

Active Listening for Engineering Students

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Abstract—Employers of engineers seek to have their engineers use active-listening skills. Good active listeners demonstrate skills such as avoiding judgmental responses and giving supportive and appropriate verbal and nonverbal feedback. To support students in developing active-listening skills, we developed teaching modules covering sixteen learning outcomes, to be delivered across a four-year engineering program. These modules have been designed to integrate with the program's core content. Informal pilot testing with seniors in a capstone design course suggests that this curricular approach enables students to understand and to be able to practice introductory active-learning skills.

Keywords—Active listening, teaching modules, skills assessment

I. INTRODUCTION

This paper reports work in progress to develop an approach to teaching active listening over the course of a four-year undergraduate program in engineering at an R1 university. In October of 2020, we contacted representatives of ten of the department's stakeholders who employed the department's graduates or sponsored capstone projects. The stakeholders, which included Fortune-100 companies, utilities, and startups, identified the most important personal skills of leadership for engineering students: collaboration and teamwork, communication, interpersonal skills/creating relationships, listening, having a broader view of leadership, adaptability, decision-making, and problem-solving. The stakeholders also identified the five personal skills of leadership for which the department's students most needed to improve:

- **Communication:** Students do not practice enough active listening where they listen to understand rather than listening to respond, and their writing skills are probably the least developed and practiced in the program.
- **Ethics and compliance:** Students should understand that ethics and integrity are the guiding principles for everything that excellent organizations do.
- **Conflict Resolution:** Students should actively practice scenarios and the best way to facilitate solutions.
- **Critical thinking:** Students should communicate the technical models supporting the solutions.
- **Networking:** Students should develop interpersonal skill, social skills, communication skills, and humor, which helps when building rapport.

In response, we began developing and deploying curriculum to address the need to improve these five skills for our students. The first skill on which we worked was active listening, for

which we developed learning outcomes, curricular modules, and assessment plans. This paper reports the results of this work by describing the skill of active listening, reviewing related pedagogy, outlining a set of learning outcomes, briefly describing the teaching modules, and discussing our experience in informally piloting one of the modules.

II. THE SKILL OF ACTIVE LISTENING

Active listening is a one of the top skills demanded by employers [1, 2]. Active listening includes empathic responding using both words and actions, based on understanding the speaker's idea, attitude, and point of view, so that the listener senses how it feels to the speaker and grasps the speaker's frame of reference about the subject [3]. Good listeners listen with an open mind and free from personal bias, take time and have patience while listening, permit the speaker to finish without interruptions, give the speaker one's full attention, listen with sincerity, listening without regard to status differences, and place oneself in the other's position [4].

The skills of active listening can be organized in four phases (adapted from [4]):

- **Pre-listening:** Physically establishing a supportive listening environment; asking questions or otherwise showing that the listener wants to hear what the speaker has to say; and coming prepared and ready to listen.
- **During listening:** Giving supportive and appropriate nonverbal feedback to show comprehension and continued attention; and giving supportive and appropriate verbal feedback, such as empathy and agreement.
- **Post-listening—Immediate:** Giving appropriate nonverbal and verbal responses; avoiding changing the subject without an appropriate transition; avoiding judgmental responses; and encouraging the speaker to continue speaking.
- **Post-listening—Long-term:** Giving a verbal response that shows understanding of the previous conversation; giving a nonverbal response that shows familiarity with the previous conversation; and taking appropriate action (or explaining why action was not taken).

Unfortunately, actively listening skills cannot be applied in different situations using a one-size-fits all approach. Situations of verbal interaction, requiring variations in active-listening skills, can be differentiated in terms of five factors: transactional aspects, asymmetry, formality, social distance, and time; this

means that an effective listener would need to acquire range of approaches to listening [5].

