STEM Tell Research: How Communication Centers can Impact the Scientific Communication Competency of Grade School STEM Students

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University Communication Centers are beacons of feminist intervention and radical pedagogy. This identity demands we meet the communication needs of students regardless of race, gender, sexuality, ability, or age. The following article demonstrates how one Communication Center fulfilled this initiative by stepping outside the physical space of the center, and venturing into the community to consult with culturally diverse grade school students from the surrounding districts. Our Communication Center at the University of North Carolina at Greensboro had the privilege of working with Dr. Heidi Carlone, a professor of Science Education in the Department of Teacher Education and Higher Education. Earlier last year, she was awarded a 1 million-dollar grant, and is using the money to further her research into innovative learning initiatives for junior high students in the Science, Technology, Engineering,and Mathematics (STEM) program in Guilford County. She is passionate about cultivating these dynamic learning settings with students who embody varied ethnicities, abilities, genders, and socioeconomic backgrounds. Dr. Carlone reached out to our Communication Center to ask if we could assist these students with preparing and presenting their scientific research.

Besides just detailing how our Communication Center prepared for and conducted consultations with these STEM students, this article also offers insight into the innovative theories, praxes, and pedagogies at work throughout our sessions. The findings ultimately provide an awareness of how Communication Centers can be involved in pedagogical initiatives that fall outside of a traditional college classroom, as well as how this involvement can further develop consultants' skillsets when working with undergraduate college students in introductory communication courses. It is my hope this piece can contribute to the Communication Center's reputation of being a critical site of intervention for every student who comes seeking help (Pensoneau-Conway & Romerhausen, 2012).

Theory and Pedagogy

First, allow me to provide a framework for the theory and scholarship our Communication Center engages with in this article. Dr. Heidi Carlone (2004) has written extensively concerning how feminist reforms to the scientific curricula can have a vital impact "for students who are marginalized from science and open up new possibilities for what it means to 'do' science and 'be' a science person" (p. 18). The population we worked with during this STEM program were students from economically and racially diverse backgrounds who were engaging in a radical interpretation of what a science class can and should look like. Carlone (2003) also elaborates that an understanding of "context" and "agency," where the student is coming from and what the student wants to

accomplish, are unalienable factors of student success in the science classroom (p. 24). As Communication Center consultants, we are trained from genesis to meet students where they are and listen empathetically to their needs, always striving to withhold judgment and uphold a feminist, collaborative agenda where all parties can grow and learn (Cuny, Wilde, & Stevens, 2012). Carlone's concepts of context and agency bolster communication consultants' firm belief in the center as a "site wherein students can...effectively avoid the traditional hindrances of power that are inherent to a conventional classroom setting" (Pensoneau-Conway & Romerhausen, 2012, p. 39). One can see how closely Carlone's work and the mission of the Communication Center align. By implementing strategies such as learning the students' various concerns and stakes in their projects, observing each student's strength in a group, and adapting to meet the fluid needs of the group, consultants can quickly form and nuture a bond of trust, wherein respect for the student's context and agency are priority.

Taking these notions of context and agency a step further, consultants can readily transfer the skills they have honed in a grade school environment to working with college freshmen in introductory communication courses. Anis Bawarshi (2003), a composition scholar whose work overlaps with Communication theory, writes that students create (through writing, speaking, art, etc.) based on what they already perceive in the world, as well as how that perception in-turn shapes their self identities (p. 9). He argues that students must be shown how to "locate themselves and...participate within these positions more meaningfully, critically, and dexterously" (p. 146). In other words, they must develop an awareness of their context and agency as well as how to analyze and utilize them

productively. Freshmen are new to collegiate demands, pressures, and quality of effort. They can often doubt themselves due to a lack of understanding about their context, both internally and from their professors, which in turn hinders them from developing a sense of agency. In the Communication Center, however, no one evaluates or assigns grades. Instead, we engage in a form of radical pedagogy that rejects traditional, hierarchical notions of learning, and instead posits teachers *and* students as sites of knowledge production and critical inquiry. bell hooks (1994) articulates this concept the most beautifully:

> As a...community, our capacity to generate excitement is deeply affected by our interest in one another, in hearing one another's voices, in recognizing one another's presence. Since the vast majority of students learn through conservative, traditional educational practices and concern themselves only with the presence of the professor, any radical pedagogy must insist that everyone's presence is acknowledged. That insistence cannot be simply stated. It has to be demonstrated through pedagogical practices. (p. 8)

By being interested in the feelings, attitudes, values, stakes, fears, and hopes of freshmen, consultants can help lay the foundation for a bridge over the gap between university life and high school.

