The Communication Conundrum Exercise: Pedagogy for Project-Based Learning

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Many professionals spend a significant amount of their time managing and supporting project teams. To help students learn how to work in this environment, we present the Communication Conundrum Exercise (CCE). The CCE challenges students to solve a symbol-identification problem with tension from hierarchical controls and narrowly defined rules for communication. Students assume roles that correspond to the major roles found on real-life hybrid project teams, and work with the triple constraint triangle common in project management. We provide the rationale for the CCE and the method and results of our analyses from 126 management students in 26 groups, and provide the details of exercise setup, execution, and debrief. The CCE delivers a high-energy, high-impact experience for students on the nature of hybrid project teams and their communication challenges. *Organization Management Journal*, 12: 209–220, 2015. doi: 10.1080/15416518.2015.1096759

INTRODUCTION AND RATIONALE

A significant consensus exists in both the academic and practitioner literatures for the ubiquitous role of projects in contemporary organizations (Daim et al., 2012; Dineen, 2005; Kerzner, 2009; Volkema, 2010). Whether these organizations are business, nonprofit, or public, their collective planning for and use of project teams is a major structural mechanism for moving initiatives, products, or services within both internal and external marketplaces.

In contrast with other types of teams, for example, self-managed, operational, product, the structure of project teams typically derives its distinctiveness from working horizontally across flat structures with different functional areas of expertise within matrix structures at local or global sites of organizations. Although cross-functional project teams structurally appear to encourage more flexible, creative productivity of organizational strategies than within functional silos with bureaucratic controls, the professional discipline and practice of project management has evolved a strong hierarchical inclusion of scope, cost, and schedule controls (Clegg & Courpasson, 2004). This "hybrid structure" limits a project team's flexibility, innovation, and breakthrough thinking that are often necessary to compete successfully within the complexity of modern project environments (Clegg & Courpasson, 2004; Lenfle & Loch, 2010; Thomas & Mengel, 2008). Compounding this dynamic, an increasing number of organizations are adopting projectized structures throughout their entire enterprises as a way to control systematically all or most project initiatives, resources, and schedules (Kerzner, 2009).

Within this changing landscape of project management, scholars are calling for an increase in project management education, especially within business schools and management programs. This literature includes communication as one of the core areas for knowledge and skill development in project management education programs and coursework. As primary examples, Ashleigh, Ojiako, Chipula, and Wang (2012) demonstrate the importance and transferability of education in communication skills for project teams. Ojiako, Ashleigh, Chipula, and Maguire (2011) focus upon the changing and challenging project environments in modern organizations and the need for students to develop the types of communication skills that will enable them to communicate effectively with a variety of project stakeholders. Similarly, Pant and Baroudi (2008) place the need for student communication skills within modern complex projects. Thomas and Mengel (2008) echo this theme on the educational necessity of student competency development in communication due to both the complexity and constant change taking place within modern projects. Overall, scholars are making compelling cases for the necessity of project management education that incorporates knowledge

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and skill development in communication due to the changing and complex nature of organizational and project management environments.

We maintain that project management pedagogy also needs to prepare students to experience and understand communication in the context of hybrid project teams and discover ways to break through hierarchical controls that can inhibit effective communication. In our exercise that follows, we focus upon communication in both the taskwork and teamwork of a hybrid project team structure that contains both implied and explicit hierarchical controls. We include and model the "triple constraints" of project management control in the scope, schedule, and resources of this hybrid team structure. The scope constraint refers to varying degrees of hierarchical control on the definition and authorization of a project to solve a business or organizational problem. Scope can be determined by a project sponsor (senior or executive manager), and formally assigned or informally emergent project manager or team members (subject-matter experts). There is some level of negotiated agreement on the scope objectives between or among these key roles, but this depends on the degree of hierarchical control present in the project environment. The schedule constraint typically involves top-down deadlines with varying degrees of bottom-up reality checks, the key question being, "what" is possible to accomplish within these time limits with flexible or predetermined amounts of human and capital resources? Sponsors of projects control and authorize the allocation of resources and, to varying degrees, scope definition and parameters of a project. Also, sponsors often need input from project managers and team members to check their expectations, again to varying degrees, for what is possible given the scope challenges, availability of needed resources with competing demands, and overall timelines of other projects.

Given the educational needs and background discussed already, we present the Communication Conundrum Exercise (CCE) in this article. Research by Leavitt (1951), Shaw (1964), and Crawford and Lepine (2013) on group configurations provide the foundation for the CCE. Leavitt (1951) studied the effects of group configurations on communication patterns. Using symbol-identification games, he found that most group configurations formed a funnel that defaulted to the person located in or near a central position. This central person coordinated the group's communication in finding the symbol they held in common. Leavitt's (1951) research was studied and validated further by Shaw (1964). Most recently, research by Hossain and Wu (2009) on 252,759 messages of 17,568 users in the Enron data set compellingly showed "a significant relationship between centrality and coordination" (p. 810). Leavitt's (1951) original methodology for the symbol-identification game also included limited information for each member of the different group configurations that was necessary to determine the common symbol. Contemporary research has identified this and similar communication efforts in research as creating "hidden profile problems" (Lewis & Grosser, 2012) in which group members make assumptions about what information other group members have. In the symbol-identification game of the CCE, we purposely replicate the method of limited information for each individual.

