COLLEGE OF EDUCATION AT ILLINOIS

Latest CS/CT Research Overview

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Shifting education

CTRL+shift

Creative Technology Research Lab

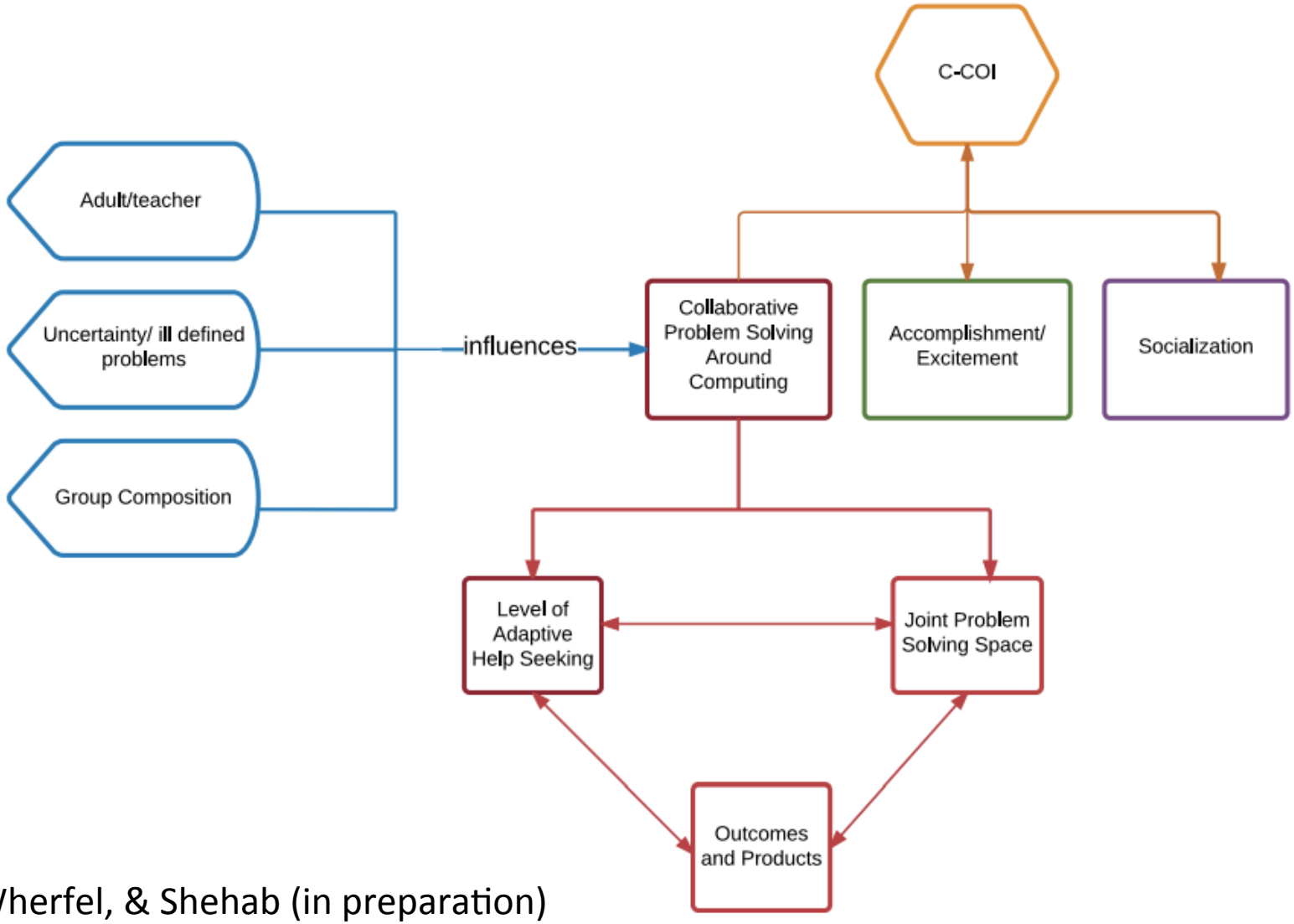
Roadmap

- Introductions and Overview
- Collaborative Computing
- Students with disabilities
- Integrated math and CS/CT
- Next Steps

