Rethinking Loafers: Understanding the Productive Functions of Off-Task Talk During Collaborative Mathematics Problem-Solving

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Abstract: This study examines the role of off-task participation in collaborative mathematics problem-solving among fourth graders. Results show that majority of instances served productive functions in relation to the collaborative problem-solving process. These functions include: warming up to the collaboration, gaining the attention of others, gaining access to the collaboration for self, recruiting others into the collaboration, extending the task, and resisting concentrated authority.

Students commonly get off-task when working together in small groups, whether because they start playing with manipulatives, discussing games or movies, or singing together. Teachers, like most adults, typically assume such activity is counter to the work-at-hand, and some studies have suggested that off-task interactions are detrimental to learning (Baker, Corbett, Koedinger, Wagner, 2004; Sabourin, Rowe, Mott, & Lester, 2011). Yet, off-task interactions can serve a variety of functions, some of which have the potential to support important aspects of the collaborative process (Langer-Osuna & Esmonde, 2013; Sabourin, et al, 2011, Baker, D'Mello, Rodrigo, Graesser, 2010). Students utilize various strategies, often implicitly, to manage the attention, engagement, and cognitive activity of collaborative academic work (Barron, 2003; McCaslin, 2009; Volet, Vauras, & Salonen, 2009; Webb, 1982, 1991).

The functions of off-task talk during collaborative work is less often studied from positioning theory, though recent work suggests that particular kinds of subject positions enable productive collaborative work, while others constrain possibilities for engagement (Wood, 2013). Subject positions become available through socially constructed storylines (Davies & Harré, 1990; Holland, Lachincotte, Skinner, & Cain, 2001). While on-task participation draws from storylines of schooling and school mathematics, off-task participation can draw on a greater range of storylines, including those of friendship, popular culture, and so on, potentially making a greater range of positional resources available to students to leverage during their collaborative activity (Esmonde & Langer-Osuna, 2013; Langer-Osuna, 2015). These storylines interact through both on-task and off-task talk. Langer-Osuna (2015) found that students drew on a variety of storylines including but going beyond the storyline of school mathematics as they engaged with one another in collaborative work. The storylines that organized much of the off-task interactions, such as youth popular culture or the armed forces, offered the focal student, Terrance, positional identities that ultimately supported engagement in the mathematical work.

Bringing these bodies of work together to bear on the potential role of off-task participation during collaborative work, we hypothesize that off-task participation can contribute to collaborative problem-solving process by making a greater range of positional resources available to students. As such, it suggests the possibility that off-task participation plays an even more robust role in collaborative problem-solving than previously considered (Hickey, 2003; McCaslin, 2009).

Data sources and analytic approach

We analyzed 13 videotapes of collaborative mathematics problem-solving among fourth graders during a unit on place value (Fosnot, 2007). The unit included about 20-30 minutes of student-led small group collaborative work each day, always around an open-ended conceptual problem that required students to compose and decompose numbers, as well as combine numbers, as units of 10s and 1s. These activities were in the context of a story problem where the main characters, a young boy and his grandmother, start a T-shirt factory and must find a system of organizing T-shirts for selling. The characters ultimately decide to sell T-shirts as bundles of ten and loose T-shirts. Students had access to materials such as paper and pencil, clothes hangers and rubber bands, as well as linking cubes and base ten blocks, for use during their activity.

For each of 7 instructional days, we collected video of the entire classroom, as well as 2 additional representative small groups (1). Because in this classroom, students had the autonomy to choose both who they worked with and where they worked, the students captured in each of the focal small groups varied. We additionally collected pre- and post-assessments and student interviews. Here we focus exclusively on the videos of the small groups. For each small group table, we used a video camera mounted onto a tripod raised

over the small group and pointed in a downward angle in order to capture all students and their collaborative work artifacts. We used a table mic connected to the camera to capture small group talk.

