Impact of Communication Styles on Teaching Engineering

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Abstract

Communication is an important part of our everyday life. It allows us to share knowledge, information, and skill sets with people around us. Many professionals are likely aware that effective communication can lead to faster success and the resolution of many outstanding problems in a university working environment, however, the knowledge of students' communication styles is lacking. In most cases, proper communication does not take place or is not available due to a lack of information. For example, instructors may not know the predominant communication style of the class and, in most cases, may not fully understand their own communication style. This paper will address four different communication styles and compare their differences to help instructors understand how to communicate with their students more effectively. The purpose of this paper is to determine the differences in the communication styles between engineering students and instructors through a survey, then, use the results to better equip the instructor in adapting the communication of the course to the class communication style. The results of this paper will demonstrate trends in communication styles between engineering students and instructors. In addition, survey results will be analyzed and discussed. This paper will help instructors facilitate improved communication with students both in verbal and written communication, thereby increasing the effectiveness of teaching and learning.

Background

Since communication is an important part of our everyday life, it is vital that we know how to communicate well. Share knowledge, information, and skill sets with people around us is vital especially for instructors. To determine the differences in communication styles between engineering students and their instructors, a survey was created for the instructor to take as well as administer to each student. The survey helps the instructor determine the predominant communication style of the class and compare it to their own communication style to strongly understand how to effectively communicate with the class in both lectures and examinations. Although communication is both verbal and non-verbal, this paper focuses on verbal communication as it pertains to university teaching in both spoken and written forms. In addition, the survey results can be analyzed to help instructors facilitate improved communication with students both in verbal and written communication. The goal being to increase teaching and learning effectiveness.

Instructors are obligated to share knowledge, information, and skill sets with their students. However, many instructors are unaware of their students' preferred communication styles. Furthermore, even across different sections of the same course, each individual class can have a completely different communication style. Many people are even unsure of their own communication style. As a result, each course should be adapted to meet the needs of each different group of students each semester the course is taught. According to the literature, engineering students are hands-on, active, and visual learners [1]-[4]. Comparisons of the student's self-assessment versus a direct comparison of the course objectives [5] can also help demonstrate whether a student's perception of the course communication is accurate. Many studies have been conducted to evaluate written communication [6], allowing students to differentiate between reports, presentations, proposals, and design documentation. This type of communication evaluation is commonly used in introductory-level engineering classes.

Other studies [7]-[8] concentrate on communication mediums that engineering students should master. These documents are primarily concerned with written documentation, oral presentations, and electronic documentation. Many current papers focus on the communication skills that engineering students will need after graduation. However, this paper focuses on the oral and written communication between the instructor and the students in the classroom. According to research [9]-[10], students are capable of learning through both classroom-based and online instruction; however, the key to success in both formats is incorporating verbal stimuli. This paper proposes that using verbal stimuli where the instructor and students have corresponding, or similar, communication styles can help ensure that the course objectives correspond to the student's understanding of the material.

This paper employs four communication styles: Direct (DI), Spirited (SP), Considerate (CO), and Systematic (SY). Each communication style is defined, and a description of how to communicate effectively with that specific style follows:

Direct (DI) Communication Style

How does a straightforward person communicate? - A person with a direct communication style prefers to be in control and therefore is focused on the end goal once communicating. Because the direct communicator is a task-oriented person, he or she is likely to take charge and speak with urgency. The direct interaction style is distinguished by its fast-paced, loud speech. A direct communicator makes firm decisions with little to no emotion. This individual has a competitive personality that can appear insensitive to others. *How do you address a direct person?* - To effectively communicate with a direct person, one must use brief and precise language. A direct person is task-oriented, so be prepared to solve problems that arise during the conversation. There is no need to waste time on idle talk. Prepare to dive right into the work at hand. When communicating with a direct person, emphasizing the main points is more effective than focusing on minor details. As a result, it is critical to identify the direct person's goals and then present options with clear costs and benefits. Furthermore, claims of progress should always be supported by concrete data. This clearly communicates to a direct person how certain goals were met.