Where We've Been

- Fall 2013:
  - Cross-case analysis across 6 teachers in different contexts (classroom teachers, enrichment, specials, etc.)
  - Focus on teachers and classroom implementation
- Spring 2014-Fall 2014:
  - Shift to student data collection
  - Data: Student collaboration, students with disabilities,
  - instrument development: Collaborative Computing Observation Instrument (C-COI)
- Spring 2015
  - Integrated computing and mathematics
  - Continued work on collaborative computing with the C-COI instrument
  - Students with disabilities case study
- Fall 2015
  - Focus on assessing computational thinking, continued work on C-COI data collection/analysis, and coaching

Collaborative Computing Conceptual Framework



Israel, Wherfel, & Shehab (in preparation)

Measuring Collaborative Computing

- Collaborative Computing Observation Instrument (C-COI)
  - Use of Screencast software to capture all computing activities and audio of student collaboration
  - Dependent variables include amount of time persisting on tasks, methods of help seeking, collaborative problem solving, and computing challenges.

C-COI: Collaborative Computing

- Development, validation, and use of the Collaborative Computing Observation Instrument (C-COI)

Path #10

1. (13:00) 1-G: Student works independently with self-talk [Student continues to work independently on the same problem by manipulating the blocks.]—**END**

Path #11

1. (13:48) 1-A: Student seeks attention
2. (13:48) 2-A: Student expresses a problem
3. (13:48) 3-B: Problem is related to computing/programming
4. (13:48) 4-B: Student expresses need for help but is not explicit to the problem ["Hey [Student name], can you help me?" Peer answers, "What are you trying to do?" Student responds, "I'm trying to do this. It's just not working"]
5. (13:48) 8-A: Student initiates peer "Denise"
6. (13:48) 9-A: Peer verbally responds to the problem [P: "What have you tried already?" S: "I tried that?" P: "What else do you think you could try?" S: "Hm. Um. Changes the numbers inside the blocks. P: What happens if? Um. [Inaudible] Students are experimenting with the degrees and movement amounts.]
7. (13:48) 10-B: Student and peer are interacting together on the student's problem
8. (15:00) 12-B: Peer and student collaboratively discuss the problem, problem was not solved
9. (15:00) 14-A: Problem was not solved, student works independently [Student continues to play with the blocks but there is no systematic method to this exploration.]
10. (17:56) 1-A: Student seeks attention
11. (17:56) 2-A: Student expresses a problem
12. (17:56) 3-B: Problem is related to computing/programming [This is the same problem that the student has been working on.]
13. (17:56) 4-B: Student expresses need for help but is not explicit to the problem ["Hey [peer name], help"]
14. (17:56) 8-A: Student initiates peer "Anthony"
15. (17:56) 9-A: Peer verbally responds to the problem ["What have you tried already?" S: I tried this.]
16. (18:00) 10-A: Peer does not know how to help [Peer, "[peer 2 name], do you remember how to do this?"]
17. (18:34) 1-A: Student seeks attention [Peer elicits another peer. They don't work together. It becomes a new interaction.]
18. (18:34) 2-A: Student expresses a problem
19. (18:34) 3-B: Problem is related to computing/programming
20. (18:34) 4-B: Student expresses need for help but is not explicit to the problem
21. (18:34) 8-A: Student initiates peer "Denise" [Peer initiates another peer]
22. (18:34) 9-A: Peer verbally responds to the problem
23. (18:34) 10-B: Student and peer are interacting together on the student's problem [Peer: "Denise, do you remember how to do this?" Peer 2: "What else do you think you can try? Peer 2 walks the student through the problem. "What would happen if, do you know how to do the triangle?"]
24. (18:34) 12-B: Peer and student collaboratively discuss the problem, problem was not solved [Peer: "Let's run the program to see where we are." The program is incorrect. Peer: "You probably need to move forward." Peer: "What would happen if you put a repeat block right there and um." It is unclear whether the peer is doing the work here or the student.]
25. (21:34) 14-A: Problem was not solved, student works independently [Student continues to work on the problem.]
26. (21:34) 1-G: Student works independently with self-talk—**END**

Path #12

1. (24:06) 1-B: Student is initiated by a peer "Unknown"
2. (24:06) 7-+: Other: [Peer says, "I need help." Student says, "Me too."]—**END**

Path #13

1. (24:06) 1-A: Student seeks attention
2. (24:06) 2-A: Student expresses a problem
3. (24:06) 3-B: Problem is related to computing/programming [Student is still on the same problem]