To relate this idea back to scientific communication in grade school STEM groups, consultants have the ability to interact with and empower marginalized students before they even begin college. By showing a legitimate acknowledgement in their, as hooks puts it, "voices" and "presence," consultants can help contest the overarching societal hierarchies that work to systematically disenfranchise these populations, facilitating students' realization

of their own agency, intelligence, creativity, and ability. In addition, consultants can collaborate with feminist scientists and teachers, like our Communication Center did, in order to promote "equitable access to science learning for marginalized groups" (Huffling et al., 2016, p. 1).

My team members also expressed their excitement for how Communication Centers can impact this demographic:

> Exposure is powerful, so is having someone believe in you and want you to succeed. I believe that the...Center is a prime place to breed this environment based on my personal experiences here. As long as we can do this and make a great experience with the STEM groups, they will go back with their stories to tell that can and will create greater interest in liked individuals to pursue similar paths. (Troy Moss, personal communication, May 1, 2018).

And also mentioned how collaborations like this can affect individuals:

> I do believe that the Speaking Center interventions could help impact the demographics of STEM groups in significant ways. By giving students the knowledge they need on public speaking, they can better verbalize what it is they are seeking to research or even something they are already researching. I feel as though it is particularly effective with STEM groups, as the students are already eager to learn and know more, and by learning more about how to convey what they are passionate about, they will gain more confidence in chasing their aspirations later on in life. (Abby Thomas, personal communication, May 1, 2018).

By developing an understanding of the theories and practices surrounding radical pedagogy, context, and agency, Communication Centers consultants prepare themselves to be a virtually limitless force in the community.

Praxis

Overview and Initial Workshop. Now that I have articulated the relevant scholarship, I will relay specifically what my team of consultants and I did during our sessions with the STEM students. For this project, the students were tasked with studying the environmental effects of water run-off as it relates to the construction of our campus's new nursing building. In groups of four (Water Pollution group, Construction group, and two Biodiversity groups), they researched and performed experiments on water and air pollution, impacts the construction will have on biodiverse animals and their native habitats, and ways the building can be more responsible and sustainable with how it recycles water. After spending weeks researching their respective topics, these students now had to construct a presentation where they would use models, graphics, posters, powerpoints, and etc. to communicate their research to professors and University stakeholders. This is where our Communication Center began its intervention.

I spent a Saturday morning with these STEM students in a large classroom as they talked in their respective groups about their research topics. After about an hour and a half of floating around and hearing everyone's brilliant ideas about research models and persuasive ways to demonstrate their experiments, it was time for my workshop. Because I took the time to hear everyone's passions, concerns, and potential solutions, not only did I establish a repertoire of interest and respect in these

students' respective contexts and agencies, I had the materials necessary to make my workshop as applicable and interesting as possible for a group of excited, restless 6th and 7th graders.

The basic format of the workshop was on the fundamentals of organization and delivery competencies, and I supplemented the persuasive skills section of the presentation by using examples they had discussed with me in their separate groups, such as one student's worry of: "What about when someone is walking their puppy by the construction and he gets thirsty and drinks some water out of a random puddle?" and another's concerning how "All of the squirrels will have no homes and may get hit by all the cars" (the building is next to a highway), and one student even said, "I think they could have a greenhouse lounge on the roof where they can collect rainwater and use it for the plants." Taking the time to hear each student express their own personal questions and stakes with their research allowed me to navigate a rhetorically effective space as both a workshop presenter and someone who sympathizes with their concerns.

I also employed much more audience participation than I usually do during workshops in order to allow the students to feel like they were in charge of their own learning journeys and scientific research presentations. Junior High students spend all day listening to teachers talk at them; I wanted this workshop to be a space where they also contribute to the knowledge, discourse, and meaning-making for the communication tools I was introducing. For example, I would repeatedly ask "Who thinks they know what such and such word means?" and "Who can come up with an example where this might be useful in their presentation?" as well as bringing up specific things students had said, e.g.: "Jane, I remember you telling me about how the

beavers in the nearby lake won't have enough wood to build their dams if we cut too many trees down during construction. Who can tell me why this is important and what section of the presentation it would fit best in?" These students are extremely intelligent, and my training as a Communication Center consultant helped me to focus on what our speakers do know and can contribute, instead of trying to lecture them on what they do not or should know. Dr. Heidi Carlone and other stakeholders in the audience remarked on how impactful this style of workshop facilitation was for the students.