For each of the 56 instances, we coded the functions of off-task interactions on the collaborative dynamics. We coded the entire data corpus, drawing from both the literature (e.g., managing attention, Barron, 2003; resisting domination, Esmonde & Langer-Osuna, 2013) and an inductive analysis of the video data itself (e.g., gaining entrance into the collaborative work) until saturation. To do so, we created analytic memos describing: (a) the content of words or actions, and (b) the spatial arrangement of students' bodies and resource, before, during, and after the off-task interactions. The spatial arrangement of the collaboration included students' eye gaze and bodily positions in relation to one another, as well as physical access to the artifacts of the collaborative work (e.g., manipulatives, worksheet). We determined the function of off-task talk in relation to shifts in the spatial and verbal aspects of (on-task) collaborative work directly subsequent to off-task interactions.

Codes for off-task function were discussed and refined across the four authors for all instances until consensus was established and the data was saturated. In limited cases an instance was coded with more than one function when the same off-task interaction served different functions for pairs of students at a table of four. In all of the double coded instances, an off-task interaction that served to fill time for one pair of students served a productive function for the other pair of students.

Results

Results show that off-task interactions served both productive and unproductive functions in relation to the collaborative problem-solving process. The functions of off-task interactions in our data set (n=56 instances), in order of prevalence, were: (a) filling time (n=17); (b) warming up to the collaboration (n=9); (c) gaining the attention of others (n=7); (d) avoiding work (n=7); (e) gaining access to the collaboration for self (n=6); (f) recruiting others into participation (n=6); (g) destabilizing collaboration (n=4); (h) extending the task (n=3); and (i) resisting concentrated authority (n=2). An additional 7 instances were coded as flops (2). Table 1 defines each function operationally and offers examples of the kinds of interactions that were coded as such.

Table 1: Functions of off-task interactions

Function	Definition	Example	Percent Frequency (n=56)
Fill time	Off-task interactions that occur after a declaration that the task is complete and continue until end of collaborative session	A student utters aloud, "we're done!" and high-fives his two peers in the group. Giggling, the students spend the remainder of the session time hitting their ten stick together, testing which are the "strong" or "weak" sticks.	30.36
Warm up to the collaboration	Off-task interactions that mark the beginning of the collaborative activity and functions to support initial connection/interactions with peers	Students walk over to their table for the first time as a group. A student asks her peer whether the purple pen is his and then starts to take all of her pens out of a bag to demonstrate their varied colors. As the rest of the table mates join the table, they acknowledge the display of pens and one another. Immediately after, a student offers the first on-task directive to the group.	16.07
Gain attention of others	Off-task interactions that serve to shift the gaze of others toward a marginalized peer	Prior to the off-task instance, a student bids for the attention of this table mates, who ignore him. He begins to tell a story about playing the game Minecraft. His peers' gaze shift toward him, gaining their attention.	12.50
Avoid work	Off-task interactions that occur after a declaration that the task is not complete and that serves to	A student bids for his partner to model the number 38 with connecting cubes. His partner counters by telling him the green	12.50