Instrument citation: Israel, Ramos, Wherfel, & Shehab (2015). Collaborative Computing Observation Instrument (C-COI). Board of Trustees of the University of Illinois at Urbana-Champaign. Available at http://mste.illinois.edu/c-coi

Node 1: Capturing student's action	Node 2: Capturing student's expression	Node 3: Problem content
Student seeks attention Student is initiated by a peer Student is initiated by an adult Student offers elicited support to peer Student offers unelicited support to peer Student works independently without self-talk	Student expresses a problem Student expresses curiosity, excitement, or accomplishment Student socializes Other (use notes)	Problem is related to general technology Problem is related to computing/programming Problem is related to academic content Problem is related to navigating software Other (use notes)
Node 4: Help Seeking	**Node 5: Describing curiosity or excitement**	**Node 6: Describing socialization**
Student clearly states how they need help Student expresses need for help but is not explicit to the problem Peer offers help in response to the student's frustration Peer offers unelicited help Adult offers help in response to student's frustration Adult offers unelicited help Other (use notes)	Student is curious about something associated with their own work Student is curious about something associated with peer's work Student is excited about something associated with their own work Student is excited about something associated with peer's work Student wants to show or express accomplishment on their own work	Student socializes with peer, not related to computing Student socializes with adult, not related to computing Other (use notes)
Node 7: Peer or student's response to help seeking	**Node 8: Who is initiated?**	**Node 9: Response to initiation**
Peer helps student with a problem on student's computer Peer seeks student's curiosity/excitement/accomplishment on student's computer Peer starts socializing, heard on student's computer	Student initiates peer Student initiates adult Student dismisses their attempt to interact Other (use notes)	Peer verbally responds to the problem Peer verbally responds to student's curiosity/excitement/accomplishment Student verbally responds to peer curiosity/excitement/accomplishment Another person joins the student-peer interaction around
Node 10: Reporting Interaction	**Node 11: Adult's response**	**Node 12: Describing Interaction**
Peer does not know how to help Student and peer are interacting together on the student's problem Student terminates the interaction	Peer helps student with a problem on student's computer Peer seeks student's curiosity/excitement/accomplishment on student's computer Peer starts socializing, heard on student's computer Student helps peer with a problem on student's computer Student ignores the peer	Peer and student collaboratively discuss the problem, problem was solved Peer and student collaboratively discuss the problem, problem was not solved Peer explains the problem, problem was solved Peer explains the problem, problem was not solved
Node 13: Problem solved	**Node 14:Problem not solved**	
Problem was solved, student works independently Problem was solved, the student seeks attention from the same peer Problem was solved, the student seeks attention from a different peer Problem was solved, the student seeks attention from an adult	Problem was not solved, student works independently Problem was not solved, student seeks attention from the same peer Problem was not solved, student seeks attention from a different peer Problem was not solved, student seeks attention from an adult	

Example 1

Student seeks attention from a peer around a problem related to computing. Collaborative Discussion Framework partially implemented but problem was not solved. The student seeks further help from an adult.
Comp 10 11/6/2015 @ 4:01