Spirited (SP) Communication Style (Promoter/ Socializer)

How does a spirited person communicate? - A spirited person is an intuitive person who is outgoing and enjoyable to be around. A vivacious communicator is an entertainer who thrives when she is the center of attention. This person is easy to work with but quickly becomes bored with the day-to-day routine. The spirited person wants work to be enjoyable for everyone, so he or she enjoys brainstorming with others and hearing their perspectives. Individuals with this communication style are very talkative and open about their identities. They have a positive attitude and believe that the possibilities are limitless. When dealing with others, a spirited communicator prefers a creative and flamboyant approach. *How do you address a spirited person?* - Setting aside enough time to talk with a spirited person is essential for effective communication. This is because spirited communicator enjoys conversing about their personal lives as well as the lives of others. Prepare to inquire about their family and future and be open to sharing your own. This communicator's style may require assistance in prioritizing, so make lists of what is important and skip the unnecessary, boring material. After a meeting, it is helpful to reiterate and clearly write down who is doing what and when. Furthermore, spirited people value the opinions of others, so criticizing them

frequently is ineffective. Instead, they find motivation in praise, particularly when it is given in front of others.

Considerate (CO) Communication Style (Supporter/Relater)

What methods does a CO use to communicate? - A person with a considerate communication style values interpersonal relationship greatly. This communication style is the most people-oriented of all. As a result, a considerate communicator prefers to form a network of friends to assist with work. He or she is frequently the mediator between people and places a high value on acceptance and stability in situations. These people because of their easygoing personality, makes slow decisions and dislikes change. The considerate person is also known as a good listener who is cautious about expressing opposing views that may hurt the feelings of others. Overall, this style of communication is perceived as sensitive and friendly. *How do you communicate with a CO?* - To effectively communicate with a considerate person, one must show genuine interest in them as a person. Because a considerate person values others, it is critical to learn more about him or her and develop a personal relationship before diving into the business at hand. This communication style necessitates patience and sensitivity to feelings. Try to create a welcoming atmosphere. Coming on too strong or pushing a considerate person to get what one wants is ineffective. Instead, one can be more persuasive by assuaging fears and providing clear explanations.

Systematic (SY) Communication Style (Analyzer/ Thinker)

What methods does a SY use to communicate? - A person with a systematic communication style is detail oriented and places a high value on being correct. The systematic individual is a logical thinker who enjoys interpreting situations and others. The individual is an introvert who prefers to work alone and keeps personal matters private. As a highly organized person, every event is meticulously planned before acting, even if it is for fun. Systematic communicators are distinguished by their frugal and prudent approach. They have very high expectations for themselves and others, which can manifest as a critical and pessimistic approach to communication. *How do you communicate with someone who is SY?* - To effectively communicate with a systematic person, avoid small talk about personal matters. It is critical not to rush and to give the person time and space to think about the situation at hand. Because the systematic communicator is likely to be skeptical of what you say, be prepared to provide detailed answers backed up by precise data. Also, to gain his or her trust, keep promises and document what was discussed.

Methodology

A communications survey [11] was used to assist instructors in better understanding themselves and their individual classes. The survey consists of 24 multiple-choice questions that ask respondents how they would react in each situation or setting. Each of the four multiple-choice options, A through D, corresponds to one of the four communication styles: Direct (DI), Spirited (SP), Considerate (CO), and Systematic (SY).

This survey is for both the instructor and the students in each course. When the surveys are finished, the instructor uses the scoring form to determine each respondent's communication style. A tally of the respondents' overall communication style, along with the instructor's

score, will aid in the development of an efficient course, allowing the instructor to share course information and skill sets with their students in the most efficient manner.