Research by Crawford and Lepine (2013) on team processes and structure completes the foundation of the CCE. Configural theory (Crawford & Lepine, 2013) explains how patterns of team communication influence team effectiveness or ineffectiveness by virtue of the structure of individual members' positions. Crawford and Lepine (2013) integrate contemporary research (e.g., Balkundi, Barsness, & Michael, 2009; Hollenbeck et al., 2011) to propose that in groups and teams "centralization of task work [is only] associated with higher team effectiveness when paired with decentralized teamwork" (p. 39). Paradoxically, however, decentralized teamwork possibilities are purposely limited by a team's focus or over-focus on taskwork. Drawing from the work of Marks, Mathieu, and Zaccaro (2001), Crawford and Lepine (2013) describe *taskwork* processes as including communication between and among team members regarding the team's tasks, resources, and challenges. *Teamwork* processes, on the other hand, refer to communication between and among team members about tracking progress, completing their tasks, coordinating and integrating work efforts, having healthy debates with minimal dysfunctional conflict, encouraging and motivating others when things are difficult, and helping others to manage stress in order to keep good emotional balance on the team.

In the CCE we create an experiential learning tension between taskwork at the expense of teamwork. Since we control for communication in the participants' teamwork by limiting communication methods and who can communicate with whom to default to the central position held by the project manager (see Figure 1), we put the project manager at risk for becoming overwhelmed, saturated in his or her centrality, and/or ineffective in taskwork at the expense of teamwork. The high risk for the project managers' role saturation inevitably leads many teams to experience severe bottlenecks in the flow of their communication, which amplifies the constraints that other team members experience, putting an overemphasis on their taskwork and little if any decentralized teamwork. All in all, the CCE exemplifies Kolb's (1984) philosophy for experiential learning, "Learning is the process whereby knowledge is created through the transformation of experience" (p. 38).

OVERVIEW OF THE CCE

The CCE involves students attempting to solve a symbol-identification problem in hybrid project teams of four or five members, while constrained by communication rules regarding who may communicate with whom using written messages. Each team member is provided with a role description instruction sheet containing a unique mix of symbols that they may not show to other team members (Appendix B). Each instruction
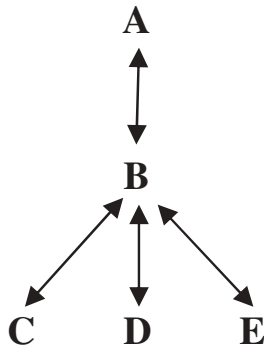
Front wall of Room

A

B

C D E

FIG. 1. CCE project team configuration and communication rules. All participants sit facing the front wall of the classroom. Communication rules are: Role A can communicate with Role B and vice versa; Role B can communicate with Roles C, D, and E and vice versa. Roles C, D, and E cannot communicate with one another or with Role A. All communication is by written messages passed back and forth according to the communication rules. The objective of the CCE is to solve an analytical problem (scope), i.e., finding the common symbol among all team members. Each role receives a unique instruction sheet to use in participating toward finding the common symbol. Each participant is asked to provide verbal estimates (from 0 to 100%) of the amount of work their team has completed at every 5-minute interval (total of 3 estimates) throughout the exercise, which demonstrates a common control mechanism for hybrid project teams.

sheet also contains rules for whom they may communicate with and vice versa. Their challenge is to determine the common symbol among them (the symbol is the division sign), but only the person in Role A has these full directions. Students perform the exercise in 15 minutes of actual work while seated forward and facing the front of the room in an inverted T-configuration (Figure 1). This arrangement is intentionally hierarchical, visually reflecting the paradoxical structure of project teams as a hybrid form of bureaucratic structure. After each 5-minute increment of teamwork, the instructor stops work and quickly records the status of each team member on a whiteboard in front of the room through their estimates of how much work they think their team has completed, from 0 to 100%, at that point in time. Requests for and determinations of incremental status reports are a common practice in project management, especially within organizational structures that have control mechanisms as part of their project management methodology. The CCE also contains a substantial debriefing (Appendix A). All in all, the CCE represents a project scope (the symbol-identification problem), four or five team members (resources), and a 15-minute schedule of work (discounting the status reports). Thus, the CCE represents the triple constraint triangle considered essential to project management control. Note: The CCE does not require student or instructor prework unless the instructor chooses to implement the exercise within the context of a learning module related to his/her class.

DESCRIPTION OF THE CCE EXERCISE

Objectives
- Strengthen students' ability to communicate effectively on project teams.
- Give students a greater understanding of the causes of communication problems on project teams.
- Clarify how ineffective communication can occur on project teams.
- Give students a greater understanding of what communication behaviors lead to effective communication on project teams.

Audience
The audience is undergraduate and graduate students in management, organizational behavior, organization development, project management, and other related courses where understanding the impact of communication and organizational structure is included.

Placement
The CCE can be placed at any point in an instructor's course, depending on how an instructor wants to use the exercise, for example, as an ice-breaker for a class session, for preparing students for a group project assignment, linking to a unit in organizational communication or group communication, using it as an example of most topics in management and organizational behavior, incorporating it in a module and/or course on project management, and so on. Generally, we recommend using the CCE at the beginning of a class in order to have sufficient time for an immediate, full debriefing.

Time Allocation
Prior to class: 15 minutes.
Explain CCE: 10 minutes.
Arrange class set-up: 10 minutes.
Run the exercise: 20 minutes.
Debriefing of exercise: 30–45 minutes.

