. *Journal of Research on Computing in Education*, 28(3), 346-358.

Park, M., & Lash, T. (2014). *The Collaborative Discussion Framework*. Champaign Unit 4 School District.

Sencibaugh, J. M., & Sencibaugh, A. M. (2016). An analysis of cooperative learning approaches for students with learning disabilities. *Education*, 136(3), 356-364.

Recommended Citation:

Lash, T., Jeong, G., Wherfel, Q., & Israel, M. (2017). *Helpful strategies for peer collaboration during K-12 computer science instruction*. Project TACTIC: Teaching All Computational Thinking through Inclusion and Collaboration. Retrieved from University of Illinois, Creative Technology Research Lab website: CTRL.education.illinois.edu/TACTICal

Note: There are no copyright restrictions on this document; however, please use the proper citation.



Funding for this research was provided by the National Science Foundation (award #1639837). Any opinions, findings, conclusions, or recommendations expressed in this material are those of the authors and do not necessarily reflect those of the NSF.

For More Information, please contact: Maya Israel (misrael@illinois.edu).