III. PEDAGOGY OF ACTIVE LISTENING

Teaching active listening, much like teaching engineering leadership, is not amenable to a quick fix; it is not realistic to expect to improve long-term listening skills with a single three-hour activity session [6]. The instructional approach in [2], conducted over several weeks, had four components: initial self-assessment and reflection, learning materials, active listening exercise, and re-assessment. Other techniques include interpersonal activities such as mock interviews and storytelling, and group activities such as learning the interests or hobbies of other participants [7]. Experiential learning of skills of active listening is more effective than learning based on lecture and discussion [8].

One approach to teaching active listening involves instruction in four critical skills: preparing to listen, open-ended questions, paraphrasing, and reflecting feelings [9]. However, while paraphrasing makes the speaker seem more socially attractive, it does not increase the speaker's perception of feeling understood [10]. Techniques for instilling active-listening skills include using a formula, such as "you feel __ because __," practicing with prompts and modeling and demonstrating. Different contexts for developing these skills include role play, in which students take on personas in imagined situations, and "real play," in which students share experiences from their actual lives [9]. An example of "real play" is the "Heard, Seen, Respected" activity from Liberating Structures [11], which fosters empathic capacity through non-judgmental listening.

IV. LEARNING OUTCOMES

The research literature provides multiple possibilities for expressing learning outcomes for active listening. Three learning outcomes for listening skills were formulated in [12]:

1. Describe specific behaviors that comprise active listening.
2. Recognize contexts where active listening is applicable and use it in situationally appropriate ways.
3. Identify ways of, and feel confident about, using and continuing to develop active listening skills in the future.

Describing the skills of competent listeners, [13] effectively provided another set of learning outcomes for listening skills:

1. Demonstrate knowledge and understanding of the listening process.
2. Demonstrate ability to use appropriate and effective listening skills for a given communication situation and setting.
3. Demonstrate ability to identify and manage barriers to listening.

While each of these approaches captures important aspects of learning goals associated with active listening, they are (a) largely complementary and (b) not detailed enough for the planning and assessment of active-learning skills in a thread that

runs through eight semesters. Accordingly, we articulated sixteen learning outcomes that reflect the outcomes from [12], [13], and primarily the elements of [2]'s phases of active listening.

1. Knowledge and Comprehension. Explain the key concepts of:
 - The purposes and importance of active listening
 - The four phases of active listening
2. Application and Analysis. Apply skills of:
 - Avoiding judgmental responses
 - Giving supportive and appropriate verbal feedback, such as empathy and agreement
 - Giving supportive and appropriate nonverbal feedback to show comprehension and continued attention
 - Physically establishing a supportive listening environment
 - Coming prepared and ready to listen
 - Avoiding changing the subject without an appropriate transition
 - Encouraging the speaker to continue speaking
 - Giving a verbal response that shows understanding of the previous conversation
 - Giving a nonverbal response that shows familiarity with the previous conversation
 - Asking questions showing that the listener wants to hear what the speaker has to say
 - Taking appropriate action (or explaining why action was not taken)
3. Synthesis and Evaluation
 - Self-assessing active-listening skills in project teams
 - Assessing others' active-listening skills through observation
 - Developing a plan for improving one's active-listening skills

V. TEACHING MODULES

To achieve the learning outcomes for active-listening skills, we developed a suite of modules to be delivered in the core courses across the four years of the major. The modules comprise brief lectures, group and individual active-learning activities, with associated assignments that include observation and reflection.