Consulting the Sub-Groups

The following Saturday, myself and a team of two consultants, Abby Thomas and Troy Moss, returned to the STEM group and consulted with each of the sub-groups as they prepared their models and research presentations. Thomas and Moss took the Construction and Water groups, and I floated between the two Biodiversity groups. These were excited, brilliant, and dynamic junior high students, so we had to quickly modify how we normally conduct sessions in order to accommodate our audience while still providing relevant communication competency advice.

The construction group. Moss asked his group while they were working on their models, "Okay, so we want to get the audience's attention first, what should we do so that they want to pay attention?" and wrote the students' answers on the board. Then he asked, "Alright, now we need to introduce everyone; Who wants to do this?" and wrote it down. In reflecting on this experience, he remarked that, "having to forego the usual script was a challenge but the most difficult part was getting the students in a position to start working on the

delivery portion of their proposals. There had to be a balance between allowing the students to put the final touches on their projects and working on the way that they want to present that information" (Moss, personal communication, May 1, 2018). As an example of this experience, one of the students wanted to "flip the script" and said they should instead do an interview-type format to present their research. This way, he said, it would help get the information across clearly because half of the group would be interviewing the other half of the group, asking specific questions that structured the stakes of their research agendas accordingly, such as one student asking, "What does this mean if I'm walking my dog and he drinks this water run off?" and the other student answering with her scientific research and proposed solution.

In order to accommodate this new turn of events, Moss changed his question asking strategy to one of role-playing (i.e. "Who will be our news reporter? Who will be our innocent bystander/dog walker?") to help each student navigate their part in the presentation. "Once I finished assessing the situation," Moss said, "I thought that a modified organization type discussion was the way to go. The biggest difference (for me) was having it where the students had to commit themselves to the structure that they talked to me about...We decided that a mock interview style was the best way to have everyone give their parts and to switch between speakers...Part of what we are trained for in the Speaking Center is adaptability" (personal communication, May 1, 2018). Not only did this consultant exercise his adaptability skills, he never tried to take over the session; he gave the students agency to choose how *they* wanted to present, and advised them accordingly.

The water pollution group. My other team member, Abby Thomas, had

similar yet nuanced experiences with her group. "In order to meet the needs of the junior high students, I really had to rework my mindset and adapt to the dynamic of the program. I had to change my mindset from expecting group consultations where students are focused on one thing to somewhat of a facilitator...while they were finishing their projects...they were going to have to multitask" (personal communication, May 1, 2018). This element of multitasking meant that Thomas had to form her questions as succinctly as possible and write every element of the presentation down on a nearby whiteboard so that everyone could glance up at it and be on the same page, and no one would forget their part in the chaotic multitasking environment. She told me:

> It took me most of the morning to adjust to the dynamic of the group and finally establish the approach I was going to take… and after visiting with [my teammates], I decided to write out on the whiteboard the different parts of a persuasive speech and begin to delegate with the students I had in the room. I assigned each of them to a different role, for example one to state the introduction, one to state the call to action, etc. After I had finally assigned each student to a role and ensured that they were comfortable with this speaking role, we were able to...practice. (Abby Thomas, personal communication, May 1, 2018)

This consultant respected the state of mind in which the students were absorbed and adjusted her consulting style. Instead of trying to drag everyone into a state that was comfortable for her, for instance, sitting down with undivided attention, she met her group where they were and allowed them to

work with their models while she spoke with them, using that tactile immediacy to craft an impactful presentation.

The biodiversity groups. My experience with the two biodiversity groups also demanded I be adaptable and respect the students' agency. In one biodiversity group, each student ended up doing his ro her own separate project instead of everyone working together on one big project. Thus, in this moment, my objective became to work with these students individually and then determine how we could put everyone's project in conversation collectively. This tactic included a lot of team-building dialogue among the students, with myself helping to facilitate the discussion. For example, I asked one student, "Can you explain your model to me?" and then said, "Hey, that sounds a lot like so and so's graphic over here, doesn't it? Do you think you two could present this section together using your two models?" This strategy allowed the students to remain in control of how they presented their research while still maintaining a cohesive group dynamic. These students ultimately took several sole endeavors and, with guidance from my workshop handout, pieced their ideas together to form a collaborative presentation.

In my second biodiversity group, I had a smattering of scientific artists. These students were shy but they were amazingly talented and were painting, drawing, and crafting architectural moving models. I knew immediately I needed to play to these creative strengths. One student in particular caught my attention. I remembered her being concerned about the wildlife whose habitats were being threatened by the construction when I first spoke with her on workshop day. I asked her what the most important part of this scientific research was to her, and she responded that it was the safety of the animals. We chatted a little bit about what kinds of animals in particular, and she started drawing a family of foxes on a sheet of construction paper. She was an extremely good sketch artist. I kept talking with her and she kept drawing them in a rhetorically pathetic manner: drinking bad water, getting sick, losing their parents, and etc. I then paired her up with a group member whose experimental model dealt with the impact construction will have on wildlife. Their logos and ethos operated together effectively. Therefore, I kept talking with students in the group and seeing whose artistic renderings would pair well with others' experimental models.