Specific Exercise Instructions
- Prior to class: Obtain a considerable amount of scrap paper and cut into small pieces for students to use in writing and passing messages. Expect to have enough strips of paper for each student to pass many messages over the course of the exercise. Next, print out sets of roles (Appendix B) for each team of students depending on the size of the class. Lastly, prepare a flip chart or other visual for projection of the seating configuration in Figure 1 if you do not plan to draw that configuration on a whiteboard during class.
- In class—Explain the CCE:

- Announce to students that they are about to engage in a problem-solving exercise that will require them to work in project teams. Then draw Figure 1 on a whiteboard and explain the five roles, illustrate where each role member will sit in the configuration for the exercise, and draw and explain the lines and arrows that represent the communication rules of who can communicate with whom and vice versa (Figure 1).
- Emphasize that during the exercise there will be no talking; all communication is accomplished using written messages to and from the person with whom one can communicate.
- State that each student will be given an information sheet describing their role in the exercise once the teams are sitting in their correct configuration. Inform the students that they are to remain in this sitting arrangement until the exercise is fully completed and the facilitator/instructor calls an official end to the exercise. Emphasize that no one is to show their information page to anyone else until the debriefing of the exercise.
- Also state that the students in Role A may report when their project team has completed its task by raising their hand and discretely showing the solution to the instructor.
- Finally, for this section, tell students that you will stop their work every 5 minutes (at 5 minutes, 10 minutes., and the end) and quickly ask them for their individual estimate of how much work, from 0 to 100%, they think their team has completed thus far. This estimate will be an arbitrary guess, typically projected from their individual progress. (Note: The estimate portion of the CCE represents a common and required practice in hybrid project teams to monitor and track intermittent progress in order to control for scope, resource usage, and schedule slippages. We discuss this in the debriefing.)
- Arrange class setup of CCE.
- Assign students to groups of five. Groups of four may be used as necessary if the total number of students does not support all groups having five students.
- If the classroom allows for seating to be moved about freely, have students or assistants arrange chairs or desks to reflect the configuration depicted in Figure 1. If seating is in fixed rows, ensure that students are organized as closely as possible to Figure 1 once they are seated. Ensure that each team member has within reach a sufficient number of paper strips on which to compose messages.
- For each project team at a time, hand each of the five team members their role sheets. For any teams having four students, one of the students can be given both Role D and Role E. Ask students to keep their instruction sheets turned over so that they cannot read them until the instructor officially begins the exercise.
- Run the exercise.
- Once all teams have been supplied with information pages with all members seated according to the seating chart, instruct the class to begin the exercise. Mark the time that students begin their work and determine the first 5-minute pause in which you will collect their estimates.
- Periodically during the exercise casually state, while students are working, that the scope of their project is a simple analytical problem and shouldn't be too difficult to solve. This manipulation may promote later discussion of how perceptions of difficulty may differ, as well as affect morale and/or motivation, when such statements are made.
- Also periodically, as needed, remind students that the only form of communication is written and that they may not turn around toward another team member (this is especially true for Role A and Role B).
- You may wish to take notes on observed behavior or assign one or two students to act as observers of the teams as they work. Observations can include nonverbal expressions, frequency of message passing, accumulation of messages by role, allocation of effort, and periods of being idle and by whom.
- After 5 minutes of work, announce that teams are to pause their work. The instructor then quickly asks each team member, what is the amount of work, from 0 to 100%, that your team has completed to this point? Record each answer on the whiteboard. Typical answers within a single team can vary greatly on this first 5-minute status report. Answers that range from 0% to 80% or 90% are not unusual. Often there is a reaction of humorous surprise from students about the disparity in their estimates. State that these estimates are data for the team to use in self-correcting their communication behavior during the next 5-minute work period.
- When all estimates are taken and recorded on the whiteboard, ask the teams to resume working. State that you will check in again in another 5 minutes for their second round of estimates. Record this second start time and calculate the time for concluding the next 5-minute period.
- Sometimes after the first estimates, one or two teams report a solution to the problem. When an incorrect answer is given, the instructor indicates that the solution is not correct and directs the team to resume work. When the solution is correct, the instructor should acknowledge this fact, mark the time of completion on the whiteboard, and direct Role A to quietly continue to send messages to determine whether all team

members know the purpose of the exercise. This step is essential since it is possible to solve the analytical problem without Roles C, D, and E knowing the actual problem that their team has solved.

- Stop the teams again at 10 minutes and take another status check (as already described).
- Once all teams have solved the problem or the allotted time has expired, take one last status check, then call an official end to the CCE.
- Debriefing of exercise. In Appendix A, we provide the specific steps for guiding a robust and effective debriefing. We also include many of our experiences in debriefing the CCE that highlight important areas for consideration during implementation.

STUDENT FEEDBACK

In order to evaluate the efficacy of the Communication Conundrum Exercise and student learning, we administered a survey based on our four learning objectives to 126 graduate (MBA and project management) and undergraduate (management and organizations) students at a West Coast university. In total, we collected data on 26 teams, 22 of which had five members and four of which had four members (on the four-person teams, one person played the roles of both D and E). Our survey contains six quantitative items, each on a 6-point Likert scale. We also created one open-ended qualitative question. The first four items of the survey correspond to our four learning objectives; the remaining two items measure students' overall experience and satisfaction with the CCE (Rosh & Leach, 2011). Our open-ended question asked students to provide written responses describing how the CCE enhanced their understanding of the specific project role they played, A–E. We also collected data on individual students' 5-minute, 10-minute, and final estimates of the amount of work their respective project team had completed up to each of the respective 5-minute points in time during the 15 minutes of the CCE ($N = 126 \times 3$ estimates/each time period $= 376$ total estimates of work completed).