http://mste.illinois.edu/c-coi/

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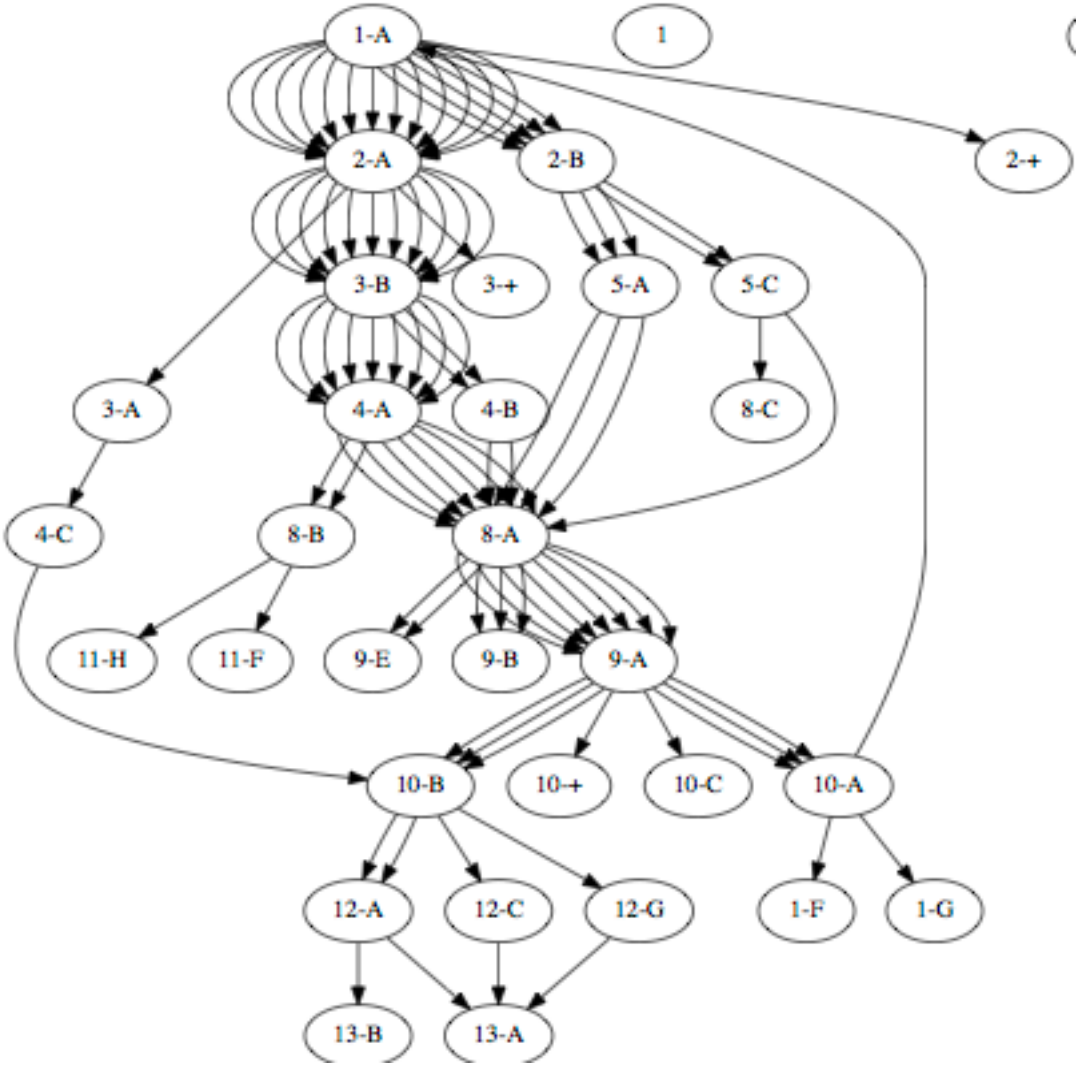
Node 13: Problem solved	**Node 14:Problem not solved**	
Problem was solved, student works independently Problem was solved, the student seeks attention from the same peer Problem was solved, the student seeks attention from a different peer Problem was solved, the student seeks attention from an adult	Problem was not solved, student works independently Problem was not solved, student seeks attention from the same peer Problem was not solved, student seeks attention from a different peer Problem was not solved, student seeks attention from an adult	

More Examples

Student seeks attention and socializes with an adult.
Comp 6 11/6/2015 @ 6:01

Student seeks attention from an adult around a problem related to computing. Adult directs student to talk to a peer.
Comp 6 11/6/2015 @ 24:23

C-COI Instrument Output



Data Collection

- We have observed students across K-5
- Most recently…. We picked 20 students across 3rd and 4th grade to see a range of abilities related to:
  - Computing
  - Collaboration
- Used Screencastify to record screens of student computers and audio of

Israel, Shehab, & Wherfel (in preparation)

Findings and Tips

- Students are using the Collaborative Discussion Framework!!!!
  - Sort of…..
- There is a lot of competition on Code.org.
  - How do we get them to slow down?
- Some students spend a LOT of time on a single level, show persistence, but do not collaborate and do not succeed.

Computing and Students with Disabilities

- SWD who struggle with complex problem solving, math, and abstract reasoning face challenges with computing.

- Teachers working with SWD are trying to understand how to support their learners in computing so that they can meaningfully engage in and benefit from computing education.

Snodgrass, Israel, & Reese (in preparation)

Research Study Context

There is a well established rationale for computing in K-12.

Few studies have examined computing with diverse learners.

No studies until ours have examined school-wide computing in diverse K-12 contexts.

