Work in Progress: Supporting Better Conversations in Senior Design Teams

Dr. Charles Riley, Oregon Institute of Technology

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Abstract

Effective interpersonal communication in senior design teams can be the key to their success or the reason for their failure. The high-risk, high-reward nature of senior project courses can lead to challenging team environments where miscommunication between even just two members can have significant consequences for the whole team. While team member assessment tools that structure feedback have been available for some time (e.g., CATME and similar instruments), direct instruction in interpersonal communication in senior project settings can vary. The senior project faculty in a civil engineering course sequence at a western public polytechnic university incorporated a structured lesson in having better conversations, with modules including state, assumptions, context, listening, and feedback, to equip students with skills to navigate interpersonal relationships more effectively during their senior project course. This work-in-progress paper describes the background and history of the Better Conversations lesson as well as the course, population, and methods employed to measure student learning and the impact of the lesson on the senior project experience. According to survey responses, a large majority of students who participated demonstrated comprehension and valued the Better Conversations tools.

Introduction

Senior project courses are a fixture in most civil engineering curricula in the country because of ABET accreditation requirements [1] related to effective communication and team performance, as well as industry goals that students perform design work for an unstructured design problem in the college environment prior to entering practice. In such courses, students have the potential to demonstrate their best work in a team environment, making the courses an ideal place to conduct assessment. The benefits of team-based design courses come with challenges inherent in team environments, including miscommunication, personality conflicts, conflicting goals, and differences in work methods and expectations of the quality of work products.

Interpersonal communication instruction is not new to engineering classrooms. Berntein [2] emphasizes the need for such skills by citing industry demands and a lack of instruction in interpersonal communication to support the creation of a first-year course at the University of Nebraska. Burchfield and Kedrowicz [3] describe interpersonal communication as "a process of shared meaning making that relies on the relationships between communicators" that can complement traditional instruction in writing and presenting that is more common in senior design courses. Dawson et al. [4] and Wolfe and Powell [5] focus on the gendered environment in engineering classrooms that may make effective interpersonal communication challenging, especially for women. Dawson et al. describe the effectiveness of an online resource called CareerWise in supporting students with interpersonal communication skills.

The anticipated outcome of the Better Conversations intervention on the students in the senior project course described here is for students to be able to use a model of fundamental elements of interpersonal communication to optimize and adapt themselves and their team's productive and

communicative capacities to achieve a defined goal for their senior project. The Better Conversations modules established a model of interpersonal communication for each student to use as a basis for refining their interpersonal communication skills in a professional working environment, as well as practice syntax tools for mitigating the unwanted impact of assumptions on listening and giving feedback. The research questions explored in this study are (1 - understanding) are students able to correctly define and interpret the subject matter of the modules, (2 - integration) do students claim an ability to apply the approaches in their senior project team environments and lives, and (3 - valuing) does student feedback indicate that the modules were valuable to them and could be valuable to other engineering students?

Background

The senior design experience at a western public polytechnic university has been taught for more than 15 years as a two-course sequence in two 10-week quarters.

In the first quarter, a 2-credit 400-level civil engineering course is co-taught with a 3-credit 400-level communication course with course outcomes in written and spoken communication as well as effective team performance. Multiple civil engineering instructors and a single instructor from the Technical Communication Department comprise a faculty team to deliver the course. As is common in most senior design courses, student teams are coached through a process of team formation to deliver multiple written and verbal presentations of their qualifications, project understanding, response to a request for proposal, and, by the end of the term, a 30% (conceptual) design presentation and report. With the design project as context, the focus of the instruction in the first term is written and verbal communication. Assignments and course activities are structured to offer multiple opportunities for students to receive feedback on writing in industry-standard genres like cover letters, memoranda, and reports, as well as individual and team oral presentations.

In the second quarter, a 3-credit 400-level civil engineering course is the platform for students to complete the design of the project solution they conceived in the first course, with a focus on project management, effective use of standards, solution methods and tools, and the presentation of a calculation package and construction documents. At the start of the second quarter, teams should have formed, stormed, and normed and should be performing effectively, but this is not always the case.