		resist efforts to make progress on task	connecting cubes are peas and they will make soup. They begin to build with the cubes. As he attempts to make sticks of ten, his partner launches into a story about making soup and insists the blocks are her ingredients.	
Gain access to collaboration for self	Off-task interactions that a) enable a student that was previously not participating in the collaboration to enter, and b) are followed by on-task interactions between now-collaborating peers	Student's on-task bids for participation are rejected. He and his peer begin to play fight with connecting cubes. In doing so, their bodies and talk become oriented toward one another. Student's subsequent bid for participation in the collaborative task is successfully taken up.	10.71
Recruit others into collaboration	Off-task interactions that a) bring a student or students previously not participating into the collaboration, and b) are followed by on-task interactions between now-collaborating peers	Prior to off-task instance, a student makes several bids to recruit his two table mates into the collaborative task, which they repeatedly reject. He then begins to play with the connecting cubes, loudly declaring that he is building a tower. His two table mates shift their bodies toward him and one another, enabling cooperation, smile and join him in creating towers of their own and comparing them to each other. Immediately subsequent, the student repeats his original contribution, which is now taken up by his peers who shift into on-task interactions.	10.71
Extend the task	Off-task interactions that are related to the context of the task, but that depart from the task instructions	Students are tasked with adding imagined orders for T-shirts, totaling the number of T-shirts in an order. Before starting on the expected task, students spend several minutes discussing who should be in charge of small, medium, or large sizes of T-shirts, elaborating on personal characteristics, such as height or preferred fashion style, that would make particular sizes reasonable for specific students to take on.	5.36
Resist concentrated authority	Off-task interactions that serve to ignore or deflect a directive or other move that positions one peer with concentrated social or intellectual authority	A student tells her peer to stop making sticks of ten and to instead write his name on a shared worksheet. Her peer begins to combine his ten sticks into a long stick, naming it a sword and launching into a story about its strength and importance. He then begins a new ten stick, naming it a new sword, ignoring the shared worksheet.	3.57
Sustain the collaboration	Off-task interactions that (a) occur simultaneous to on-task interactions and (b) promote or maintain peer interactions	Students break out into choral singing while building ten sticks together.	3.80
Destabilize the collaboration	Off-task interactions that serve to reject or deflect bids to join or remain in the collaboration	Two students work on representing the number 34 as 3 tens and 4 ones. One student asks his peer if she has another idea for representing the number 34. His peer responds with teasing him about who he "likes" and continues to tease him until he stops asking for her contribution.	7.14

Flops	Off-task interaction includes a bid to shift the group dynamics (e.g. gain attention of others or grow the collaboration) but no shift occurs, and/or the interaction is interrupted by teacher intervention	A student repeatedly attempts to share an idea with his table mates. His two peers ignore his attempts, as they share a story about a classmate who got in trouble that morning and pass the shared worksheet between the two of them.	12.50

The most prevalent function of off-task participation, more than a quarter of all instances was to fill time when students perceived their task to be complete. Perhaps unsurprisingly, off-task participation occurred often when students acted as if they had nothing else to do. However, when students did perceive work to be done, the majority of off-task instances, 58.93%, served a productive function. Only 12.50% of the time did off-task interaction serve to avoid work, one of the primary concerns of teachers. Below we offer a brief illustration of each of the productive functions of off-task interactions, in order of their prevalence in the data set, and demonstrate the ways in which students used off-task interaction as a positional resource to shift the dynamics of the collaboration.

Warming up to the collaboration

16.07% of off-task interactions served to essentially launch the collaboration. Similar to filling time, which occurred when students believed they were done with the task, these interactions served to connect the students who were gathering together, before establishing the done to be done. While most often, the collaboration would begin with an on-task question, such as "so what are we doing?" or a directive "you get the hangers and I'll get the base ten blocks", students also initiated connection and interaction through some amount socializing before the work began in earnest. For example, in one instance at the beginning of the group work session, as students join the small group table, they interact with one another around the topic of the video camera near their table. One student waves at the camera, as two others look on. A student jokes, "It's recording us. Hi, my name is Vanessa. Just kidding. It is my name, so I'm not kidding." In doing so, their bodies orient toward one another and their gazes meet. The students then agree to get some building blocks to begin their task. The off-task instance functioned to orient students to one another at the start of the collaborative session, enabling the launch of the work.

Gaining the attention of others

The second-most prevalent productive function of off-task interactions, representing about 12.50% of instances, served to shift the gaze of peers toward a student who was previously not being attended to by others. At times this was the first step to gaining access to the collaboration or recruiting new peers into the collaboration, while at other times, students were already in the collaboration, but were simply struggling to gain the attention of their peers. Once attention was gained through off-task interactions, students often shifted back to their on-task contribution, which was now more likely to be acknowledged or responded to by peers. The example below illustrates this dynamic between two girls, Vanessa and Leah, working together as partners:

Leah and Vanessa are both creating sticks of ten connecting cubes and representing particular numbers with ten sticks and loose cubes. Leah has represented and counted her number and has unsuccessfully bid for Vanessa's attention to verify her work. Vanessa is instead counting her own ten sticks and loose cubes. Leah then states, drawing on a pop song with the lyrics "black and yellow, black and yellow", "See look...black and zombie, black and zombie" to refer to her alternating black and green cubes on her 10 sticks. Vanessa shifts her gaze to Leah's cubes and smiles, looks over her representation and says, "You add four more" and placed four cubes down on table.

