

High School Students' and Scientists' Experiential Descriptions of Cogenerative Dialogs

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STEMers

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Research Motivation

- **Benefits of working with scientists**

- Students' scientific knowledge (e.g., Charney et al. 2007)
- Students' understanding of the nature of science and scientific inquiry (e.g., Burgin & Sadler, 2016)
- Attitude toward and interest in science (e.g., Gibson and Chase 2002)
- Students' confidence and self-efficacy (e.g., Stake & Mares, 2005)
- Students' career aspirations (e.g., Abraham, 2002)

- **Challenges of working with scientists**

- Intimidation (e.g., Howe-Walsh & Turnbull, 2016)
- Barriers of communication- jargon and complex concepts of scientific language (e.g., Shein & Tsai, 2015)
- Ineffective teaching practice (Mumba, Mejia, Chabalengula, & Mbewe, 2010)
- Disappointing interactions (Masson, Klop, & Osseweijer, 2016)



Cogenerative Dialogue

Cogenerative dialogues (cogens) are conversations among **different stakeholders** to reflect their **collective experiences**, with the goal of reaching **collective decisions** about the rules, roles, and responsibilities that govern their shared activities (Roth, Tobin, and Zimmermann 2002).

Positive Impacts

- Reflexivity of science teachers (Siry & Martin, 2014)
- Students' attendance, achievement on tests, and time on tasks (Tobin, 2008)
- Attention from individual to collective, shared responsibility (Bondi, 2013)



Research Question

What were high school students' and scientists' experiential descriptions about cogenerative dialogs?

Significances

- Pioneering study to use cogens in a science internship setting with scientists
- Capture both students' and scientists' experience discourse

Research Context: Work With A Scientist Program

<http://workwithascientist.utep.edu>

Work With A Scientist Program

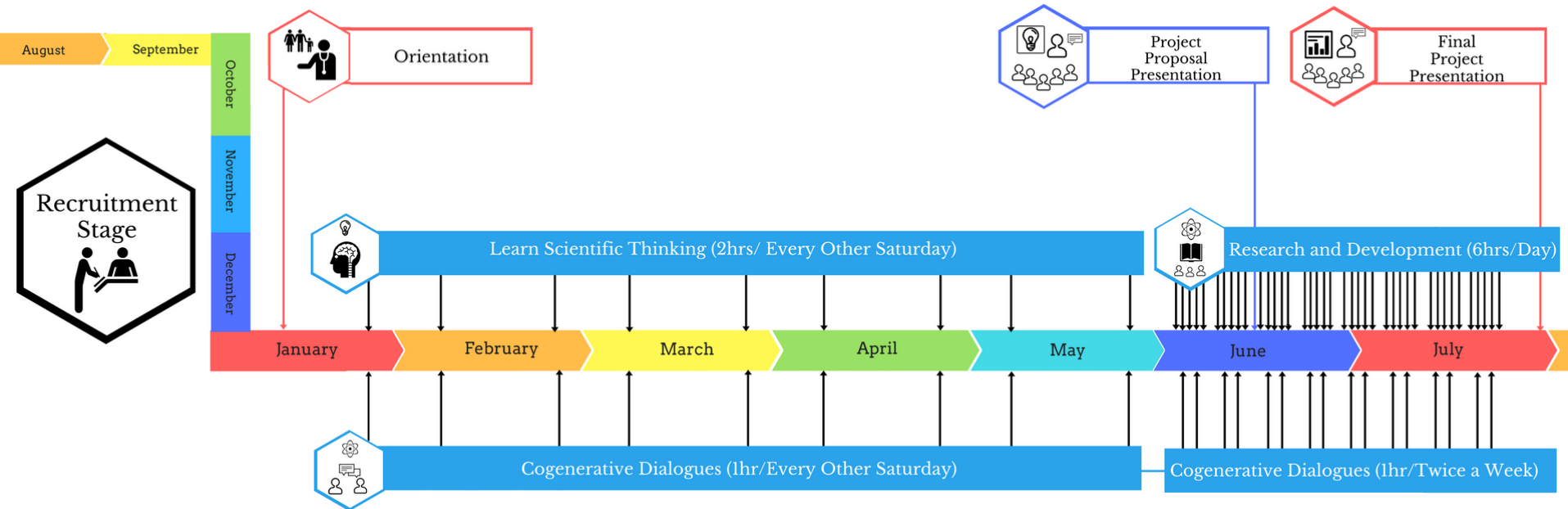


Welcome Media Team Co-generative Dialogues Testimonials Student Projects Documents and Forms
Newsroom Publications Presentations Newsletter FAQ Contact Us Acknowledgement