For more than five years, the CATME [6] peer and self evaluation rubric has been used to structure feedback to improve team dynamics. At the end of the first quarter, students score themselves and their peers on behaviors in five areas: contributing to the team's work, interacting with teammates, keeping the team on track, expecting quality, and having relevant knowledge, skills, and abilities. The "interacting with teammates" area is the most relevant to this project. While the other areas can reveal symptoms of problematic behavior, the behaviors in the interacting with teammates area have the potential to improve the communication necessary to remedy those symptoms.

The behaviors in the "interacting with teammates" area of the CATME assessment tool are:

● Communicated effectively.
● Facilitated effective communication in the team.
● Exchanged information with teammates in a timely manner.
● Provided encouragement to other team members.
● Expressed enthusiasm about working as a team.
● Heard what teammates had to say about issues that affected the team.
● Got team input on important matters before going ahead.
● Accepted feedback about strengths and weaknesses from teammates.
● Used teammates' feedback to improve performance.
● Let other team members help when it was necessary.

While students in the civil engineering program have used this rubric in various courses for many years up to this point, they have never received direct instruction in interpersonal communication. To encourage students to find solutions to their own problems within their team, the course includes a "dismissal protocol" to address behaviors that violate established team rules. Designed to be used after other approaches have failed, this protocol requires that team members prepare a written statement, deliver it to the course instructors, engage in a meeting to hear concerns and develop plans to remedy them, and, if the behavior is not corrected, a student can be removed from the course so long as the department chair approves. This requires the student to enroll in the course sequence again the following year. This protocol has only been used on rare occasions in the past 15 years, with only two students in that time being required to retake the course. Despite this rarity, interpersonal difficulties within teams do occur. Thus, the instructors sought a resource to support students in interpersonal communication to address unwanted behaviors more effectively on their own. The resource chosen is an open-source series of lessons called the Better Conversations, which we refer to here as the intervention.

The Better Conversations program was developed by the non-profit Better Conversations Foundation with the goal of helping people have better conversations at work and beyond [7]. The Foundation has attempted to distill and package a repeatable communications training so that new staff at participating companies could be brought up to a minimum working competency to communicate better across disciplines. The course was developed so various staff could not only learn communication competencies, but also learn how to deliver the training within the organization.

The Better Conversations Foundation was formed around this program for one specific private professional organization at first, with the intention to spread it to other organizations and contexts. The Foundation regularly hosts cohorts to experience the course by their most experienced trainers as well as train new individuals to deliver the course materials. The course script ("flight plan") is published under a creative commons license, encouraging people who have completed the course to bring it into their organizations both to improve communication competencies, and to recommend it to others to learn how to deliver it. The Better Conversation materials are well developed and defined as well as freely available [7].

The instructors who delivered the course to the polytechnic student cohort in this study have undergone the training for delivering Better Conversations, and though they are affiliated through that training and have four years of experience delivering the content, they are not part of or represent the Better Conversations Foundation. They used the materials provided by the Creative Commons license with minor modifications to accommodate this specific population.

The Better Conversations program consists of five modules: State, Assumptions, Context, Listening, and Feedback. The State module introduces a state framework that has students self-reflect to identify their ability to engage in conversation as green (good to go), yellow (proceed with caution), or red (stop and take a break). A model of communication is introduced that describes each person in a conversation

1. seeing or hearing something,
2. thinking and feeling something as a result, and
3. saying or doing something.

The other person then sees/hears, thinks/feels, and says/does, and the cycle continues through the conversation. The Assumptions module has students consider the extent of the assumptions they make in interpreting what another person communicates. The Context module explores how a person's context (environment, lifestyle, social class, etc.) may be exposed or hidden, and that it can influence that person's state and the assumptions they make in a conversation or that another person might make about them. It is emphasized to students that state is a type of context, and so state, context, and assumptions are all inexorably linked. The Listening module facilitates students to practice two types of listening: (1) listening without interruption and (2) listening to accept and extend understanding. Question syntax to minimize assumptions is provided, and mindfulness of the influence of state, assumptions, and context is encouraged. Finally, the Feedback module introduces a method of providing feedback in which one explains

1. what they saw or heard,
2. how they interpreted what they saw or heard
3. the impact this had on them, and
4. their intention for providing feedback.

The goal of this approach is to separate observable facts from interpretation in providing feedback to avoid miscommunication.