In the above example, neither Leah nor Vanessa were initially marginalized from the collaboration. Both were working individually on the shared task, yet Leah struggled to gain Vanessa's attention to her work. Once she referred to her 10 sticks, not as mathematical objects, but as related to a popular song, Leah was able to gain Vanessa's attention and show Vanessa her progress.

Gaining access to collaboration for self

10.71% of off-task interaction functioned for a student to gain access to the collaboration who was previously spatially marginalized. These off-task instances typically began after unsuccessful bids to work with others on the task. The off-task interactions created new opportunities for the students to engage with one another by disrupting the on-task dynamics and enabling students to either gain traction into and join existing collaborations. These instances typically occurred after a series of unsuccessful bids to either join or initiate

collaborative work, suggesting that interactional pathways into the collaboration through on-task activity were restricted or more cumbersome. While our analysis makes no claims about student intentionality, the off-task interactions successfully functioned to grow the collaboration in ways that previous on-task interactional bids were not. The following example illustrates these dynamics between 3 students, Felix, Jose, and Mutya:

Felix and Mutya are discussing how many ten blocks they were supposed to build, leaving Jose out of the collaboration. Felix and Mutya then take all the blocks that are on the table, including blocks that Jose was holding. Jose takes back one 10 stick, made up of red and green blocks, and teases, "You want to fight me?" Felix's gaze shifts to Jose and he responds, "No, you Christmas tree." Jose reaches over and takes more blocks, switching the colors of his 10 stick to black and red (rather than the Christmas colors green and red), and jokes again, "You want to fight me now?" Felix holds his gaze on Jose and repeats "No, you Christmas tree." Jose responds, "Because you're scared. I'm stronger than you." Jose then suggests the group make his number first, stating, "Why don't we make mine first because it's like the shortest." The group takes up his suggestions and collaboratively represents his number with the manipulatives.

Just prior to the off-task instance, Jose was marginalized from the collaboration and lost access to the materials. Jose playfully takes one stick of 10s back and offers to battle his stick against one of Felix's. Through this action, Jose successfully gains Felix's attention as well as access to the materials. He extends the interaction, taking up Felix's retort that he would not battle a stick that looked like a Christmas tree, by gaining access to more materials and positioning himself as powerful (...you're scared. I'm stronger than you."). From this relatively more powerful position, Jose bids for collaboration, suggesting they represent his number first as a group. The students follow his suggestion, growing the collaboration to include Jose.

Recruiting others into collaboration

10.71% of off-task interaction functioned to recruit others into collaboration. Even during a group task, students often pursue components of the task independently. Recruitment of group-mates into collaboration is central part of negotiating a collaborative task. Like gaining access to the collaboration for self, recruiting others into the collaborations entailed off-task interactions, which subsequently shifted back to on-task, after growing the number of participants working together in collaboration.

In one example, two pairs of students are working in parallel at the same table, not orienting to the members of the other partnership. Gabe and Katy form one of the two partnerships. When Gabe bids to recruit Lina, one of the members of the other partnership, through on-task talk, into a joint collaboration, his partner Katy resists. She tells Gabe "No, they're working together," and later bids for Gabe's attention by placing her glasses on top of the table mic and says "it's a person." Eventually Katy claims control of the materials and refuses Lina access. As Lina orients toward Gabe, Gabe beings a conversation about Minecraft. He announces that he rode his horse and burned down the village. With this story, Gabe gains the gaze of both Lina and Katy and returns to the task at hand, directing them to "put all your tens in here, put all your tens in here." As the episode ends, Gabe, Katy, and Lina are all building ten sticks and oriented toward each other.

