



# Using Cogenerative Dialogues to Address Emotional Issues in a Project-Based Learning Science Internship

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## Introduction

Project-based learning (PBL) has been suggested as an effective way to engage students meaningfully in science learning because it provides a student-centered authentic learning environment. However, many challenges may occur when PBL is enacted. PBL tasks are often “messy” at different levels, making it difficult for teachers to guide and evaluate students’ performance. Three dimensions of challenges and dilemmas teachers may counter when implementing science inquiry include the *technical dimension*, the *political dimension*, and the *cultural dimension* (Anderson, 2002). Without appropriate scaffolding from teachers, students may lack sufficient knowledge and tools to help them address problems and encounter anxiety and confusion in the process of inquiry. These challenges for both teachers and students inevitably bring emotional issues (e.g., frustration, fear, uncertainty, anger) into the teaching and learning process. Cogenerative dialogues (cogens) appear to have great potential to improve the emotional atmosphere in PBL because of the democratic and empowering interactions associated with participation in cogen. Our purpose in conducting this study, which was grounded in hermeneutic-phenomenology, was to investigate how cogens might serve as a tool to dissolve emotional breakdowns in a PBL science internship.

## Theoretical Framework

**Polyvagal Theory** addresses numerous functions of the vagal nerve and explicates how physiological actions are initiated, monitored, and controlled, without our conscious awareness (Porges, 2011).

- The dorsal vagal complex (DVC) system (most ancient): immobilization behaviors (e.g., shutting down, fainting, defecation)
- The sympathetic nervous system (SNS): mobilization behaviors (e.g., fight or flight)
- The ventral vagal complex (VVC) system (most recent): social engagement (e.g., communications)

❖ The autonomic nervous system reacts to real-world challenges in a predictable hierarchical manner that parallels, in reverse, the phylogenetic history of the autonomic nervous system in vertebrates (VVC→SNS→DVC).

❖ There are bidirectional communications between the brain, organs, and affect.

## Research Context & Methods

The study is part of a four-year research project, which invited high school students to work alongside scientists in an internship partnership between the university and three local high schools.

- Research Context
  - ✓ Work With A Scientist Program
  - ✓ Seven months (every other Saturday in Spring Semester and 30 days in summer)
  - ✓ Four lead scientists (chemistry, neuroscience, immunology, biology) with their research teams
  - ✓ 36 high school students from Title 1 schools
  - ✓ Open inquiry projects with regular cogenerative dialogues
  - ✓ Proposal and final presentations to the public
- Methods:
  - ✓ Video-based ethnography
  - ✓ Interviews with students, assistants, scientists and teachers
  - ✓ Student journals on internship experiences
  - ✓ *Event-oriented inquiry* (Tobin, King, Henderson, Bellocchi, and Ritchie 2016)

## Cogenerative Dialogues

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).

### Rules of Cogens

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)

## Data Analysis

### The Emotional Evolution About the “Lucy Incident” During Cogenerative Dialogues

#### Day 1: Scheduled Cogen

##### Students Prepared to Bring Up Lucy’s Concern (VVC)

- “Is Lucy gonna come?” (Brian)
- “Sarah, did you wanna discuss about what Lucy was talking to us about?” (Jacky)
- “Jacky, I know what you’re talking about, so, I’m gonna bring it up later.” (Joe)

##### Students Expressed Lucy’s Concern (VVC)

- “I remember we were talking to Lucy during lunch about this, and she was a little concerned about the time that we have left to do our projects, um, concerned with our efficiency...she was just a little worried about us because it’s not going as well as she thought in her mind.” (Brian)

#### Day 2: Emergent Cogen 1

##### Mentors Fought and Mobilized to Address the Lucy Incident (SNS)

- I hate to say it, I’m a little insulted. (Ms. Karen)
- I wanna talk about what happened yesterday. I was kinda disappointed. I think the whole time we’ve been here, we, we have really talked about being open and sharing, and never once have we seen you guys as anything other than colleagues, ever. And after what I heard yesterday about what happened in here, I was really disappointed. If you have a concern about how things are progressing, I was hoping that you would feel comfortable and come talk to me... I don’t feel like we’re a team anymore, and we used to be. I don’t understand what happened. (Dr. Mac)

##### Students Immobilized and Expressed Shock About Mentors’ Disappointment (DVC)

- Dr. Mac: Vera, what about you? I know it’s been a real emotional issue for you.
- (13 seconds of silence, Vera’s head faced down and other participants were looking at Vera for her response)
- Vera: Leave me. I don’t want to talk. (Vera spoke with low voice, and then cried, stood up and eventually left the room)