Table 1 displays the mean scores and standard deviations of students' responses to the six items of the questionnaire, ranging from 4.59/6 ($SD = .957$) on item 1 to 5.25 on items 5 and 6 ($SD = .995$ and 1.003, respectively). Students agreed that their participation on the CCE project teams (a) enhanced their ability to communicate effectively, (b) gave them a greater understanding of the causes of communication problems, (c) clarified how ineffective communication can occur, and (d) gave them a greater understanding of what communication behaviors lead to effective communication. Students also reported high mean scores ($5.25/SD = .995$ and 1.003) for items 5 and 6, which indicate that both the CCE and the debriefings were a positive experience for them overall and a satisfactory learning experience in particular.

We next wanted to see whether there were any significant differences in participants' three time estimates of the work completed on their projects during the CCE. To determine these differences, we chose to run a nonparametric Friedman test. Pairwise comparisons were performed with a Bonferroni correction for multiple comparisons. We found that the students' estimates of work completed were significantly different at the three time points during the CCE, $\chi^2(2) = 163.29$, $p < .0005$ (Table 2). We then ran a post hoc analysis that revealed significant differences in students' estimates of work completed from 5 minutes ("Mdn" = 20% completed) to 10 minutes ("Mdn" = 60%) ($p < .0005$); 5 minutes to 15 minutes ("Mdn" = 100%) ($p < .0005$); and lastly, 10 minutes to 15 minutes ($p < .0005$) (Table 2).

We also wanted to determine whether there were differences in the participants' three time estimates of the work completed on their respective teams and their different team roles (A–E). We ran a Kruskal–Wallis test to answer this question. Again, pairwise comparisons were performed with a Bonferroni correction for multiple comparisons. Specifically, both the 5-minute estimates ($\chi^2(4) = 19.431$, $p < .001$) and the 10-minute estimates ($\chi^2(4) = 13.314$, $p < .05$) were significantly different among the project team roles. In addition, post hoc analysis revealed significant differences in participants' 5-minute time estimate scores between Role E ("Mdn" = 10) and Role A

TABLE 1
Participant reports of learning objectives and their experience and satisfaction ($N = 126$)

Participation in the CCE has:	Mean	Standard deviation
Enhanced my ability to communicate on project teams.	4.59	.957
Given me a greater understanding of the causes of communication problems on project teams.	5.10	.937
Clarified how ineffective communication can occur on project teams.	5.10	.862
Given me a greater understanding of what communication behaviors lead to effective communication on project teams.	4.75	.857
Overall the CCE and debriefings were a good experience for me.	5.25	.995
Satisfied my learning experience in the CCE and debriefs.	5.25	1.003

TABLE 2
Post hoc differences in estimates of work completed at different time points during the CCE (N = 126)

5 minutes	10 minutes	15 minutes
Mdn = 20% complete	Mdn = 60% complete*	
Mdn = 20% complete		Mdn = 100% complete*
	Mdn = 60% complete	Mdn = 100% complete*

*$p < .0005$.

("Mdn" = 20); Role E ("Mdn" = 10) and Role B (Mdn = 30); and Role D ("Mdn" = 10) and Role B ("Mdn" = 30).

Qualitative Analysis

We interpreted the participants' written responses to an open-ended question by adapting a thematic network analysis developed by Attride-Stirling (2001). Specifically, we identified the key themes present in student responses to the following request: "Briefly comment on how the project simulation and debriefing enhanced your understanding of the project role that you played." After identification of key themes, we uncovered multiple subthemes using an iterative process that enabled us to examine the responses at varying levels of abstraction. We systematically examined a database of all the individual textual responses, allowing us to identify the most frequently appearing examples of emotions, attitudes, reactions, and observations described by the student participants after experiencing the CCE. We took care to preserve the original language of the students as we identified frequently occurring themes for each respective role. Over several subsequent meetings, we examined our own individual interpretations of these themes, resulting in a reduced set that we elaborate upon here.

Participants in all of the five project team roles reported feeling some form of personal responsibility and the realization that contribution from their project role was essential to solving the problem (e.g., "I should have been explaining the objective to the team," "I was the only person who could communicate with everyone," "[I needed to] be ready to perform when those who know more need my help"). The CCE clearly generated a sense of urgency and palpable stress for all project team members. However, notable differences were observed with respect to the chief sources of that stress for different roles.

For example, students in the project sponsor role, Role A, reported to some degree that they felt the importance of making sure everyone else knew the objective of the CCE, but several failed to realize that their role sheet actually contained the directions for solving the problem and assumed that all other roles had the same information on their handouts, which indeed no other role handout contained. As one Role A student stated, "My first act should have been to explain the objective to the team." Another said that their behavior "shows my quickness to make assumptions that others on the team already understood the team objective." Other students in this role realized from

the CCE the necessity of openly sharing information as well as monitoring their team's progress to some degree. "I learned the importance of communicating everything to all group members so all know what is going on."