As of January 2025, the Better Conversations materials are undergoing continued revisions to make the content diversely applicable within multiple industries and demographics. The latest version has shifted the Module 5 topic from "Feedback" to "Intention", which is believed to be more applicable to a wider audience than the version taught to this study cohort. The version taught here was focused on "feedback". The version that was taught has Module 5 as feedback for three reasons. The first is that it is believed the task of separating observable fact from opinion to be a useful syntax for engineers entering a corporate work environment. The second was that the presenters of this cohort had more familiarity with the Feedback module and the third is the Intentions module has not yet undergone as rigorous a testing and revision process as Feedback.

Methods

Senior design course meetings consist of two two-hour meetings per week, but only a portion of these meetings was used for the Better Conversations intervention. In the second week of the course, a half-hour introduction session was held to set expectations for student participation and to introduce the Better Conversations facilitators. Five one-hour sessions were delivered in the following weeks to deliver the modules, with each lesson building upon the one before. The sessions were structured as one hour for ease of scheduling. Each module opened with a state check, a review of the previous module's homework, and an opportunity for students to ask questions about prior modules. Then, there was a 10-minute lecture on the content of the module, followed by two breakout room activities, each followed by an unpacking session, with "unpacking" meaning the students were invited to share what they discovered in their breakout room activities for the larger group to learn from each other.

The sessions were delivered via Zoom, with course instructors and students in a classroom with facilitators joining remotely for all but the second module. For module 2, students, facilitators, and instructors joined a Zoom session to facilitate an exercise that required participants to describe an object off-screen in their physical environment as a way to explore the assumptions of their conversation partner. This hybrid delivery approach is a deviation from the traditional remote delivery of the Better Conversations course that has participants meet via Zoom and takes advantage of breakout rooms in that platform. The hybrid approach was chosen because the facilitators were not available to travel to the institution and the class was scheduled as an in-person class.

The population in the study consists of 22 senior-level students, 8 identifying as female and 14 identifying as male.

In an effort to answer the research questions, a 50-question survey (see Appendix) has been developed to assess student knowledge and perceptions of the Better Conversations content. The goal is to measure student learning and perceptions using both direct assessment, with correct and incorrect answers via multiple choice questions, and indirect assessment, with Likert-scale responses to statements indicating whether students agree or not with various competencies presented in the intervention. Because the survey has questions that assess knowledge of the content, it will be provided completion credit rather than a score based on student performance in an effort to reduce bias in the students' responses. Institutional Research Board (IRB) approval to administer the survey was requested and approved; only 18 consenting student responses are presented here (7 identifying as female and 11 identifying as male).

Results and Discussion

Insights into the impact of the Better Conversations intervention can be gleaned from (a) anecdotal evidence derived from student feedback and module observations and (b) students survey responses; both will be presented in this section.

Anecdotal Evidence

Many students indicated that the course supplied them with valuable resources that improved their communication skills. Students reported using the frameworks taught in the course in a variety of settings, including teamwork and family interactions. For example, one student shared how they clarified communication with family over Thanksgiving break using the framework. Another applied the traffic light system in meetings with their senior design team. Several students indicated that the State module increased their awareness of their own and others' emotional states during conversations, with some articulating their feelings to better navigate interactions. Students reported that the modules on Context and Assumptions helped them understand different perspectives and reduce misunderstandings. One student mentioned keeping the "I hear, I feel, I say" illustration in mind during conversations to avoid assumptions. Additionally, listening skills improved for one student, particularly in allowing speakers to talk uninterrupted during breakout room sessions.

Areas for improvement fell into broad themes of delivery, content, and curriculum:

Delivery

- Adapting the originally designed online course to an in-person classroom setting presented challenges. For example, students may have been more hesitant to share their "red" states in person compared to a remote setting with less familiar participants.
- Some students found it difficult to adhere to the structure of breakout room activities, especially with familiar classmates.
- For the facilitators, it was hard to ensure the syntax was followed in break-out rooms - especially with the hybrid structure. There has been some thought to seeding future cohorts with students who have been through the intervention to encourage full participation with the activities.
- Accountability and task management during the sessions was improved when the facilitator or producer were able to pair up with a participant for break-out room activities. This happened specifically when a student joined a session remotely.