#### Day 2: Emergent Cogen 2

##### Mentors and Students Socially Engaged in “Hearty Conversation” with Reciprocity and Synchronicity (VVC)

- Ms. Rachel: So, we need to hear your feedback and I’m taking a list, so what would help you the most?
- Yasmine: We think that we need to put more effort. Because right now, it’s like a 100 [from you], not even 50 like 30 [from us]. Because it was obvious that we weren’t.
- Ms. Karen: Can I ask why? Why was the percent not matched in the first place?
- Joe: Jacky made a very good point, which is freedom. I remember we talked about this another time that in high school, there is structure and organization and deadlines that are very stringently enforced. And in college, it’s more of up in the air and up to the individual, up to personal responsibility. And right now, we’re in this kind of limbo where we have so much freedom and our deadlines are like more relaxed. And the panic monster does not have as much effect on us as it would have in high school... We don’t really know how to conduct ourselves in this new environment of freedom, this new atmosphere.

##### Students Reflected Synchronically and Called for Self-Discipline (VVC)

- We should be grateful that he’s doing this and I think it’s up to me. I’m here and I wanted to do this program. I got out of bed every day to go to this program. I could be out swimming with the rest of the other kids. I’ve got to put on my big girl pants, if I don’t get something done, it’s on me. Because you guys are fighting us enough. And I guess the only way I feel, I feel like I let everybody else down, because I’m not helping anybody. ‘Cause at the end of the day this internship is about us, it’s how we make it, how we shape it. ‘Cause you’re basically just providing us the tools and that’s fine. But it’s up to us what we want to do with it and if we decide that we want to do it this way, we can’t complain about the outcome that we get. If we change and we have that outcome, we’re like, “Oh, well.” ‘Cause we worked at it, we enjoyed it, we did because we cared. We did it because we wanted to, and like Dr. Mac said, you can’t force anyone... Because at the end of the day, they’re just there, it’s us. We’re Group Four. We’re Lab Four, it’s us. We’re the ones that are making the posters. We’re the ones that are doing the work. Our names are on it, not just theirs. (Vera)

##### Internship Structure and Rules Renewed After Two Cogens on the Lucy Incident (VVC)

- Ms. Karen: Yes, it’s not something to be afraid of. Tension is going to be there. I know that now this is what we need to because this is the most I’ve ever heard you guys talking to the three of us.
- Dr. Mac: It’s the magic circle. That’s what it is.
- Ms. Karen: I will do this more often. Ms. Rachel and I will start sitting, one of us will sit here and one of us will sit in the back until you guys start getting accustomed. But, going forward, I want you guys to hold each other accountable, too. If you have a peer that’s like, “I didn’t finish.” “Why didn’t you finish? What can we help you on?” Because not only did they fail, somehow, we all failed as a team.
- Dr. Mac: That’s the thing. Not only are you holding them accountable, but you’re holding them up. Right? That’s the key. We have to hold each other up, and we support each other, and that’s how it works. It’s really important. That’s right. That’s my cell phone number. You can call me at any time or text me at any time.

## Conclusion

Research is urgently needed to learn how to improve the emotional atmosphere of science learning by ameliorating excesses of negative emotions, which may lead to students dropping out of school, teachers burning out, and health problems. This is especially true when teachers and students are situated in highly challenging environments such as project-based learning (PBL) practice. PBL is regarded as an effective way to engage students meaningfully in science learning. However, emotional dissonance between teachers and students can arise because of many challenges in PBL (e.g., difficulty of assessing learning, uncertainty about teacher and student roles). In this study we investigated how cogenerative dialogues (cogens) served as a pedagogical tool to address emotional issues in a PBL science internship. Data resources included 210 hours of video-recorded internship and cogen sessions conducted with one laboratory team. Drawing on *polyvagal theory* and *event-oriented inquiry*, this case study shows how educators used cogens as a tool to transform the emotional atmosphere in the classroom through respectful communication emphasizing equality, thereby increasing reciprocity/equality and synchronicity among teachers and students. Our research can help students and teachers to regulate their emotional expressions and enhance the quality of classroom interactions and learning environments.

Phenomena observed:

- The emotional evolution about the “Lucy incident” aligned with the reaction evolution of the autonomic nervous system described in Polyvagal Theory (VVC→SNS→DVC).
- The emergent cogens transformed the emotional atmosphere from the mobilization (SNS) stage and immobilization stage (DVC) to the social engagement stage (VVC).

## Implication

- Cogens can be used as a pedagogical tool to successfully address emotional conflicts between scientists and high school students in a PBL science internship.
- Cogens can be used as a formative assessment to detect students’ concerns.
- Cogens can be used to address the challenge of students’ procrastination and lack of self-discipline to complete inquiry-related tasks.
- Cogens can be used to address instructors’ challenges, not only in the technical dimension, but also in the political and cultural dimensions.
- Polyvagal theory can be used as a theory to investigate emotions and associated social learning.

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