Our first, most comprehensive, design had two modules per semester, for a total of sixteen. A second and more practical design had ten modules. At this point, discussions with our faculty colleagues disclosed a serious problem: if we were to implement similar levels of instruction for all of the personal skills of engineering leadership listed in the introduction, this material would effectively crowd out the core engineering content that is our program's principal point. As designed, the ten modules of the active-listening material alone would take an average of 68 minutes of class time and 28 minutes of homework

time per semester. Facing this problem, we redesigned the modules to integrate with existing content in the courses to the greatest extent possible. That is, we strove to include the active-listening material in projects and other assignments and activities that the courses have already. As a result, the active-listening material will instead take an average of 33 minutes of class time and 38 minutes of homework time per semester. Here are three examples of how the active-listening material will be integrated into the core courses in the major:

Semester 2 is an introductory course that emphasizes team skills in engineering. The course's learning outcomes for active listening are (1) physically establishing a supportive listening environment (2) coming prepared and ready to listen, (3) avoiding changing the subject without an appropriate transition, and (4) encouraging the speaker to continue speaking. Module 2 integrates these skills into preparing for a design review for sustainability through (a) a jigsaw of materials on the skills, (b) individually writing a brief description of a situation in which you used these skills, and (c) a group activity in which the students exchange their descriptions with another student and share feedback.

Semester 4 is a course on engineering measurement that includes mini-projects with electrical circuits. The course's learning objective for active listening are (1) giving supportive and appropriate verbal feedback, such as empathy and agreement, (2) giving supportive and appropriate nonverbal feedback to show comprehension and continued attention, (3) giving a verbal response that shows understanding of the previous conversation, and (4) giving a nonverbal response that shows familiarity with the previous conversation. Module 4 integrates into the feedback and reflection process on a project. The students work through the "Appreciative Feedback" process of Liberating Structures [11], from the prompt "What challenges did you face in Project 1?"

Semester 5 is a course on engineering design, including customer discovery. The course's learning outcomes for active listening are (1) asking questions showing that the listener wants to hear what the speaker has to say and (2) developing a plan for improving one's active-listening skills. Module 5A integrates the question-asking skill into an existing lecture on how to interview for customer discovery. This is followed by a class activity of developing examples of customer-discovery questions that show that the listener wants to hear what the speaker has to say. Later in the semester, Module 5B involves a homework assignment with reflections on (1) the active-listening skills demonstrated in the current project for each of the four phases and (2) a plan for improving the active-listening skills that were demonstrated least.

VI. SKILL ASSESSMENT

Even when the department deploys the entire suite of modules for active listening skills for engineering leaders, this pedagogy may or may not actually improve the students' skills. Determining the initiative's success depends on accurate assessment of the skills we seek to teach.

For interpersonal skills generally, the Behavioral Assessment Grid [14, 15] provides a high-level theoretical framework for assessing affect and motivation, cognition and

knowledge, and behavior and skills, and there are hundreds of assessments of communication and social interaction [15]. For example, the Interpersonal Competence Questionnaire [16] assesses initiation, self-disclosure, negative assertion, advice and guidance, and conflict resolution. Nevertheless, a review of the research literature discloses only one validated instrument for assessing active listening, the Active Listening Observation Scale [17]. However, this approach involves experts observing participants in conversation, which would be infeasible for assessment of learning outcomes in the context of a pedagogical thread in an engineering major.

There are instruments for self-assessment of listening skills, but these instruments do not specifically address active listening (e.g., [18, 19, 20, 21]). One instrument, with 47 items, measured a combination of active-listening and person-centered attitudes [22]. Another instrument, described and validated in [23], assessed students' improvement in listening skills, their learning of course concepts/constructs, and their critical listening and thinking skills.

A study of an approach to improving listening skills [2] asked participants to complete two complementary self-assessments, the Listening Skills Inventory (LSI) [22] and a listening self-inventory [23]. The LSI has been validated, but neither instrument addresses the complete range of active-listening skills described by [4] or corresponds to the set of learning outcomes presented in Section IV. Perhaps the most appropriate instrument is the STEM Active Listening Skills Assessment [24], a validated, 42-item instrument that assesses knowledge of active listening, ability to apply this knowledge, and self-efficacy with respect to active listening. These categories closely track the kinds of learning outcomes in our program. Formal assessment of the active-listening curricular initiative will involve pre- and post- surveys using this instrument.