Content

- Some students interpreted a "yellow" state as "neutral" rather than "proceed with caution." This is not inherently problematic, but it does indicate how students might bring their own interpretation to the models presented.
- When describing their state, students tended to focus on external circumstances rather than internal, somatic awareness. As a result, the facilitator wanted to consider ways to bring the focus of the exercise back to personal reflection without negating the students' initial responses.
- While the facilitators expected the students to be challenged by the Context module because it contains multiple concepts and new terminology related to temporal, spatial, and environmental contexts and a bigger cognitive leap than the previous modules, many students later expressed that they found it impactful in their final homework for the feedback module.

- Students expressed discomfort both in listening without interruption and in speaking without being interrupted, possibly related to their developmental stage.
- Many students expressed gratitude for the feedback method as a tool they could use immediately to great effect, while others struggled to use the method during the session or describe how they used it in their homework response.

Curriculum

- One student suggested that the course content might be more impactful if introduced earlier in the degree program.

These preliminary results suggest that the Better Conversations intervention had a positive impact on student communication skills and self-awareness. Furthermore, at least one team directly benefited from the feedback tools learned in the course to address an internal concern.

Addressing challenges related to course delivery and student discomfort with certain modules should be done in future iterations. A more comprehensive assessment of the program's effectiveness is possible through a review of the formal survey results.

Survey Results

The survey, presented in the Appendix with correct answers and numbers of responses, included true-false and multiple-choice questions to gauge respondents' understanding of the Better Conversations content. Responses were generally correct with at least 13 out of 18 students responding correctly for any given question; true-false questions had a higher rate of correct responses with many questions answered correctly by all respondents. This indicated that a majority of the students interpreted the material correctly and left the course with a foundational comprehension of the tools presented.

The survey also asked students about the value of the Better Conversations course with multiple specific questions about each course module (Figures 1-5). In general, students responded positively to the course content (neutral to positive), while one or two students selected somewhat disagree or strongly disagree for most questions. Over half of students somewhat or strongly agreed that they gained or improved abilities or valued the tools presented. Neutral to disagree responses ranged from two to six students out of 18 respondents, depending on the question, again indicating that the course had a positive impact on a majority of students.
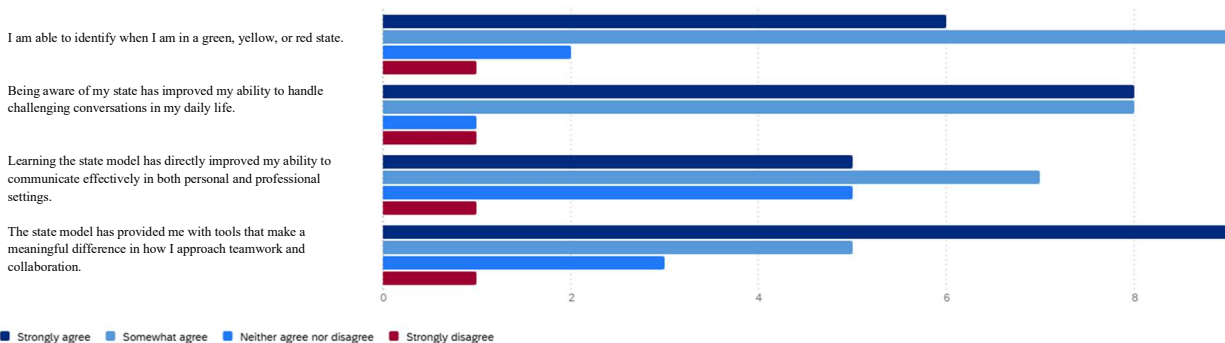

