Off-task Interaction as a Mechanism to Support On-task Participation

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Abstract: In this paper, we seek to further understand the relationship between off and on task interactions, particularly for students who do not typically verbally participate. We focus on one such student, Jessica, and apply framing theory to two episodes of her on-task participation in order to study whether off-task interactions leading up to these episodes support her on-task participation that follows. We find that the frames of the off-task interactions have a sort of stickiness: expectations characteristic of these off-task frames bleed into the on-task activity. We argue that this has implications for equitable access to both scientific discourse practice and identities.

Keywords: off-task interaction; equity; collaborative small group; framing

Off-task behavior in collaborative group work, though common in actual science classrooms, is often stigmatized or overlooked in teaching and research. However, research in math education is beginning to suggest that off-task interactions can provide some students access to positive identities which support on-task participation. In one study of off-task behavior in an elementary mathematics classroom, more than half of off-task interactions functioned to support the on-task collaborative process (Langer-Osuna et al., 2018). In another, one student was allowed to engage in on-task behavior after positioning herself positively in off-task storylines (Esmonde & Langer-Osuna, 2013).

The lack of attention to understanding off-task interactions in science education research may be particularly relevant for students who either don't position themselves or are not positioned by others as being competent in science learning contexts. Our interest in this work grows out of attention to learners with identities typically marginalized in science. Despite the possible benefits of off-task behavior for such students, teachers often view it as disruptive and thus discourage it. A version of this assumption exists in research literature as well. Many papers that study small group interactions purposefully choose data with little off-task activity, considering it the "best-case scenario" for that reason (ie. Scherr & Hammer, 2007). This lack of attention paid to off-task behavior by researchers is concerning due to the productive role it may play for students with identities typically marginalized in science classrooms.

Theoretical and analytic framework

The literature on the potential value of off-task behavior generally uses positioning theory as a theoretical lens. In her work, Langer-Osuna (2018) notes a similarity between storylines and Goffman's frames (1974). We have used frames and framing in past work and were curious about the value of framing as an analytic lens when considering how participation in off-task interactions can support subsequent on-task participation.

The central idea of framing is that individuals generalize knowledge from past experiences to make sense of subsequent interactions they perceive to be similar (Goffman, 1974; Tannen, 1993). In this view "framing" a social situation involves a tacit interpretation, effectively answering the question "What is it that's going on here?" (Goffman, 1974). How an individual frames a situation shapes their expectations and the choices they make.

Analytically, we focus primarily on expectations. We analyze our data for evidence of groups' collective expectations about the activity and then seek to characterize the overarching frame based on those expectations. A particularly important feature of a frame for us is the observation that, when the nature of a social situation shifts, the expectations of the earlier frame are sometimes "sticky"; that is, individuals sometimes continue to make choices about participation based on the expectations of the previous frame (MacLachlan & Reid, 1994). This property suggests a possible mechanism for off-task to on-task transitions is the stickiness of expectations.

Data source and methodology

Our data is video of collaborative small group interactions from a pre-orientation program for first generation and deaf/hard of hearing incoming undergraduates interested in the sciences. The program involved students engaging in small group investigations about the mechanisms of climate change. A group of researchers collected video

data of all groups on all days. In this study we focus on a target student in one collaborative group made up of four students: Justin (he/him), Brittany (she/her), Pat (they/them), and Jessica (she/her). All names are pseudonyms. Jessica is our target student. We analyze video and transcripts of the first 25-40 minutes of 4 of the 6 days this group worked together. Jessica was absent on one day and we don't have access to complete data from the other. In total we investigated about 2 hours of this group's interactions across four different days.

Our data choice is opportunistic. Because this is exploratory we use video and transcripts available through a larger collaboration. However, our choice of Jessica as the target student is intentional. She was the least verbally participatory member of the group. A sampling of talking time participation of these group members (Payne & Hutchison, 2019) shows Jessica averages about 7% of the total talking time while the other three group members average approximately 50%, 25%, and 20%. In addition, when she did participate verbally, it tended to be off-task in nature. For these reasons, Jessica was of particular interest to us. She is the kind of student we would like more involved in on-task interactions and we hope to gain insight into the context of her on-task activity.