In terms of the corresponding multiple-choice answer and communication style, the answers are randomized. When Question 1 asks, "When I am in a meeting, I prefer to sit___?" the possible answers are: (A) at the head of the table, (B) where people can see me, (C) directly next to another person, and (D) with at least one seat between me and the next person. The survey itself makes no mention of communication style. As a result, the communication style scoring sheet in the survey is used to determine the respondent's style.

The scoring sheet enables the instructor to directly match the respondents' responses to a communication style or category. If, for example, answer (C) was selected, the respondent would receive a "1" in the CO category. This process would be repeated for all 24 questions, with the final scores in each category being reviewed. The category with the highest score represents the respondent's dominant communication style. It should be noted that a respondent may score in more than one main communication style; this occurred in the surveys for this paper, but only in three of them. The specifics of these findings are discussed further down in this paper.

Results and Discussion

Two sections of the ENGR0020 Engineering Probability and Statistics course were surveyed anonymously. The ENGR0020 course was chosen because it consists primarily of junior and senior-level engineering students, and because it is required for all engineering disciplines, the engineering majors of the students in the course are diverse. The course sections had 17 and 23 students, with each having a different instructor, who was also polled. This yielded 40 students and two instructor results. After the survey was completed, the scores were converted to a communication style, and the results are shown in Table 1.

The numbers in each of the communication style columns represent the number of questions in the survey whose answers corresponded to that style. The dominant style is determined by examining the style with the highest score.

Figure 1 depicts the results for each class section. The first section of the course, which had 17 students, had a predominant communication style of CO (47%) with a close second style of SY (41%). Both the DI and SP styles had a very low percentage (6%), corresponding to one student in each category. The second section of the course, which had 20 students, had a predominant communication style of SY (46%), with CO (41%) coming in second. The DI (8%) and SP (5%) styles had low percentages, corresponding to three and two students, respectively.

It should be noted that the three students (Students # 18, 19, and 23 in Table 1) who appeared in the second section of the course were not plotted. The dual results for students #18 and #23 supported the CO and SY result in both sections of the course. Student #19, on the other hand, had results for both DI and SP. Because the results of these three students corresponded to the overall course results, they were not plotted in Figure 1. The average results for both sections are shown in Figure 2. The findings indicate that viewing each section of a course separately provides the instructor with a better understanding of the differences between each section. The sections gave different predominant styles when viewed individually, but when

viewed as a whole, the predominant style was SY (46%). This result also corresponded to the communication styles of both instructors (SY).

Table 1: Outcome of the various communication styles for two sections of a Probability and Statistics Course

Student #	DI	SP	CO	SY	Predominate Style
1	5	5	9	5	CO
2	4	3	12	5	CO
3	3	2	5	14	SY
4	2	10	8	4	SP
5	2	7	12	3	CO
6	4	2	4	14	SY
7	6	2	7	9	SY
8	5	3	5	11	SY
9	3	2	11	8	CO
10	5	6	9	4	CO
11	11	5	3	5	DI
12	6	6	7	5	CO
13	4	2	1	17	SY
14	6	6	5	7	SY
15	6	3	7	8	SY
16	3	7	8	6	CO
17	1	4	10	9	CO
18	2	6	8	8	CO/SY
19	7	7	4	6	DI/SP
20	5	8	4	7	SP
21	4	1	5	14	SY
22	13	3	1	7	DI
23	3	5	8	8	CO/SY
24	4	5	8	7	CO
25	7	4	4	9	SY
26	3	4	8	9	SY
27	9	4	4	7	DI
28	2	7	12	3	CO
29	2	3	10	9	CO
30	3	3	11	7	CO
31	6	4	2	12	SY
32	4	5	5	10	SY
33	6	5	7	5	CO
34	3	3	10	8	CO
35	7	3	4	10	SY
36	4	4	4	12	SY
37	3	8	4	9	SY
38	4	4	7	9	SY
39	6	6	5	7	SY
40	6	5	7	6	CO
Instructor 1	3	2	5	14	SY
Instructor 2	7	1	6	10	SY