Several students in Role A perceived their authority in the exercise due to their placement in the structure and the facilitator's request that students in Role A report their team's answer to the facilitator. For example, one student stated, "I learned that even though I was in a head/leader position, I was not the biggest asset to our team." Another student said, "[The exercise] shows me how I have internalized the worst aspects of hierarchy." Based on the facilitators' observations, students in Role A also tended to spend a significant amount of their time "waiting" and not active in their team's efforts to solve the problem. Yet several Role A students described their desire to know how to overcome the structural limitations of their role in order to help their team produce a quality outcome. They acknowledged that the process they followed or assumed they needed to follow led to troubles for their team in understanding the problem early on.

Students in the project manager role, Role B, encountered the unique challenge of being in the central position, the communication bridge, within the hybrid project team structure. As such, they were required to handle literally every transmission of information that is passed among team members. Students in Role B described how they were involved with message management to such an extent that they often forgot about the project sponsor (Role A), who then became relegated to being simply a reporter of the project team outcome, the common symbol, to the facilitator. Of all the roles within the CCE, students characterize the project manager role as the most critical to the solution of the problem from the exercise's start to finish, as well as the role most saturated with work. As a result, students in Role B described their frustration with the pace and volume of communication they were required to sustain and process. "I experienced such frustration that I was the only person to connect with each group member while I did not notice everything." "I was overwhelmed by the symbols I was receiving from my team." "I was overwhelmed with information. I wanted to help C, D, and E know what I was working on but I didn't have time to write everything down."

Role B students also described their need to articulate both questions and answers, and many indicated a realization that the other roles did not simply need more information in order to better assist in solving the problem. Some of their comments

include: "I did not get the chance to ask questions to anyone." "I should have tried to make everybody think about the objective of our team rather than their own objectives." "I took away a better understanding of [the need to] keep all team members informed of the process." "I found out how important it was to make sure everyone knew the objective because that was the only thing that held us back in the end."

Within the CCE, we define Roles C, D, and E as individual contributors. The experience of these roles is most characterized by a lack of understanding of the problem being solved, especially early in the exercise. Individual contributors reported feeling uninformed, isolated, and confused about the purpose and goal of the project objective. "I often felt in the dark about what everybody else was doing." "I felt isolated and unable to help the overall goal." "I felt distant and confused on both the purpose and goal of the project."

On many teams the correct solution was announced by the project sponsor without any of the individual contributor role players realizing what problem their information was even used to solve. Some individual contributors decided to volunteer information or ask questions about the problem, but their messages frequently went unanswered, leaving the individual contributors awaiting clarification of objectives or a request for further input. Thus, several students in these roles wrote about their need to wait during the periods of uncertainty. "I realized I need to communicate on topic and be patient with waiting for communication from others." "It was easy to feel unproductive and underutilized." However, from their distinctive physical vantage point and context, individual contributors tended to have the richest observations of the project managers' activities during the CCE, leading to several remarks of sympathy for the project manager (e.g., "I really felt the pain of Person B"). So it was not uncommon for participants in Roles C, D, and E either to proceed with their own agenda, for example, solving the analytical problem as if the symbols represent an equation, or to check out completely by not participating further.

Overall, our quantitative results support previous research that shows how communication roles have a direct influence on individual and team performance (Ahuja, Galletta, & Carley, 2003; Henderson, 2008, respectively). Indeed, this result goes hand-in-hand with role differences that students described in the qualitative portion of the survey we administered after debriefing the CCE. Students reported that role differences go hand in hand with the structural and communication constraints in place, the role of communication in team problem solving, and the effects of centrality in communication structures.

DISCUSSION OF RESULTS

Much of the pedagogical value of the CCE derives from its presentation of a truly multilevel, holistic experience for students. Like workers in the world outside of the classroom, students often define roles solely in terms of responsibilities, levels of authority, and other key aspects that are used to

define a job and/or role. One of the excellent contributions of the CCE is that it brings to light quite explicitly how position in a hybrid project team structure directly affects one's views, experiences, and behaviors. Specifically, the exercise reveals for students the limitations that impede their agency to flexibly and/or creatively communicate in solving the symbol-identification problem (Clegg & Courpasson, 2004; Lenfle & Loch, 2010). The results of our quantitative analyses significantly demonstrate students' realization of the CCE's impact by their strong agreement that they did indeed learn the objectives of the CCE and felt satisfied from this overall learning experience (see Table 1).

Our interpretation of the qualitative results also strongly supports students' realization of the impact of the hybrid structure and constrained communication rules as revealed in their reflections. Students in Role A made significant assumptions about the information other roles had in their instruction sheets, with the most common being that Roles B–E also had the instructions for solving the problem. Here we find the greatest evidence for the effects of the hidden profile problem whereby group members make assumptions about what information other members have (Lewis & Grosser, 2012). The effects specifically fell to the students in Role B who, by virtue of their feelings of saturation, frustration, and being overwhelmed, were not able to fully engage in taskwork communication, let alone teamwork communication. Ironically, this effect on Role B was observed by students in Roles C–E who demonstrated one of the best examples of attitudes toward teamwork communication in their sympathy for students in Role B. Their sympathy led these students to alter their communication behavior by deciding to wait to send additional messages, or to create their own agenda by solving the problem as an equation, or to check out entirely with no further messages. However, in some cases this "check out" can also be attributed to Roles C, D, and E feeling uninformed, isolated, confused, and not productive or underutilized due to students in Role B not being able to fully or meaningfully respond to messages. Nevertheless, these sympathy behaviors correspond to teamwork communication designed to complete one's task, encourage and motivate others when things are difficult (indirectly in our case), and/or helping Role Bs to manage their stress (again, indirectly in our case) (Crawford & Lepine, 2013).