Research Context

Work With A Scientist Program

- Four lead scientists (chemistry, neuroscience, immunology, biology) with their research teams
- 36 high school students from Title 1 schools
- Seven months (every other Saturday in Spring Semester and 30 days in summer)
- Open inquiry projects with regular cogenerative dialogues
- Proposal and final presentations to the public





Campus Recruitment



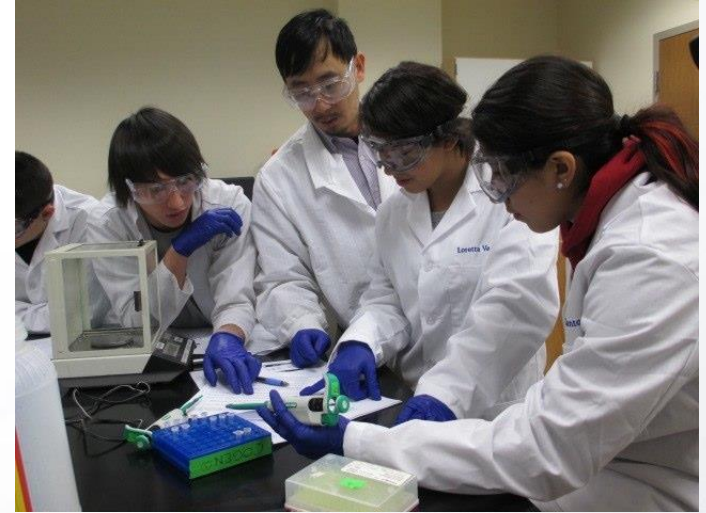
Family Night





Project Orientation





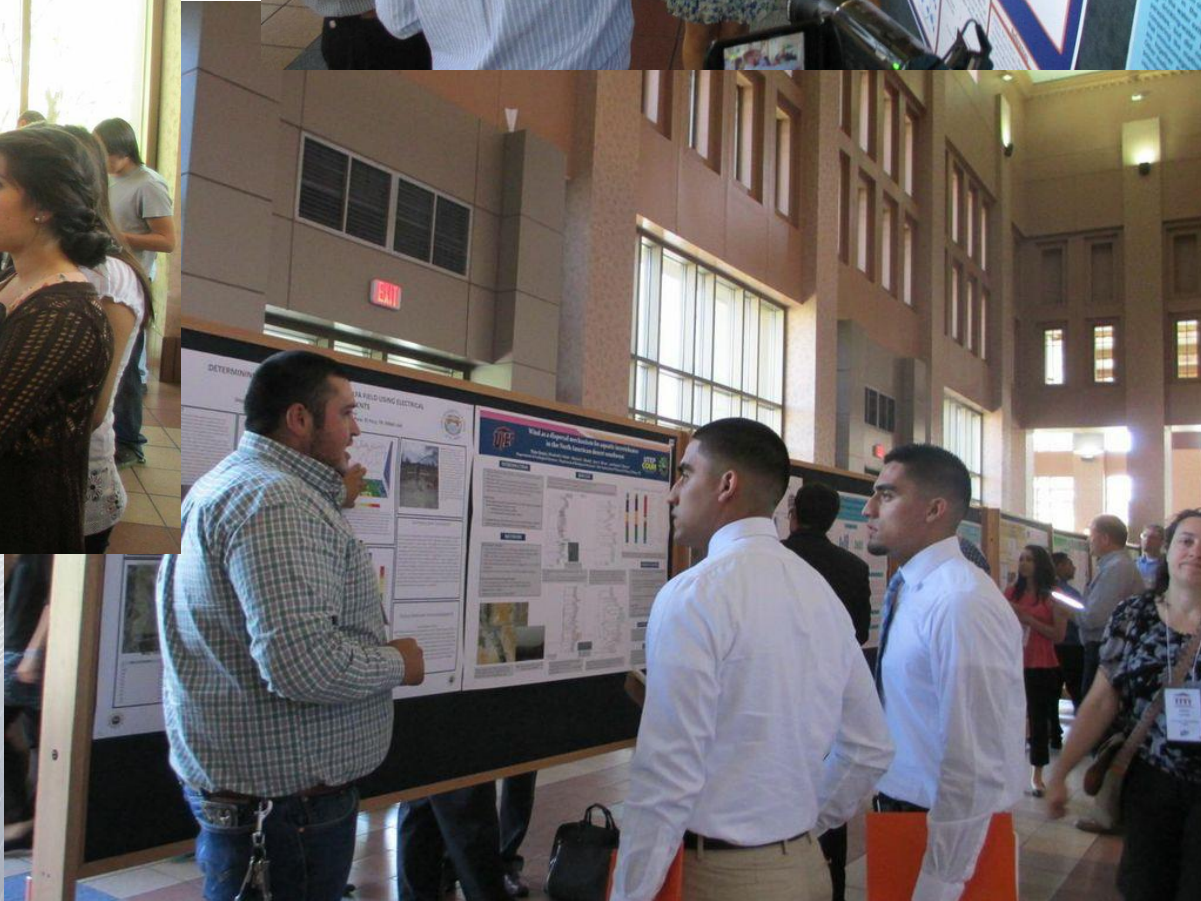
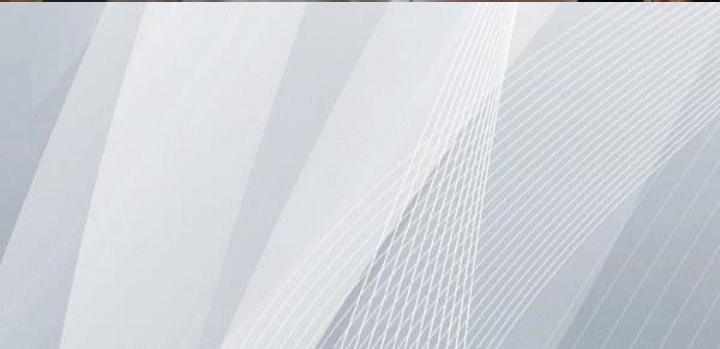
Internship Activities