VII. PILOT RESULTS

Delivery of the full curriculum will begin with the 2021-2022 academic year. We informally piloted the first module in a class session in a senior capstone design course, covering the purposes and importance of active listening; basic behaviors of active listening, including avoiding judgmental responses; giving supportive and appropriate nonverbal feedback to show comprehension and continued attention; giving supportive and appropriate verbal feedback, such as empathy and agreement. To build these skills, and the synthesis-evaluation skill of assessing others' active-listening skills through observation, the students participated in an in-class activity. In groups of three students, one student described what he or she is doing on an assignment in the course, the second student practiced active listening, and the third student observed the interaction. At the end of the conversation, the third student provided feedback on the active-listening skills that he or she observed. The roles then rotated so that each student played each of the three roles.

The pilot delivery of the active-listening material was subject to three key limitations. First, the material delivered in the pilot session corresponded closely to the material planned for the first-semester module, but for practical reasons the content delivered was tested in a senior-level course. Thus the students in the pilot session may have been better equipped to learn the material than the first-year students for whom the

material is planned. Second, because the pilot session was informal, we did not have approval of the university's institutional review board for collecting data from participating students. Third, for the same reason, we were unable to deploy and evaluate the STEM Active Listening Skills Assessment instrument. Consequently, we are limited here to reporting our general impressions of the results of the pilot session.

Even with these limitations, our experience with this pilot effort indicated that the students appeared to understand and to be able to practice the module's active-learning skills. The introductory material was delivered via Zoom lecture, with accompanying PowerPoint slides. The students' practice sessions were conducted in Zoom breakout rooms. Observation of the breakout sessions suggested that the students were, in fact, following the recommended practices for active listening. The students' discussion following the breakout sessions indicated that they were aware of dialogue behaviors of the other students.

VIII. CONCLUSION

Employers of engineers, including employers of graduates of our program, seek to have their engineers use active-listening skills. Good active listeners demonstrate these skills in four phases: pre-listening, during listening, post-listening—immediate, and post-listening—long-term. Particular skills within these phases include avoiding judgmental responses, giving supportive and appropriate verbal and nonverbal feedback. To support students in developing active-listening skills, we developed teaching modules covering sixteen learning outcomes, to be delivered across a four-year engineering program. These modules have been designed to integrate with the program's core content.

Informal pilot testing of the first module with seniors in a capstone design course suggests that this curricular approach enables students to understand and to be able to practice introductory active-learning skills. More formal evaluation of the modules' effectiveness will be conducted in the 2021-2022 academic year. However, evaluation of the attainment of all the learning outcomes across the courses in the four-year undergraduate program will not be possible until the 2021 entering cohort graduates in 2025.

The implications for educational practice will likely involve adoption of a detailed method for increasing the ability of new engineers to understand and to appreciate the contributions of stakeholders and team-members. And while the proposed modules comprise a comprehensive four-year program, many of the individual modules and their learning activities could be adopted opportunistically, even as pop-ups.