We found that the leadership obligation of the project sponsor (Role A) is to convey purpose and establish the project's goal for the project manager (Role B). In actual project management practice, project sponsors' lack of sharing all relevant information typically occurs within organizations that do not have a clear strategic direction and/or an infrastructure of priorities, which makes the business case for a project murky (Kerzner, 2009). Too often project managers and team members are left trying to make sense of the project objectives based on assumptions, again the hidden profile problem. The CCE delivers a taste of the tension, ambiguity, complexity, and uncertainty that result in hybrid project teams where hierarchical controls tend to override necessary task communication on

projects from the start of a project (Crawford & Lepine, 2013; Thomas & Mengel, 2008).

Turning back to the quantitative data, we found two significant results from the teams' three estimates of progress during the CCE: Estimates were significantly different among the three time periods (Table 2), and estimates were significantly different among the roles in the configuration of the CCE: Students in Role A had significantly different estimates at the first 5 minutes than students in Role E; at the 10-minute estimate students in Role B had significantly different estimates than students in Role E; and at the end of the CCE, students in Role B had significantly different estimates than students in Role D. We were not able to discern any statistical differences involving Role C. In retrospect we surmise that students in Role C may have felt more "aligned" in the configuration with A and B than those students in Roles D and E, who were structural outliers by virtue of their position in the configuration. We did not find any discernible differences in the qualitative data among C, D, and E that might bear this out.

The estimates represent a fundamental practice in hybrid project management methodology to understand the status of the triple constraint triangle and provide data for making periodic trade-offs between and among these constraints (Clegg & Courpasson, 2004; Kerzner, 2009; Lenfle & Loch, 2010), which is why we provided all teams with open estimates on the whiteboard whereby they could use this information to self-correct their work in the subsequent 5-minute interval. We found no evidence in either the quantitative or qualitative results that students engaged in any teamwork communication regarding tracking progress, completing tasks, and/or coordinating their work efforts (Crawford & Lepine, 2013) as a result of openly listing individual estimates on the whiteboard, although this could have influenced their behavior.

Crawford and Lepine (2013) provide the theoretical nucleus for the CCE in their proposition that "centralization of taskwork communication is only associated with higher team effectiveness when paired with decentralized teamwork communication" (p. 39). All of our results attest to the presence of a centralization effect from the configuration of the CCE structure. We found this most glaringly in the large number of pieces of paper that the students in Role B held at the end of the CCE! Compared to students in every other role, Role B students had a substantial stack of messages at the end of the exercise. Clearly, this finding bears out the research findings of Leavitt (1951), Shaw (1964), and Hossain and Wu (2009) regarding the power of group configurations to default to the person located near or at the central position. More importantly, however, our qualitative results for students in Role B reveal the personal costs that team members endure who are centrally located in the hybrid project structure. A common reality for project managers is that they are responsible and accountable for the process and results of their project, but not formally authorized to manage the efforts. In the multiple times we have used this exercise, we find predominately good humor and a-ha moments among the

students in Role B at the end of the CCE. Yet the centralization effect does cause them stress, and here is where opportunities for decentralized teamwork communication can make a positive difference to project managers in real-life project management.

ALTERNATE USES FOR THE CCE

Instructors may wish to use the CCE as a central experiential exercise in overarching modules of different topics. In the following list, we highlight three possibilities.

First, use another theme from Clegg and Courpasson (2004) on the negative effects of hybrid project teams. Link this theme to the paradox of hybrid structures that actually mask the disempowerment of team members in using flexibility, creativity, and innovative thinking. Contrast with theories of power, for example, French and Raven (1959), and empowerment (e.g., Yukl & Becker, 2006). Ask students to write a follow-up paper on their suggestions for meaningfully incorporating taskwork communication and teamwork communication on hybrid project teams.

Second, ask students to write a paper about their experience of inhibiting team configurations with limited communication rules from their personal experience. Conduct a follow-up discussion with students about their papers and highlight their findings. Relate back to the CCE and ask students to compare and contrast their collective personal experiences with what they learned from the CCE.

Last, allow students to repeat the CCE, but to create their own communication network structure using their digital devices. Challenge them to come up with a way to do the CCE more effectively from a virtual perspective, a way that would increase satisfaction and effectiveness with taskwork communication and teamwork communication.

CONCLUSION

In conclusion, we found the CCE to be a high-energy, stimulating, satisfying learning experience for students. Moreover, in courses where we have used the CCE, we discovered that students did not forget the experience anytime soon, as we have been able to refer to the learnings of the CCE in subsequent class modules. Thus, the power and longevity of this exercise can add coherence to an instructor's overall coursework. All academic instructors value, to one degree or another, high-engagement learning experiences for their students. In our paper, we have established the reliability and validity of the Communication Conundrum Exercise to give instructors confidence for adding this exercise to their teaching repertoire.