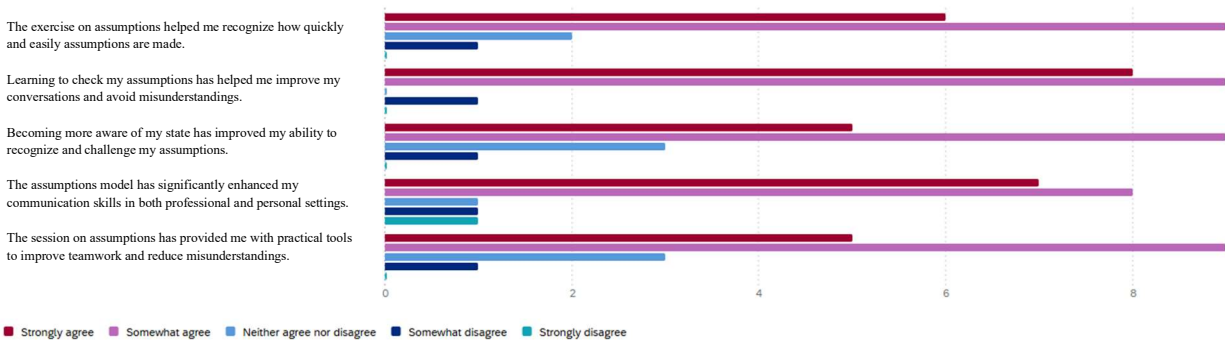Figure 1. State-related responses.
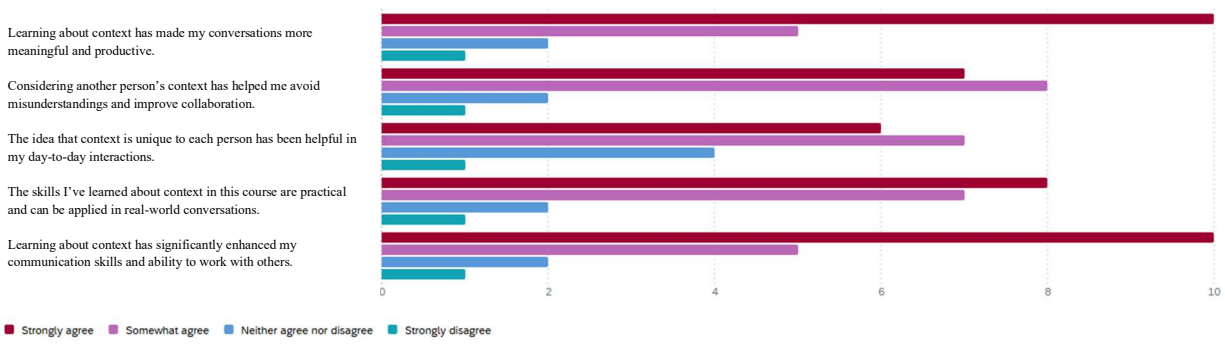
Figure 2. Assumptions-related responses.

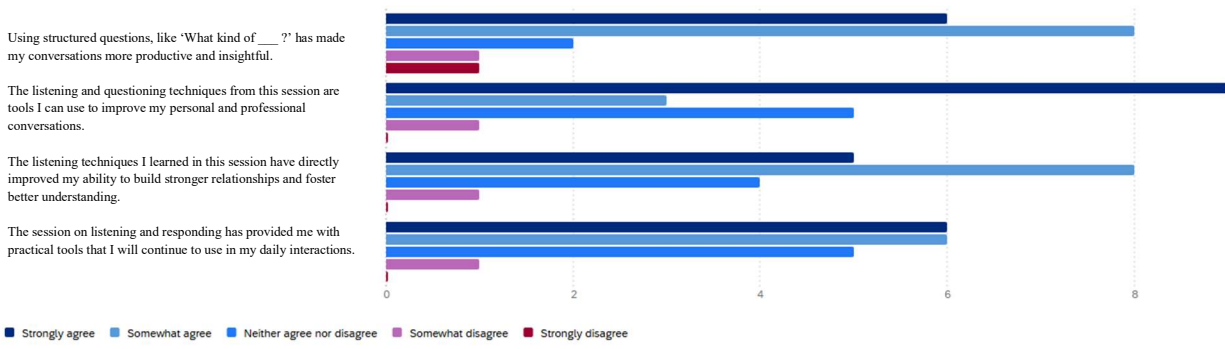Figure 3. Context-related responses.

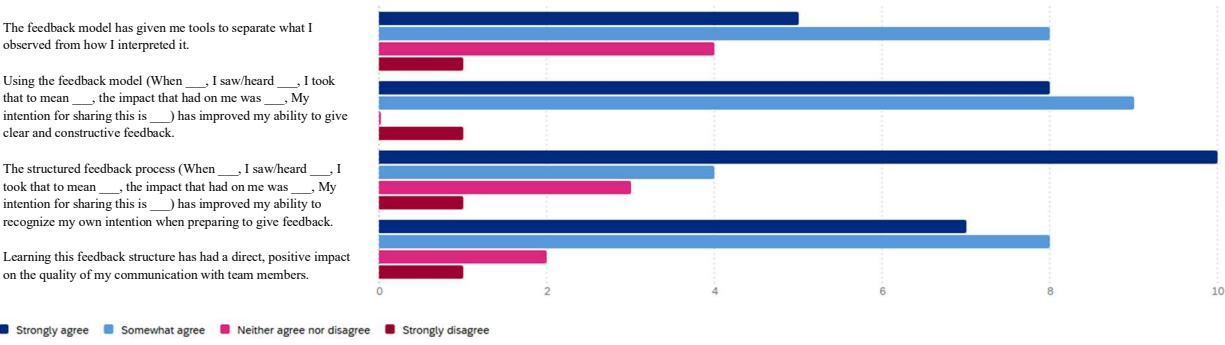Figure 4. Listening-related responses.