Cogenerative Dialogues



COURI Conference Visit





Proposal Presentation





Final Presentation



Work With A Scientist Program Timeline and Activities

Scientific Thinking and Practice (Jan-May)

Research Proposal (June)

- Research Proposal Presentation (June 20, UTEP)

Project Plan (June)

Hands-on Scientific Practice and
Research Report (July)

- Research Report Presentation (July, 25, UTEP)

Regular
cogens

Cogenerative Dialogues in the Science Internship



- **Rules of Cogens (Emdin, 2011)**

1. Each person has equal turns and times to talk
2. Each person shows respect and listens attentively in conversations
3. A plan of action for addressing issues is generated, to be implemented in further practice.
4. Video clips of collective practice are available for discussion.

- **The Structure of Cogens**

1. Discuss the implementation of ideas generated by consensus in the previous cogen
2. Discuss issues/positives/topics this week
 - Discuss issues and solutions with group
 - Discuss positives
 - Discuss other topics
3. Discuss the quality of cogen today (randomly check 3 items from the heuristics [Tobin & Alexakos, 2013])

Cogenerative Dialogues Heuristics (Tobin & Alexakos, 2013)

1. I strive to make sense of what others are saying.
2. Others choose to strive to make sense of what I am saying.
3. I try to get others to contribute to what is being discussed.
4. Others try to get me to contribute to during discussions.
5. There is a place for me to speak. Therefore, I speak as much as others in my group.
6. Others in my group have the opportunity to speak as often as I do.
7. Every member of the group has equal opportunity to talk as often as I do.
8. The members of my group have equal opportunity to talk.

9. My talk is respectful.
10. The members of my group show respect for one another.
11. When I talk others listen to what I have to say.
12. When others talk I listen to what they have to say.
13. When I talk I build on what others have to say.
14. When others talk they build on what I have to say.
15. I try to learn from others' talk.
16. Others strive to learn from my oral contributions.
17. Different perspectives are valued in my group.
18. I value different perspectives of those in my group.
19. The group strives to have all voices heard.
20. The group strives to have all voices heard that incorporates all perspectives.
21. I try to understand different perspectives.
22. Others value my contributions to group dialogue.
23. There is a shared mood in the group.
24. There is synchrony within discussions of the group.
25. I feel as if I belong with this group.
26. The members of the group have a sense of solidarity.
27. I maintain focus during dialogue.
28. Others maintain focus during dialogue.
29. Dialogue in the group is timely.
30. Dialogue in the group is appropriate.
31. Dialogue in the group is anticipatory.
32. Others' oral contributions are thoughtful.
33. My oral contributions are thoughtful.
34. As I listen to others, I attempt to put aside my own perspectives and understand theirs.
35. Others set aside their perspectives when they listen to me.
36. I test the potential of others' ideas.
37. Others test the potential of my ideas.
38. I value different perspectives.
39. During group discussions there is at least one review of what was accomplished.
40. Different perspectives from members of the group have contributed to my own learning.