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APPENDIX A: DEBRIEFING THE CCE

We begin the debriefing by announcing to the class that the purpose of the CCE is to find the common symbol among members of each team, which is the division symbol, and that the person in Role A is the only team member who had the instructions. Many students are visibly surprised to learn this and there typically is lots of energy in the room as students naturally talk about what happened in their team. We ask each team to move together in a circle and discuss their experience, being sensitive to the person in Role A, who may or may not have known that they had the instructions. Usually this is all that is necessary to say, as students are engaged and quite interested in discussing what happened in their team. In other words, we find that we have only one or two minutes to say anything, as the students want to immediately discuss what happened! We often observe team members exchanging messages and tracing the flow of communication, reading one another's instruction sheets, laughing frequently over where they may have gone wrong or where they were stuck. The energy in this portion of the debriefing is palpable and we just observe and answer a few questions at this stage. The typical time for within-team debriefing is 10–15 minutes.

Next, we ask the students to finish their team debrief and invite them to discuss several points about the exercise as a whole class. It may take a few minutes to get the students settled

and turn their attention to the instructor. We ask the students to share their experiences according to their role, beginning with all students in Role A, then all in Role B, and so on. Typically we record a summary of their responses on the whiteboard in a column for each role. We have found that it is sufficient to listen to students' experiences in each role, reflect these on the whiteboard, and then ask everyone to reflect on what they have heard. Invariably, other students will chime in about their thoughts and feelings for other roles and we observe the effects of experiential learning taking hold. We then link their role experiences to hybrid project teams and discuss the roles and responsibilities on a hybrid project team for Role A (the project sponsor), Role B (the project manager), and Roles C, D, and E (the individual team members, subject-matter experts, or individual contributors). We also discuss the tension of hybrid structures that represent hierarchical control, and the problems in communication that pull the team toward limited taskwork communication at the expense of teamwork communication. This is also a good place to describe the types of communication interactions that represent both of these types of communication (Crawford & Lepine, 2013).

We then focus the debriefing on the 5-minute estimates. The recording of the estimates on the whiteboard at each 5-minute interval visually provokes many comments and reflections from students. We point out that estimating project progress is an important aspect of the control and reporting necessary in professional project management practice (Kerzner, 2009). We emphasize that estimates should be based on a team's planning of a schedule, and that students rarely take any time in the CCE to plan out how they will proceed and report progress, they just dive right into the actual work, doing versus planning. We link this to the hybrid structure of project management and emphasize the teamwork communication necessary to plan for, monitor, and track progress. We also stress the importance in hybrid project teams to first develop a shared understanding of the project scope, followed by a plan for how to accomplish the scope. We also show that in hybrid structures, the project manager is typically responsible for reporting status to the sponsor or sponsoring senior managers based on input from team members.

Most importantly, we openly ask for and record students' estimates in order to provide them with valuable feedback about what other te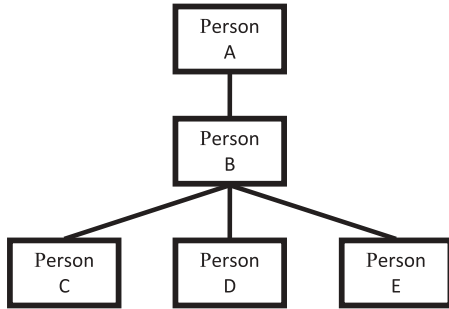am members' estimate, to consider differences, and to self-correct their work effort if possible. We also openly ask for and share these estimates to show students their progress as a team throughout the 15 minutes of the CCE. After the 10-minute estimates, most teams show movement toward more agreement in the amount of work completed on their team, which highlights those members still struggling.

Next, we discuss with students the reasons for adding the caveat to Roles C, D, and E's instruction sheets, "You may not show your symbols to anyone on your team." Ask students about the ways in which they interpreted this instruction. Explain that this caveat represents the various constraints that individual team members will have in real-life project management since the caveat may refer to possible proprietary information that team members on cross-functional project teams are not necessarily free to divulge without proper authorization from their functional area. The caveat also stands for the fact that information needed by individual contributors may need to be processed, researched, or calculated before bringing to a given project. In general, the caveat shows that all information requested or desired on a given project team may require time, approval, or access in order to contribute openly to a given team's scope and estimates. This is also a good place to introduce the effects of the hidden profile problem (Lewis & Grosser, 2012).

We finalize the debriefing by asking students what team configuration would facilitate more open and free-flowing taskwork communication and teamwork communication. Invariably, students state that some type of circle structure, whether in person or virtually, with no constrained communication rules would be the best way to accomplish a shared understanding of the project purpose (scope) and facilitate a smooth determination of the answer and completion of the scope. Here it is important for instructors to link the symbolic circle structure to the type of taskwork communication and teamwork communication necessary to create and offset the tension from hybrid structures that overemphasize taskwork for the purposes of monitoring and controlling a given project's progress. Instructors may also choose to link a metaphor of the circle structure with other aspects of team dynamics such as motivation and power. All in all, we have found that the debriefing discussion can last anywhere from 30 to 45 minutes.