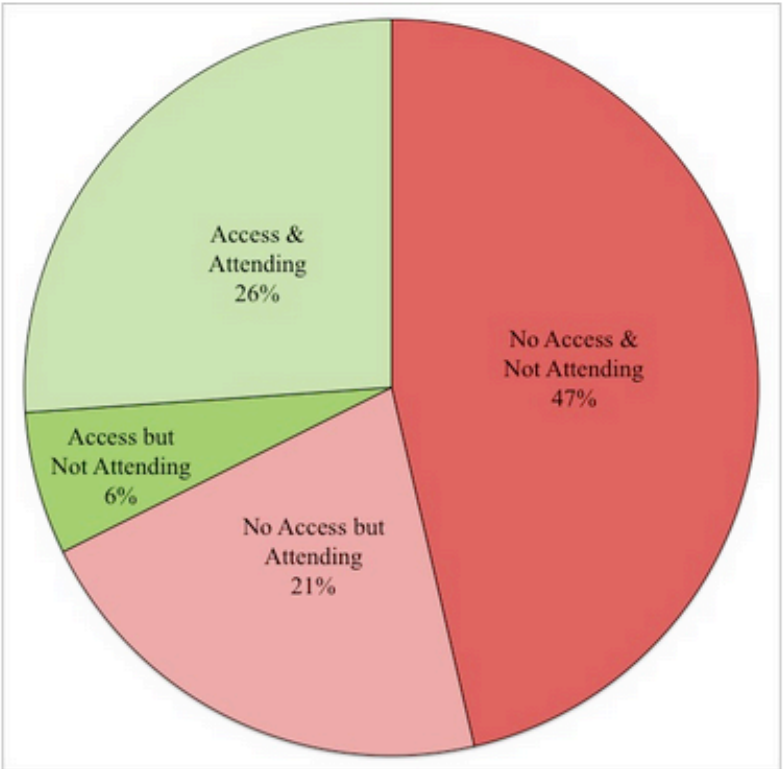
Our methods are exploratory because this is new territory… We have a lot to learn.

Changing Hypotheses

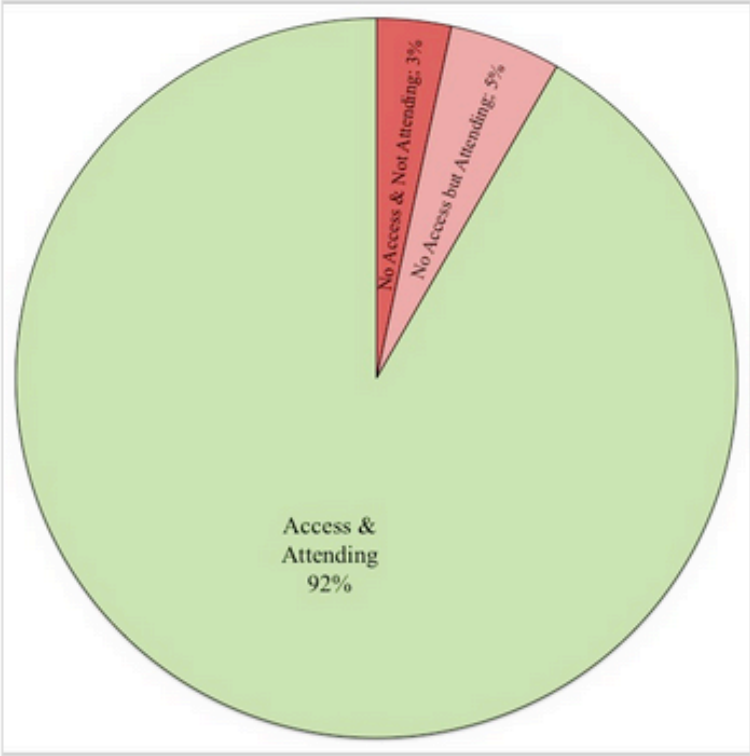
- **<u>Initial Assertion</u>**:
  - Students with disabilities require CT-specific supports to successfully engage with instructional CT activities, and when these supports are not available, students with disabilities cannot meaningfully engage in those activities.

- Teachers & researchers all had this hypothesis initially.