Cogenerative Dialogues in the Science Internship

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- **Cogen Mediator**

An example of cogenerative dialogues

S 1: I don't know if it's just me, but I felt really sleepy and like nobody was engaged.

Mediator: Okay, so would you help me understand what is the issue?

S 1: It's like [be]cause sometimes there's these big words I don't know what they are, and so it makes it hard, like hard to follow along and for me to actually form questions to ask.

Scientist: Okay.

...

TA 1: Maybe [we can have] more visuals to like, as you guys are talking, like visuals to connect, like put a picture to what they were talking about.

...

Scientist: Yeah. That's a good. So next time we can maybe do a PowerPoint presentation of the different projects that we have in the lab, but we will of course guide you step by step and you will see all of that ... I appreciate your comments. I did not realize that...

Mediator: Okay. So what Dr. Gonzales is saying is that for the next internships, they're not supposed to be that all talking without graphic or hands-on. Did I understand this right?

Scientist: Mm-hmm.

Mediator: It's going to lend itself to more

Scientist: hands on. Yeah, it's going to be more hands on.

S 1: I think it's a good solution, but I also think that there's something else that we could add to that [be]cause like the lecturing part of it, it's not really just like that they were just lecturing us, [be]cause they did ask us questions, and we really didn't engage ourselves.

S 2: I think that's another issue, like definitely.

S 3: I'd say for all of us, just to ask more questions or answer questions even if we don't know the answer to. Just try to come up with an answer, engage more.

Issue: The quality of scientists'/assistants' instructions

Solution: adding visuals, powerpoint, hands on activities

Issue: The quality of students' participation

Solution: ask more questions, engage more



Research Question

What were high school students' and scientists' experiential descriptions about cogenerative dialogs?

Significances

- Pioneering study to use cogens in a science internship setting with scientists
- Capture both students and scientists' experience discourse



Participants & Data Sources

- Participants
 - 36 internship students (~90% Hispanic, ~80% low SES), 4 scientists (chemist, neuroscientist, 2 immunologists), 8 science teaching assistants
- Data sources
 - Students' journals and interviews about cogen experience
 - Scientists and teaching assistants' interviews about cogen experience

Interview Context





Data Analysis: Phenomenography

- Familiarization
- Condensation
- Classification
- Preliminary comparison
- Naming
- Contrastive comparison

(Dahlgren & Fallsberg, 1991)

- ✓ Position
- ✓ Frequency
- ✓ Pregnancy

(Sjöström & Dahlgren, 2002)

Enhance the credibility of data analysis (Guba & Lincoln, 1989)

- Prolonged engagement (7 months)
- Persistent observation (Video recording, Field notes)



Findings

- **Postive experience**

- a) Cogens allowed participants to work as a team to improve science internship teaching and learning
- b) Cogens provided a respectful and supportive space where participants could voice their perspectives
- c) Cogens allowed students and scientists to demonstrate care and foster a stronger bond between them
- d) Cogens provided opportunities for the participants to receive constructive criticism and improve themselves as individuals

- **Challenging experience**

- a) Participants sometimes had difficulties coming up with ideas for cogens
- b) Cogen mediators did not always facilitate the dialogue effectively



Findings

- **Postive experience**

- a) Cogens allowed participants to work as a team to improve science internship teaching and learning

Cogen, well, we're sharing our thoughts, our feelings, our heart, our research, and I really like, that made me happy and that people were actually doing something, we're like **working together**. (St1)

I think cogen is critical. I think it's part of how the scientific process works. And I think it fits naturally into the process because you really have to have those dialogues for scientific ideas to bloom, and the kids figured that out right away, and they realized **that they have to network, and discuss, and talk, and brainstorm, and troubleshoot**, and all those things, which is all of what cogen is exactly. (Sc3)



Findings

- **Postive experience**

- a) Cogens allowed participants to work as a team to improve science internship teaching and learning
- b) Cogens provided a respectful and supportive space where participants could voice their perspectives

Cogen is empowering because, like, **everyone had a voice and equal amount of turns and times**. And everyone listened to you. Because, like, just be able to speak and like, truly be listened and truly be heard. I felt like that was like the greatest thing. (St4)

Cogen is the right time to sit down and listen and learn from the experience so far. It's like a general update in a nice environment where you **let everybody express themselves** about what they're learning, what they're not learning, why they're not learning. (Sc1)