APPENDIX B: ROLE INSTRUCTIONS FOR PERSONS A THROUGH E

Instructions for Person A

```
        ┌──────────┐
        │ Person   │
        │   A      │
        └────┬─────┘
        ┌────┴─────┐
        │ Person   │
        │   B      │
        └────┬─────┘
      ┌──────┼──────┐
┌─────┴──┐┌──┴───┐┌─┴──────┐
│ Person ││Person││ Person │
│   C    ││  D   ││   E    │
└────────┘└──────┘└────────┘
```
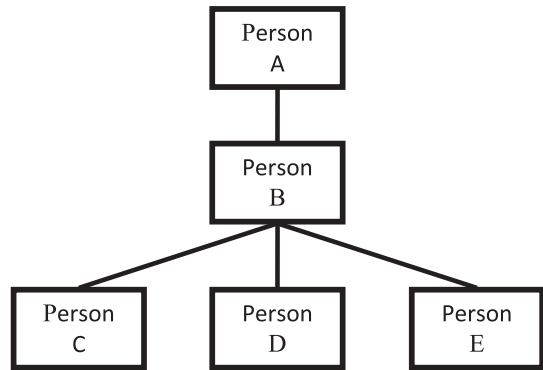
Each person on the team has been given a sheet with five symbols on it. Each symbol is one of six familiar symbols. Your task is to determine which one of the six symbols is held in common by everyone on your team. You have fifteen minutes to complete this project.

Your only permitted communication is with Person B. All communication must be written. Person B may communicate with you and Persons C, D and E via the same means. No other communications are permitted. If you have a question, please raise your hand.

Your symbols are listed below:

$=$ ♂   Ψ   ♀   ÷

Instructions for Person B

```
        ┌──────────┐
        │ Person   │
        │   A      │
        └────┬─────┘
        ┌────┴─────┐
        │ Person   │
        │   B      │
        └────┬─────┘
      ┌──────┼──────┐
┌─────┴──┐┌──┴───┐┌─┴──────┐
│ Person ││Person││ Person │
│   C    ││  D   ││   E    │
└────────┘└──────┘└────────┘
```

In this project, you are Person B.

Five common symbols are listed below. You may exchange notes with Person A as well as Persons C, D and E. No other communications are permitted.

If you have a question, please raise your hand.

Your symbols are:

♂   ?   ÷ $=$ ♀

Instructions for Person C

```
        ┌──────────┐
        │ Person   │
        │   A      │
        └────┬─────┘
        ┌────┴─────┐
        │ Person   │
        │   B      │
        └────┬─────┘
      ┌──────┼──────┐
┌─────┴──┐┌──┴───┐┌─┴──────┐
│ Person ││Person││ Person │
│   C    ││  D   ││   E    │
└────────┘└──────┘└────────┘
```

In this project, you are Person C.

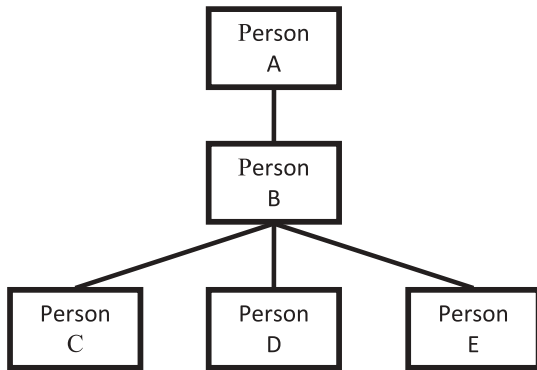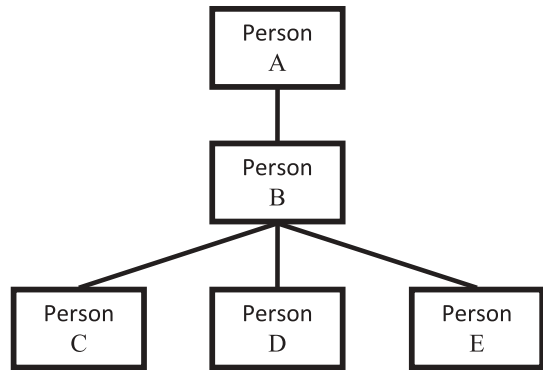You may only exchange notes with Person B. No other communications are permitted.

Five common symbols are listed below. You may not show them to anyone on your team.

If you have a question, please raise your hand.

Your symbols are:

♀   ?   Ψ   ÷ $=$

Instructions for Person D

```
        ┌──────────┐
        │ Person   │
        │   A      │
        └────┬─────┘
        ┌────┴─────┐
        │ Person   │
        │   B      │
        └────┬─────┘
      ┌──────┼──────┐
┌─────┴──┐┌──┴───┐┌─┴──────┐
│ Person ││Person││ Person │
│   C    ││  D   ││   E    │
└────────┘└──────┘└────────┘
```

In this project, you are Person D.

You may only exchange notes with Person B. No other communications are permitted.
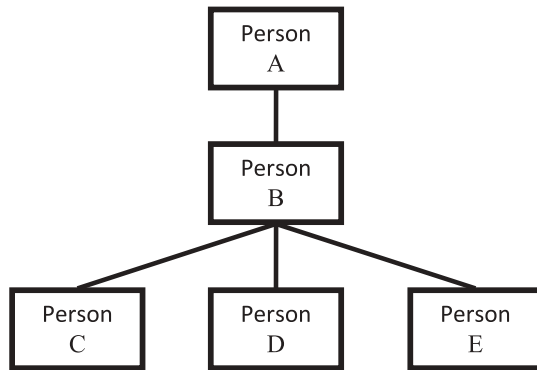
Five common symbols are listed below. You may not show them to anyone on your team.

If you have a question, please raise your hand.

Your symbols are:

?   ♂   Ψ   ÷ $=$

Instructions for Person E

In this project, you are Person E.

You may exchange notes with Person B.   No other communications are permitted.

Five common symbols are listed below. You may not show them to anyone on your team.

If you have a question, please raise your hand.

Your symbols are:

♀   ♂   **Ψ**   ÷   **?**

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