Horatio (4th grade)

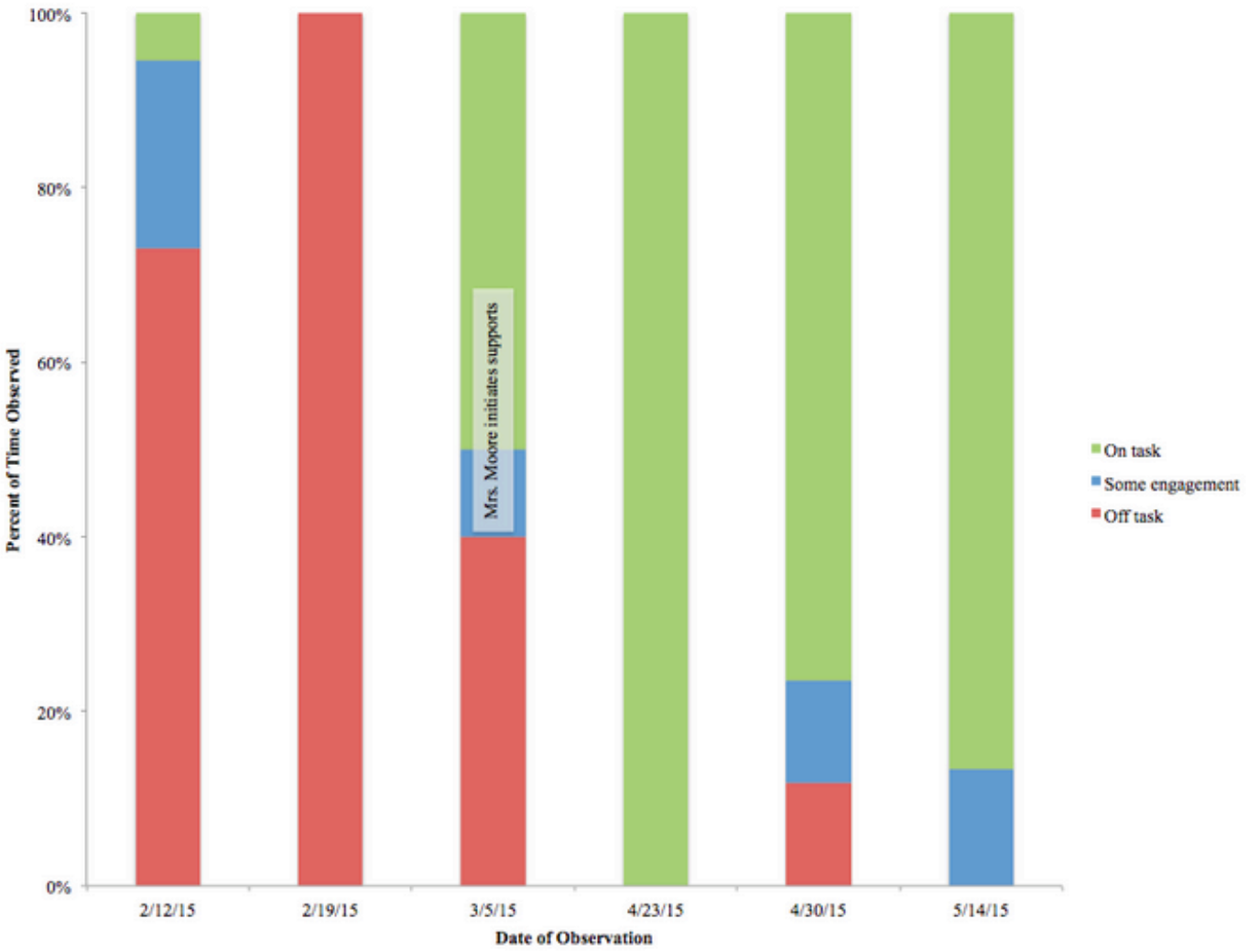


Initial Engagement



Final Engagement

Deacon (5th grade)



Final Assertions: This is VERY good news!!

Assertion 1: Identifying students' unique support needs is critical to their success in school, including CT. For students w/o disabilities, these supports are likely encompassed w/ in strong pedagogy. For SWD, supports specific to their unique needs must also be provided in addition to content pedagogy. These student-specific supports are likely persistent across content areas, including CT.

Assertion 2: Many teachers have limited CT experience, and CT pedagogy is still emerging. However, students can make progress in CT even as teachers develop their competence in CT skills and emerging pedagogy. This is also true for SWD as long as teachers also implement student-specific supports.

Integrating CS/CT and Math

- Analysis is still underway.
- All teacher interviews have been transcribed and codes have been developed.
- All observation notes are organized.

- Now, putting the puzzle pieces together.

Assessment, Coaching, and Collaboration

- Meeting with the experts

- CS/CT Writing prompts/journaling tied to Wonders Curriculum

- Artifact based interviews with peers interviewing each other (K. Brennan, Harvard).

******Student consent process******

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