Findings

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[What] greatly fascinated me is that **they not only care about our safety, but also how we feel**. Cogen rules are to help better everyone and make us all equal. The scientists made it very clear that **they care about our participation** and opinions just as much as everyone else. I like to know that the **scientist believes in all of us and cares**. (St10)

I feel like a family during cogen. When in a family, you always have to talk to each other, that is the whole point of a family. So like, converse with each other, and actually get a grasp of different values and ideas. Cogen is basically like a place where you you work as a family together. (St16)



Findings

- **Postive experience**

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Cogen has given me the opportunity to **learn about myself and fix the wrong things I have done and work on any problems like my attitude or communication with each other**, and I would have **never seen that about myself** if it wasn't for cogen. (St2)

Um, you get awareness in the sense that, um, without talking about things in cogens, you would have no idea. And if they didn't talk about it. So it would kind of go unresolved, **To have awareness of something means that it's going in the direction of improving**, than just ignoring it until it gets worse. **The point is to improve yourself**. (St17)

Findings

At times, there are sessions where we are really happy in the internship that **we don't have any problems**. That is why we sometimes have hard times trying to come up with issues during the cogenerative dialogue. (St3)

With time, I think things went better, so **they couldn't find real issues that will bother them**. There was some issues, but they kind of collected themselves in the lab, you know during at lunch or something. So I think that towards the end it [cogen] was a little bit less productive. (Sc2)

- **Challenging experience**

- a) Participants sometimes had difficulties coming up with ideas for cogens
- b) Cogen mediators did not always facilitate the dialogue effectively

Findings

There was a lot of **miscommunications** about how **cogen** was supposed to **operate**, and so a lot of discussion had to go into working with the **mediator**, so that she was running things properly. So it was just a lot of communication issues **between myself and her as well as how she was relating to the students.** (Sc3)

I think **when you have somebody telling the students, like, "I'm the boss. You sit down. I'm up here, you're down there" um, then there's a certain hierarchy that's attempted to be established that limits the communication.** (Sc4)

b) Cogen mediators did not always facilitate the dialogue effectively

Findings

	Student 33 (100%)	Scientist 4 (100%)	TA 8 (100%)
Postive experience			
a. Cogens allowed participants to work as a team to improve science internship teaching and learning	32 (97%)	4 (100%)	8 (100%)
b. Cogens provided a respectful and supportive space where participants could voice their perspectives	31 (94%)	4 (100%)	5 (63%)
Cogens were deemed as a helpful and supportive space to address many issues and improve internship as a team	16 (48%)	1 (25%)	0 (0%)
	16 (48%)	0 (0%)	0 (0%)
individuals			
Challenging experience			
a. Participants sometimes had difficulties coming up with ideas for cogens	27 (82%)	3 (75%)	8 (100%)
b. Cogen mediators did not always facilitate the dialogue effectively	6 (18%)	3 (75%)	3 (38%)

Findings

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Scientist & TA may underestimate the importance of affection in science learning for students	16 (48%)	0 (0%)	0 (0%)
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d. Cogens provided opportunities for the participants to receive constructive criticism and improve themselves as individuals	16 (48%)	0 (0%)	0 (0%)
Scientist & TA may underestimate students' openness and resilience for criticism effectively	27 (82%)	3 (75%)	8 (100%)
	6 (18%)	3 (75%)	3 (38%)

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d. Cogens provided opportunities for the participants to	16 (48%)	0 (0%)	0 (0%)
Cogens can be challenging due to the lack of topics for discussions			
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The need to provide more training on cogen mediation			
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Discussion

- **Cogens were perceived as a helpful tool to address all kinds of issues and improve internship teaching and learning**
 - Address communication barriers (Mumba et al., 2010)
 - Address the power and status gap between scientists and high school students (Kerr et al., 2007)
 - Understanding the struggles and vulnerabilities of scientists may improve students' motivation and academic performance in science (Lin-Siegler, Ahn, Chen, Fang, & Luna-Lucero, 2016).
- **The affective value of cogens may provide a crucial step to strengthen students' mentorship from science professionals**
 - Miscommunication between students and scientists could leave students with an overall negative sentiment (Masson, Klop, & Osseweijer, 2016)



Suggestions to improve cogen practices in student-scientist partnerships

- Challenge 1: Participants sometimes had difficulties coming up with ideas for cogens
 - **Collective story telling**
 - **Back up topics (e.g., application, project status, different views on science)**
 - **A flexible cogen structure**
- Challenge 2: Cogen mediators did not always facilitate the dialogue effectively
 - **More training on dialogue mediation**
 - **From outsiders to insiders**
 - **Sense of advocacy and caring for participants**

Thank you!



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