Using the transcript and video data, we cataloged all instances of Jessica's verbal participation (50 total instances) and categorized each one as either on-task or off-task, finding 20 instances of verbal on-task participation. From those on-task instances we identified interactions that were sustained for more than one or two utterances and were not directly prompted by group members or instructors in the classroom. There are only two such episodes: one in which Jessica participated in a discussion about the unit – Celsius or Fahrenheit – the group should use to record temperature and a second in which she spent several minutes assisting a group member construct a data collection apparatus. We analyzed these two episodes and the segments that preceded them to try to understand what supported Jessica's on-task participation. In the next section we briefly describe our analysis of each episode.

Results

Episode 1: Celsius vs. Fahrenheit

On the first day the group was together, they often engaged in off-task conversation, in part due to the structure of the activity that required waiting between taking temperature readings. For example, they learn each other's middle-names and talk about handwriting and writing style preferences. Our analysis of these episodes provides evidence that the groups' expectations for this type of activity include turn-taking in conversation from all group members, sharing their own point of view on the topic, often building on others' contributions, and demonstrating signs of attentiveness to the speaker. We label this set of expectations a "conversation" frame. A brief excerpt from one such off-task conversation is shown below.

Jessica:	(to Pat) I think it's wrong. (to Justin) Who has better handwriting me or her?
Pat:	Yeah right there
Brittany:	Jessica
Justin:	[leans in to look at Jessica's journal]
Pat:	I think…all right
Justin:	Yours is beautiful. I'm sorry yours is pretty too
Brittany:	I know
Justin:	The way she paragraphs, look at the way she paragraphs [takes Jessica's journal and starts paging through it]
Brittany:	It's so…the only thing
Pat:	She actually paragraphs
Justin:	[holding up Jessica's journal] The way she…
Brittany:	The only thing that I can lay claim to is like my title pages, my title pages make me happy

Here we see all of the students participating in the turn taking during the conversation. They engage fairly equally in conversation, though we still see fewer contributions from Jessica than from others in longer episode this is taken from. Most turns of talk involve students sharing about themselves and notice that many turns of talk relate to the content of a previous speaker's turn. In the video, we also see that students are generally attentive to the speaker or to the object of the speaker's attention. All of these are examples of behaviors that characterize the "conversation" frame.

After a string of such off-task discussions, there is a shift from off-task to an on-task when Justin notices the group's measurements are in Fahrenheit rather than Celsius. Here are two excerpts from that episode.

Justin:	Eighty-eight Fahrenheit we're gonna have to convert
Brittany:	[inaudible]
Jessica:	I don't know how to do that
Justin:	Aww...multiply by five-eighths minus thirty, how do I change it to Celsius?
Pat:	Or we could just write it in Fahrenheit
Justin:	What is it eighty-eight…oh I think I can do it right now. It's thirty-one degrees Celsius boom [inaudible] ...we can switch to ... thirty-one degrees Celsius … We never measured it before
	…
Justin:	No, no this is science and science is in Celsius, Celsius has a better scale
Jessica:	...all my temperatures are in Celsius
Pat:	Oh my god mine are wrong because they're in Fahrenheit...
Jessica:	[inaudible, talking to Justin]
Pat:	[inaudible] Celsius (pointing to Justin), Celsius (pointing to Jessica), Fahrenheit, (pointing to Brittany), Fahrenheit (pointing to themselves)
Jessica:	(to the instructor, who is near): Which one's better, Celsius or Fahrenheit?

Though the topic shifted abruptly from off-task to on-task, for Jessica the frame expectations remain the same. From the transcript we see that the turn taking was shared less equally, Brittany was noticeably no longer a part of the conversation and Jessica again has fewer turns talking, but in the video we still see the frame characteristics of attentiveness to the speaker, turn taking in conversation, and building off of other group members' contributions. We expect that the fact that many of the "rules" of the conversation stayed the same, despite the shift in topic, is key to Jessica's participation. Instead of seeing the conversation as "formal science discussion", a context where she may not feel comfortable participating, it functions as an extension of the conversation frame, a context in which she had previously established herself as a participant and been a fairly regular contributor.

Episode 2: Play with materials

At the beginning of the fourth day the group is together, Jessica doesn't engage much verbally with the group. This isn't surprising given the activity is largely on-task. Early on she touches the materials a few times and asks a few clarifying questions, but becomes disengaged and eventually appears barely attentive to what the group is working on.