Figure 5. Feedback-related responses.

Conclusion

A senior project course sequence was treated with an intervention intended to improve student interpersonal communication with a goal of achieving more successful senior project course outcomes. The five-module Better Conversations course was incorporated via five one-hour weekly interactive lessons. Students were surveyed to measure both their understanding of the Better Conversations competencies and their perception of their ability to perform them. Survey results indicated that a large majority of students understood, integrated, and valued the course content. Future iterations of the senior design course will continue to include the Better Conversations materials and will explore its relationship with the CATME survey responses.

References

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Appendix - Assessment Survey

True or False Questions

The correct response and number of responses out of 18 respondents is indicated in parenthesis at the end of each question.

State

1. Being more aware of our state can help us have Better Conversations. (True, 18)
2. Being aware of our state can influence the way we navigate our conversations (True, 18)
3. The traffic light model is a model used in Better Conversations to represent different states. (True, 18)

Assumptions

4. The stimulus–response model flows like this: I see/hear → I think/feel → I say/do. (True, 18)
5. Assumptions are made during the internal (I think/feel) step of the stimulus-response model. (True, 18)
6. Feelings, such as mood or emotions, never influence the assumptions we make. (False, 16)

Context

7. Everyone comes to a conversation with a unique context that shapes their perspective. (True, 18)
8. Understanding the other person's context can help reduce misunderstandings in conversations. (True, 18)
9. Context is irrelevant when we're communicating with people we know well. (False, 18)

Listening

10. Listening to accept means actively judging and questioning the speaker as they talk. (False, 15)
11. Asking "Is there anything else about that?" multiple times can help uncover more about someone's thoughts or feelings. (True, 15)
12. The questions introduced in Better Conversations can help uncover meaning without making the other person feel interrogated. (True, 18)

Feedback

13. Feedback is a way of sharing your own context and experiences, but its impact on the other person may be different from your intention. (True, 18)
14. The phrase "You have so much potential" will always be received as positive feedback. (False, 17)
15. We can assume that the impact of feedback on another person will always align with our intention. (False, 16)

Multiple Choice Questions

The correct response is indicated in bold and the number of responses out of 18 respondents is indicated in parenthesis at the end of each potential response.

State

16.   What does being in a "Green" state typically mean?
      A. "Good to Go" Feeling good, engaged, and operating at your best. (18)
      B. "Stop/Brake, and take a Break" Experiencing strong, unpleasant emotions, or perceived threat, may have a fight/flight/freeze response.
      C. "Proceed with Caution" Feeling unsure about the social rules or the situation, not completely OK.
      D. That recreational marijuana is legal in that state.

17.   Why is it important to be aware of your state during a conversation?
      A. It allows you to control the other person's feelings.
      B. It helps you understand your own reactions and have better conversations. (17)
      C. It prevents misunderstandings caused by assumptions. (1)
      D. It eliminates the need for active listening.

18.   How can recognizing your state (Green, Yellow, Red) before entering a conversation be helpful in having a better conversation?
      A. To decide whether you are in the right state to have the conversation effectively. (16)
      B. To ensure you control the outcome of the conversation.
      C. To match the emotional state of the other person.
      D. To avoid being affected by the other person's perspective. (2)

Assumptions

19.   Which question is most effective for checking assumptions?
      A. "What kind of X (where X= a word they have used)?" (13)
      B. "Are you sure X is correct?" (3)
      C. "Does X remind you of anything?" (2)
      D. "Do you like X-Men movies?"
20.   How can checking your assumptions improve your conversations?
      A. It helps you avoid misunderstandings and strengthens mutual understanding. (17)
      B. It ensures the other person agrees with your viewpoint.
      C. It eliminates the need to ask follow-up questions. (1)
      D. It allows you to steer the conversation in your preferred direction.