This scenario is yet another example of meeting students where they are, but more specifically, it involves taking shy, quiet group members and helping to show them their strengths and what they can add to the group. They literally went from saying "I don't know what to do" to "I think my piece would go well here in the presentation." In Communication Center group consultations, consultants are trained to never lose sight of the individuals that make up said group, and quickly discern the unique strengths each body has to offer, so as to respect everyone's agency.

Takeaways. One can see from these three separate consultation situations that what we had all been trained to do in the space of the center served as a basis for quick adaptability and empowerment of the STEM students. Ultimately, however, it was the unique consulting style each of my team members possessed that allowed them to connect to these students in the moment and craft a dialogue which contributed to successful research presentations. This is why it is vitally important that each consultant is able to not just learn the theories and practices of the center, but to take the time to realize how their own

identities and experiences shape their strengths and perspectives as individual consultants. For example, Troy Moss is laid back and creative, so he was able to deftly change the format of the speech from a presentation to a mock interview. Abby Thomas is organized and a proficient multitasker, and she played to those strengths when dealing with the divided focus of her group.

Conclusion and Impact

In the end, everyone's presentation was phenomenal, and I received feedback from Dr. Carlone that the stakeholders in the audience were thoroughly impressed by the persuasive techniques these students used to demonstrate the most ethical, environmental practices to utilize for the construction and sustainability of the new nursing building. Carlone has since asked our Communication Center to replicate what we did with these STEM students for her upcoming group. In addition, when I asked my team how this experience impacted them as consultants, Moss relayed that he, "would love to have more opportunities to assist community projects. Part of the Speaking Center's personality is helping anyone and everyone in the pursuit of improving their speaking skills; whether they are a [University] student or not" (personal communication, May 1, 2018). Additionally, he remarked that, "It also allows our consultants to receive experience in unorthodox ways of assisting the needs of our speakers which, I feel, expands their skill sets and [helps them] become a better...helper (personal communication, May 1, 2018). Thomas told me that she, "absolutely think[s] the center should continue to do outreach projects like this. Being active and involved in community is super important, and not only do the students benefit from this, but the consultants do too. [They] learn important

lessons about adaptability...with different groups and the different dynamics that may come with each one" (personal communication, May 1, 2018). Therefore, as Communication Center consultants and advocates, we must continually strive to diversify our skill sets and think critically about the theories behind how and what we perform in multifarious scenarios.

Communication Center consultants and directors should be open to working with those outside the traditional demographics of a college campus. By allowing myself to be flexible, and building a team of consultants who I knew would exhibit that same attention to relatability and resourcefulness, we helped these students to not only clearly relate their brilliant thoughts and innovations to the powers that be, but also effectively communicate their own feelings and concerns for the environment in which they live.

References

Bawarshi, A. (2003). *Genre and the invention of the writer: Reconsidering the place of invention in composition.* Logan: Utah State University Press.

Carlone, H. B. (2004). The cultural production of science in reform-based physics: Girls' access, participation, and resistance. *Journal of Research in Science Teaching, 41*(4), 392-414.

Carlone, H. B. (2003). Innovative science within and against a culture of "achievement". *Science Education, 87*(3), 307–328. doi: 10.1002/sce.10071

Cuny, K. M., Wilde, S. M., & Stevens, A. V. (2012). In E. Yook & W. Atkins Sayre (Eds.), *Communication centers and oral communication programs in higher education: Advantages,*

challenges, and new directions (pp. 249-256). Lanham, MD: Lexington.

bell hooks (1994). *Teaching to transgress: Education as the practice of freedom.* New York: Routledge.

Huffling, L., Benavides, A., Ash, M., Germuth, A., Matthews, C., & Carlone, H. (2016). Promoting Equitable Access to STEM in a Summer Herpetology Fieldwork Program. *Connected Science Learning: Linking In-School and Out-of-School STEM Learning. 1*(2). Retrieved from http://libres.uncg.edu/ir/uncg/f/C_Ma tthews_Promoting_2016.pdf

Pensoneau-Conway, S. L., & Romerhausen, N. J. (2012). The communication center: A critical site of intervention for student empowerment. In E. Yook & W. Atkins Sayre (Eds.), *Communication centers and oral communication programs in higher education: Advantages, challenges, and new directions* (pp. 39-54). Lanham, MD: Lexington.