REFERENCES

- [1] Janusik, L. A. (2002). Teaching listening: What do we do? What should we do?. *International Journal of Listening*, 16(1), 5-39.
- [2] Spataro, S. E., & Bloch, J. (2018). "Can you repeat that?" Teaching active listening in management education. *Journal of Management Education*, 42(2), 168-198.
- [3] Nemec, P. B., Spagnolo, A. C., & Soydan, A. S. (2017). Can you hear me now? Teaching listening skills. *Psychiatric rehabilitation journal*, 40(4), 415.
- [4] Bentley, S. C. (1997). Benchmarking listening behaviors: Is effective listening what the speaker says it is? *International Journal of Listening*, 11(1), 51-68.
- [5] Imhof, M. (1998). What makes a good listener? Listening behavior in instructional settings. *International Journal of Listening*, 12(1), 81-105.
- [6] Wolvin, A. D., & Coakley, C. G. (2000). Listening education in the 21st century. *International Journal of Listening*, 14(1), 143-152.
- [7] Djabbarova, F. O. (2020). Modern methods of teaching listening skills. *Science and Education*, 1 (Special Issue 2).
- [8] Huerta-Wong, J. E., & Schoech, R. (2010). Experiential learning and learning environments: The case of active listening skills. *Journal of Social Work Education*, 46(1), 85-101.
- [9] Nemec, P. B., Spagnolo, A. C., & Soydan, A. S. (2017). Can you hear me now? Teaching listening skills. *Psychiatric rehabilitation journal*, 40(4), 415.
- [10] Weger Jr, H., Castle, G. R., & Emmett, M. C. (2010). Active listening in peer interviews: The influence of message paraphrasing on perceptions of listening skill. *The Intl. Journal of Listening*, 24(1), 34-49.
- [11] <http://liberatingstructures.com>, accessed May 4, 2021.
- [12] Spataro, S. E., & Bloch, J. (2018). "Can you repeat that?" Teaching active listening in management education. *Journal of Management Education*, 42(2), 168-198.
- [13] Wolvin, A. D., & Coakley, C. G. (2000). Listening education in the 21st century. *International Journal of Listening*, 14(1), 143-152.
- [14] Cone, J. D. (1978). The behavioral assessment grid (BAG): A conceptual framework and a taxonomy. *Behavior Therapy*, 9(5), 882-888.
- [15] Spitzberg, B. H. (2003). Methods of interpersonal skills assessment. In J. O. Greene & B. R. Burleson (Eds.), *Handbook of communication and social interaction skills* (pp. 93-134). Mahwah, NJ: Erlbaum.
- [16] Buhrmester, D., Furman, W., Wittenberg, M. T., & Reis, H. T. (1988). Five domains of interpersonal competence in peer relationships. *Journal of Personality and Social psychology*, 55(6), 991.
- [17] Fassaert, T., van Dulmen, S., Schellevis, F., & Bensing, J. (2007). Active listening in medical consultations: Development of the Active Listening Observation Scale (ALOS-global). *Patient education and counseling*, 68(3), 258-264.
- [18] McCroskey, J. C., & McCroskey, L. L. (1988). Self-report as an approach to measuring communication competence. *Communication Research Reports*, 5, 108-113.
- [19] Rubin, R. B. (1985). The validity of the communication competency assessment instrument. *Communications Monographs*, 52(2), 173-185.
- [20] Rubin, R. B., & Roberts, C. V. (1987). A comparative examination and analysis of three listening tests. *Communication Education*, 36(2), 142-153.
- [21] Rubin, R. B., & Martin, M. M. (1994). Development of a measure of interpersonal communication competence. *Communication Research Reports*, 11(1), 33-44.
- [22] Mishima, N., Kubota, S., & Nagata, S. (2000). The development of a questionnaire to assess the attitude of active listening. *Journal of Occupational Health*, 42(3), 111-118.
- [23] Ferrari-Bridgers, F., Stroumbakis, K., Drini, M., Lynch, B., & Vogel, R. (2017). Assessing critical-analytical listening skills in math and engineering students: An exploratory inquiry of how analytical listening skills can positively impact learning. *International Journal of Listening*, 31(3), 121-141.
- [24] Wilkins, K. G., Bernstein, B. L., Bekki, J. M., Harrison, C. J., & Atkinson, R. K. (2012, October). Development of the science technology engineering and mathematics—Active listening skills assessment (STEM-ALSA). In 2012 *Frontiers in Education Conference Proceedings* (pp. 1-6). IEEE.
- [25] Pearce, C. G., Johnson, I. W., & Barker, R. T. (2003). Assessment of the listening styles inventory: Progress in establishing reliability and validity. *Journal of Business and Technical Communication*, 17(1), 84-113.
- [26] Lambert, J., & Myers, S. (1994). 50 Activities for Diversity Training. *Human Resource Development*.