Context

21.   Why is it important to consider the context of the person you are speaking with?
          A. To better understand their perspective. (16)
          B. To make assumptions about their feelings.
          C. To avoid talking about sensitive topics. (2)
          D. To ensure they agree with your viewpoint.

22.   How can you learn more about someone's context during a conversation?
          A. By making assumptions about their feelings.
          B. By asking thoughtful questions to understand their perspective. (18)
          C. By focusing only on your own state.
          D. By avoiding topics that may be controversial.

23.   How does context influence our assumptions in a conversation?
          A. It helps us avoid assumptions altogether. (1)
          B. It provides the framework we use for interpreting information. (17)
          C. It determines the outcome of the conversation.
          D. It has no effect on assumptions.

Listening

24.   What is the primary goal of listening without interrupting or judging?
          A. To identify mistakes in what the speaker is saying.
          B. To fully receive the speaker's perspective without directing the conversation to your preferred topic. (18)
          C. To prepare a strong counterargument.
          D. To direct the conversation to your preferred topic.

25.   Which of the following is an example of a question designed to uncover someone's thinking without making assumptions?
          A. "Why did you do that?" (1)
          B. "And, is there anything else about that?" (17)
          C. "Are you sure that's correct?"
          D. "Do you think that's a good idea?"

Feedback

26.   Which of the following best describes the difference between intention and impact in feedback?
          A. Intention is what we plan to communicate; impact is how it is received. (17)
          B. Intention is the tone of voice used; impact is the content of the feedback.
          C. Intention and impact are always the same. (1)
          D. Intention is irrelevant as long as the feedback is delivered clearly.

27. Which of the following questions helps to clarify your purpose when preparing to give feedback?
    A. "How can I avoid any impact?" (1)
    B. "What is my intention for this feedback?" (16)
    C. "Why is the other person wrong?"
    D. "What do I want the other person to do?" (1)

28. Which step in the feedback model helps you clarify your interpretation of an event?
    A. "When [something that happened]."
    B. "I saw/heard ___." (1)
    C. "I took that to mean ___." (17)
    D. "The impact that had on me was ___."

Rating Scale (1-5) Questions

State

29. I am able to identify when I am in a green, yellow, or red state.
30. Being aware of my state has improved my ability to handle challenging conversations in my daily life.
31. Learning the state model has directly improved my ability to communicate effectively in both personal and professional settings.
32. The state model has provided me with tools that make a meaningful difference in how I approach teamwork and collaboration.

Assumptions

33. The exercise on assumptions helped me recognize how quickly and easily assumptions are made.
34. Learning to check my assumptions has helped me improve my conversations and avoid misunderstandings.
35. Becoming more aware of my state has improved my ability to recognize and challenge my assumptions.
36. The assumptions model has significantly enhanced my communication skills in both professional and personal settings.
37. The session on assumptions has provided me with practical tools to improve teamwork and reduce misunderstandings.

Context

38. Learning about context has made my conversations more meaningful and productive.
39. Considering another person's context has helped me avoid misunderstandings and improve collaboration.
40. The idea that context is unique to each person has been helpful in my day-to-day interactions.

41.   The skills I've learned about context in this course are practical and can be applied in real-world conversations.
42.   Learning about context has significantly enhanced my communication skills and ability to work with others.

Listening

43.   Using structured questions, like 'What kind of ___ ?' has made my conversations more productive and insightful.
44.   The listening and questioning techniques from this session are tools I can use to improve my personal and professional conversations.
45.   The listening techniques I learned in this session have directly improved my ability to build stronger relationships and foster better understanding.
46.   The session on listening and responding has provided me with practical tools that I will continue to use in my daily interactions.

Feedback

47.   The feedback model has given me tools to separate what I observed from how I interpreted it.
48.   Using the feedback model (When ___, I saw/heard ___, I took that to mean ___, the impact that had on me was ___, My intention for sharing this is ___) has improved my ability to give clear and constructive feedback.
49.   The structured feedback process (When ___, I saw/heard ___, I took that to mean ___, the impact that had on me was ___, My intention for sharing this is ___) has improved my ability to recognize my own intention when preparing to give feedback.
50.   Learning this feedback structure has had a direct, positive impact on the quality of my communication with team members.