Through the positional identity as warrior, Gabe is able to recruit a new collaborator into his existing partnership and resolve the resistance coming from his existing collaboration. Where on-task talk of recruitment and inclusion of Lina into the group was rejected, the use of the powerful figure of a warrior on a horse burning down a village, positioned Gabe with the authority to give a directive with regard to the work, finally bringing Katy and Lina into a joint collaboration on the task.

Extending the task

5.36% of off-task interactions extended the context of the task, often the storyline and in a playful way that departed from the task instructions. Arguably, these interactions might be considered "on task" since they are indeed related to the collaborative work. However, because the interactions took on a sense of fantasy and play, we included them in the analysis. Like Dyson (1987), we found these extensions could at time enhance or elaborate on the intellectual work of the group, even if these interactions did not necessarily progress problem solutions. For example, in one instance, three students sit at a table with five 10 sticks in the middle. They are representing the number 38 and must choose with of the five 10 sticks to include in their solution. One student decides that the "weak" sticks should not be included and begins to hit the sticks with a pen to see which fall apart and which don't. His peer joins him in this and they begin a discussion about the qualities of sticks that would make them weak or strong.

Resisting authority

3.57% of off-task interactions functioned to resist some kind of power move made by a peer. Often, these interactions served to resist domination, in particular of a peer issuing directives to another peer. Less often,

these interactions serve to reject a bid for someone to take on a position of authority. For example, in one instance, a student states that her peer, also at the table, is the smartest of their group and should thus lead the work. They then begin a conversation about the problems with the word, "smart", ultimately refusing the positional identity.

Discussion

In this study, we found that off-task interactions may play an important role in maintaining shared intellectual work among students, in particular through its role in making available positional resources that can function to support the collaboration. Specifically, students utilized these positional resources during off-task participation, which drew on storylines of youth popular culture, friendship/romance, and home life, in ways that initiated, grew, and sustained the collaboration, gained the attention of others, extended the task, and resisted concentrated authority.

These findings have implications for research on collaboration. For one, these findings build on the literature on collaborative co-regulation. In particular, we found that off-task participation not only helped renew motivation to participate (Sabourin, et al, 2011), but also offered alternate pathways into the collaboration and the maintenance of joint attention and sustained work (Barron, 2003). Further, relationships of power matter when it comes to managing and sustaining collaboration, and these relations emerge interactionally through positioning. Subject positions become available through storylines, and school mathematics as a storyline does not necessarily offer sufficient positional resources to navigate shared work. Off-task interactions, which draw from other storylines, broaden students' negotiating capacity.

These findings additionally have implications for teacher professional development. Teachers would benefit from understanding the functions of off-task interactions on the collaborative process and to develop a lens for noticing how students engage in relational struggles in addition to the conceptual and communicative struggles of collaborative problem solving (Langer-Osuna & Munson, 2017). All of the instances analyzed in this study likely represent moments when teachers intervene and attempt to stop the off-task talk to get student back on-task. But to do so would ignore the function that these interactions actually serve in getting students into mathematical work. That is to say, these interactions *are* work, and sometimes intervention derails the work students are doing and learning to do as they engage in collaborative mathematics. Certainly, sometimes intervention is necessary. We ought to support teachers in knowing when to intervene and when to allow students to navigate their own way into the mathematics. Our findings suggest that teachers might benefit from pausing to notice off-task interactional dynamics and ask themselves questions such as, "Are students using the off-task talk to gain access?" before deciding whether or not to intervene.

Endnotes

(1) One video had faulty audio and was removed from the dataset.
(2) For example, a student who initiated off-task talk in a bid to gain attention may have continued to be ignored, resulting in no perceivable function to the collaboration. These failed bids were coded as "flops".

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