The group is building an apparatus to capture and measure CO_2 that is released when a popsicle stick burns. About 20 minutes into the activity Pat and Brittany check the strength of the vacuum that sucks smoke into their apparatus through a funnel on the end of a rubber tube. Pat holds the funnel against their hand to check the strength. When they don't feel strong suction, Brittany turns up the vacuum and Pat laughs when it suddenly sucks firmly onto their hand. Jessica and Brittany also laugh with Pat. Jessica asks if they should turn the vacuum off. Brittany doesn't acknowledge this suggestion and instead moves the funnel around on her arm and hand, feeling the suction. Jessica "asks" to join in the interaction non-verbally by extending her hand, signaling she wants to feel the suction. Brittany obliges and they all laugh together. However, Brittany turns off the vacuum when Jessica is hurt by the strong suction. Brittany asks Jessica if she's okay and after it's clear she is the three of them continue to play with the suction, picking up different materials with the funnel and later verbally inviting a TA to join them and place the funnel on his hand.

In this episode, the moment Pat laughs marks a shift in expectations that corresponds with Jessica entering the interaction. The expectations are equality and active tactile participation, and the frame is characterized by laughter, smiling, and joking tone. We see these expectations play out when the students are laughing together and smiling throughout the episode and when Brittany invites the TA to participate. We also see that when an expectation is violated, play temporarily stops. When Jessica expresses pain, Brittany and Pat immediately stop the play and Brittany asks Jessica if she is okay before returning to play with the apparatus.

After the play episode, the group returns to the on-task activity and Jessica begins to engage with the experimental set-up and her group members. She participates in on-task activity by helping Pat set up the

apparatus. She also positions herself as on-task by chastising Brittany for engaging in off-task behavior with Justin. Although this is done in a joking manner, it is a notable departure from Jessica's typical behavior.

The expectation that carries over from off-task to on-task activity appears to be active tactile participation. Initially, when Jessica's groupmates work to put together the apparatus, she is not included as a meaningful contributor and is disengaged. However, when the tone shifts, she re-frames the activity as a context in which she can participate and thus engages in it. When the group shifts back to putting together the apparatus, back to on-task activity, Jessica simply continues with her active tactile participation and assists Pat who has been taking the lead putting things together. Jessica continues even as Brittany distances herself from the work.

Engagement with instructor and TAs

Jessica's lack of participation in on-task behavior unsurprisingly continues when the instructor or one of the two teaching assistants (TAs) are present. In the data we analyzed, the instructor comes to the table and engages with the group 16 times, occasionally for five or more minutes at a time, and one or both of the TAs engage with the group nine times. When discussion between the group and the TAs or the instructor is off-task, Jessica sometimes participates (i.e. joining Brittany in teasing a TA). However, discussions with the instructor and the TAs are typically on-task, especially with the instructor who often prompts them to summarize their experiment, describe and analyze what they are seeing, etc. Jessica only engages in on-task conversation with a TA or instructor twice, both follow the episodes described above. During the Celsius vs. Fahrenheit discussion Jessica draws the instructor into a conversation. During the Play with Materials episode, Jessica offers her idea when a TA prompts the group to think about how to improve their experimental set-up. This further validates that Jessica's behavior in these on-task episodes was sustained, as she interacts with the instructor and TA in addition to her peers.

Discussion

It appears Jessica's rare instances of sustained engagement in on-task interactions are supported by off-task interactions. This finding is consistent with and lends support to work in math education (Esmonde & Langer-Osuna, 2013; Langer-Osuna, 2018; Langer-Osuna et al, 2018) that argues for the value of attending to off-task interactions. We believe our study may also be valuable in that it has equity implications. It may be that the least frequent contributors benefit most from the support off-task interactions provide to on-task ones. As noted earlier, much research that focuses on small group interactions intentionally selects data to avoid off-task interactions. But off-task interactions may be particularly important to understand how to help those least likely to participate.

We find Esmonde's (2009) definition of equity in collaborative small groups useful in helping us think about such implications. Esmonde defines equity as "the fair distribution of opportunities to learn," meaning that all students have "access to...content and discourse practices" and "(positional) identities as knowers and doers of" science (p. 249). This view of equity highlights the centrality of participation if the learning context is an equitable one. However, our use of framing as an analytic lens identifies a possible concern. If the stickiness of expectations leads to one frame bleeding into another, we worry Jessica may not understand her participation in interactions *we* code as "on-task" as participating in authentic scientific activity. If that is the case, we worry in particular about her access to positive positional identities as a knower and doer of science. The data available to us for this study allows us no insight, but it is something we hope to attend to in future work.

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