The findings revealed trends in communication styles among engineering students and instructors, revealing that 84% of the engineering students polled were either considerate or systematic communicators, with 45% of ALL students being systematic, which matched the instructors polled. When a student was systematic, their next closest style was considerate, and vice versa. Although the strong indication in the SY and CO communication styles makes sense for upper-level engineering students, it is recommended that this survey be given to each section of every class, including freshman classes where more diversity in communication styles is expected.
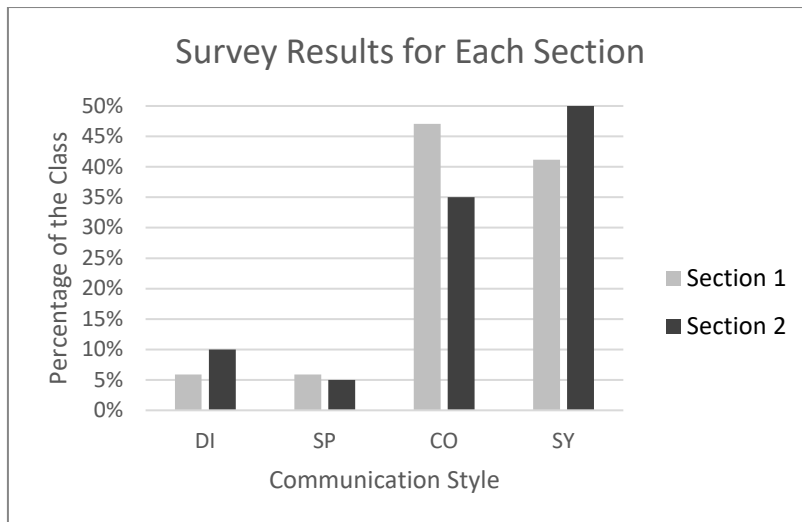
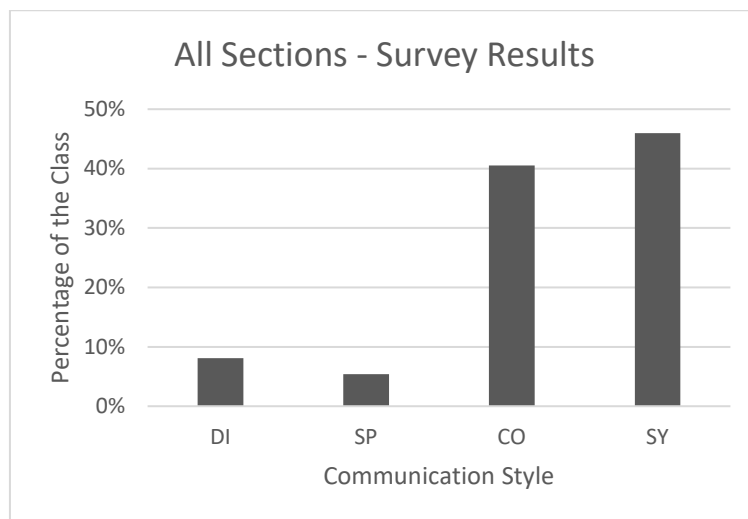*Figure 1:Communication Survey Results for Section 1 and Section 2 of the ENGR0020 Course*

Figure 2: Communication Survey Results for both sections of the ENGR0020 Course

The goal would be to create a course where all students would succeed, but that the understanding of the main communication style would be the overall guide in structuring the course. The following will give you some examples of how the instructors modified the ENGR0020 course to accommodate the survey results.

The average for both courses was 84% in the CO and SY categories. The instructors noticed that the students tended to be low in assertiveness, but they had a wide range of expression, which matched the survey. We will address the low assertiveness first. The low assertiveness is understandable for engineering students since they typically seek facts (SY) and are sympathetic listeners (CO), there were no power struggles or arguments on course material. The class tended to rely on facts as the means of definitions and problem solving. However, this meant that the remaining students in the DI and SP categories can be left behind for some detail focused topics, since they struggle with details (SP) and struggle listening through all the details (DI). For verbal communication, it is suggested that the use of diagrams, images or hands on demonstration be used in addition to lists of facts, to make it easier for the SP and DI students to focus and retain large amount of information. One simple way this was

implemented in the ENGR0020 course was in teaching Venn Diagrams. Numbered cards, similar to playing cards, were used to demonstrate a sample space. Students were then broken into groups and each individual in the group was allowed to choose a card. Each group represented an event in the sample space. Then the class was asked questions about specific cards, and they had to determine whether the number was in an event, and if it was, what event/team did it represent. Then teams would then be grouped to form unions or intersections. After the card demonstration, the Venn Diagram was introduced along with mathematical definitions of intersections and unions. Using both a hands-on demonstration with the theoretical explanation allowed for the probability section in the course to have less confusion by the students. This was shown by little to no office hour attendance for these sections of the course. Before the hands-on demonstration, there would be many in-class questions and office hours spent discussing the Venn diagrams with a few struggling students. For written communication, homework/ tests, it is suggested that a range of problems be created for testing purposes so that not all problems require multiple facts to solve. This was implemented by including a few multiple-choice questions in addition to problems requiring extensive calculation. The students capable of handling many details, did well on both types of problems, whereas few students who struggle with details were able to spend less time on the multiple-choice questions, thereby giving them more time to focus on the detailed questions.

Next, we will discuss the wide range of expression. The wide range of expression of the classes was seen both through lecture interaction and testing. For lecture, about half of the students, corresponding to CO style, would volunteer to come to the front of the class to write on the board or to answer questions in class, whereas the SY students would prefer to just listen. The SY students tended to participate non-verbally by taking notes and listening intently. In addition, there were a few students (SP) who would ask questions but in a more scattered and non-specific manner. For example, the student would be trying to figure out the problem verbally while at the same time attempting to ask the question. The (DI) person would verbally interact through raising their hand and then proceeding to make statements instead of formulating a question. Typically, they just wanted to verify their understanding of a topic. If a class consisted of predominantly CO students, then interaction and dynamic of the class would come easy. However, if the class was predominantly SY, then the instructor would need to add more hands-on or team components to force an increase verbal interaction during lecture. For the written communication on tests, SY students would directly write the solution, whereas the CO would write additional sentences explaining their solution and reasoning. It is recommended that instructors with a predominate CO class take this into consideration when creating tests. The CO student would struggle with multiple choice questions more and would rely on the instructor reading their explanations for worked out examples.

Being that the ratio of CO and SY was similar for both sections of ENGR0020, the classes did not experience any issues with verbal interaction or written interaction. Since the results were extremely close for both sections, it was almost impossible to directly make any claims as to differences between sections. Although, the results from both surveys match the communication seen by the instructors. A nice addition to the survey would be to remove anonymity. Since the survey was anonymous, we are unable to directly link a student's class interaction to a specific survey result. However, the overall results of the survey matched the overall class dynamics. A future paper will be written giving the direct correlation of communication style to specific student interaction.

Conclusions

Communication is an essential component of our daily lives. Most of the time, proper communication does not occur or is unavailable due to a lack of information. The instructor may be unaware of the dominant communication style of the class and, in most cases, may be unaware of their own communication style. This paper concentrated on verbal communication as it relates to university teaching in both spoken and written forms. The paper explained four different types of communication styles and completed a study of two different sections of the ENGR0020 engineering class. The authors intend to conduct surveys on multiple other classes with diverse class levels and discipline-specific courses to determine trends because this could help guide class structure, lecture formatting, and homework/exam wording, as well as guide undergrads with various communication styles to better understand the differences and become better communicators. This paper will help instructors facilitate improved communication with students both in verbal and written communication through the examples and suggestions given, thereby increasing the effectiveness of teaching.

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