Assessing Intuition Used Among Undergraduate Engineering Technology and Engineering Students

Melissa Cai Shi, Purdue University at West Lafayette

Melissa Cai Shi is an Undergraduate Researcher working under Dr. Lucietto. She is a student at Purdue University, pursuing a Bachelor of Science in Actuarial Science and Applied Statistics with minors in Management and Chinese. She began working under Dr. Lucietto in the Summer of 2019 as an undergraduate researcher and has thus far continued her work. She is currently working on her Honors Scholarly Project. In addition to her Actuarial coursework, Melissa serves as a leadership team leader for both the Women in Science Programs and Global Science Partners.

Therese M. Azevedo, Sonoma State University

Therese Azevedo is a fourth year student at Sonoma State University pursuing a Bachelor of Science in Statistics. Over the Summer of 2019, she had the opportunity to work with Dr. Anne Lucietto at Purdue University on a project related to math anxiety and continued that work to present.

Dr. Anne M. Lucietto, Purdue University at West Lafayette

Dr. Lucietto has focused her research in engineering technology education and the understanding of engineering technology students. She teaches in an active learning style which engages and develops practical skills in the students. Currently she is exploring the performance and attributes of engineering technology students and using that knowledge to engage them in their studies while mentoring undergraduate and graduate researchers to do the same.

©American Society for Engineering Education, 2021

Assessing Intuition Used Among Undergraduate Engineering Technology and Engineering Students

Abstract

Intuition plays an essential role in decision-making and is independent of an analytical way of thinking that is considered a gut feeling. Individuals can shape their intuition, and each field of study develops a variety of skills and trains students for a way of thinking needed for that specific area. A focus on undergraduate engineering technology students and comparing them to undergraduate engineering students allows this study to examine the types of intuition used by these two groups.

The Types of Intuition Scale (TIntS), an established, validated instrument, which categorizes intuition into inferential, affective, holistic abstract, and holistic big picture intuition, was used to assess and understand the intuition types used by both engineering technology and engineering undergraduate students. Additionally, ANOVA and t-tests are used to provide deeper analysis for comparison purposes.

This study employs inferential statistics to compare engineering technology and engineering undergraduate students in their use of intuition. Anecdotal evidence shows that these students often utilize intuition to solve problems, suggesting that they use past knowledge to guide their intuition. This study's findings provide evidence that these students use intuition, and engineering technology and engineering students report using intuition in similar ways.

Keywords: Intuition, Types of Intuition, Engineering Technology, Engineering

Introduction

A common viewpoint between engineering technology and engineering is that they have similar undergraduate academic curriculums. Engineering is more likely to emphasize advanced mathematical and theoretical courses, while engineering technology may have a lighter mathematics course load with a greater focus on hands-on experiences [1], [2]. Engineering technology is a relatively small major and due to its similarities to engineering is often overlooked and at times assessed with engineering programs [2], [3].

Due to engineering technology and engineering being two distinct fields, it is crucial to assess these fields individually as an engineering technology student's way of thinking may not be similar to an engineering student [3]. The research focused on understanding students' learning and social behaviors pursuing engineering technology will increase understanding of their approach to problem-solving [2], [4]. This study provides insight into engineering technology compared to engineering students' thought processes by identifying engineering technology students' use of intuition when responding to several problem-solving situations.

Literature review

Engineering technology has a strong emphasis on application through hands-on experiences in laboratory courses [5]. Even though there is a difference in the curriculum for engineering and engineering technology students, engineering technology is not often assessed separately, contributing to a lack of foundational knowledge in this discipline [3]. Additionally, understanding these students' approaches to decision-making will help identify the similarities and differences of these two fields. During the decision-making process, intuition is a quick and personal instinct that may be used [6]. Understanding the way students approach their academic studies is needed to equip students with the necessary skills that reflect their learning styles to maximize students’ academic and professional successes.

Engineering Technology Students

There are various reasons for students pursuing an engineering technology degree. Some students directly matriculate into engineering technology programs. Others are not accepted into their first-choice program and often selecting engineering technology as a major. Others may transfer to engineering technology from other fields [7].

The Gregorc Style Delineator's use provides a greater understanding of how students perceive and organize their thoughts [7]. This instrument categorizes the reasoning into concrete random, abstract random, concrete sequential, and abstract sequential classifications. Studies on the engineering technology student population show that the Gregorc categories of concrete random and concrete sequential are commonly found in engineering technology students. This finding suggests that classrooms should be structured more straightforwardly and logically since they prefer solving problems in a trial-and-error method while using intuition [7]. When comparing engineering technology students to engineering students, there was a statistically different result when considering the concrete random category. Thus, supporting the observation that engineering technology students are more likely to take risks when solving problems, supporting the observation of higher use of intuition [8].

Intuition within Engineering Technology

Through a study based on survey and interview questions, one particular question gave insight into how engineering technology students would feel when required to solve an unfamiliar problem. Students responded that they would rely on prior knowledge and use their instincts to navigate that situation, demonstrating that engineering technology students used intuition when solving problems [9]. Using the Cognitive-Experiential Self Theory (CEST), another study showed that intuition was scored more frequently than cognition among a sample of engineering technology students [10].

Instrument: Types of Intuition Scale (TIntS)

The Types of Intuition Scale (TIntS) [11] was selected for use when measuring intuition. This instrument was preferred because it defines intuition's different classifications: inferential, affective, and holistic (abstract and big picture) [12]. Inferential intuition occurs when an individual jumps to a conclusion without going through logical middle steps to derive an answer based on past experiences. Alternatively, affective intuition is based on emotions, while holistic intuition is related to "big picture" thinking. The TIntS is formatted in a survey that consists of 29 questions. Each item presents a statement with a scenario in which the participants will rate the statement with their best judgment using a Likert scale from 1 to 7, with 1 representing strong disagreement with the statement and 7 representing strong agreement with the statement (Appendix A).

Educators are looking to enhance their understanding of how their students think and the best practices to teach them. Research has validated intuition as a primary factor for decision-making [13]. There has also been evidence that shows intuition playing an essential role in engineering technology students' processes of thinking [7], [8], [9], [10].

Research Questions

The study focuses on determining the intuition types and the degree of usage for each type of intuition used by undergraduate engineering technology and engineering students.

- What are the types of intuition utilized by undergraduate engineering technology and engineering students?
    - Is there a difference in the type of intuition(s) used by undergraduate engineering technology and engineering students?

Methodology

The survey software Qualtrics was used to distribute the TIntS [11] to undergraduate students at a midwestern university. The survey questions are located in Appendix A. The TIntS was modified to a Likert scale from 1 to 7 to represent better the student's agreement or disagreement with each of the items' statements. Following IRB approval, the survey was distributed in early summer. The survey consisted of basic demographic information as well as the questions taken from the TIntS instrument.

Survey Administration

The survey was distributed via email with an embedded link to a Qualtrics survey. There were n = 404 total responses, n = 43 engineering technology responses, and n = 361 engineering responses. The survey was designed to take approximately 15 min. However, unlimited time was given to the students to respond to the survey. The survey was left open for approximately ten weeks with a second email reminder to complete the survey.

Survey Data Analysis

The sample sizes for engineering technology and engineering responses were greater than 30 and were proportional to the college's distribution by the sampled midwestern university. The statistical analyses, as a result, were appropriate to be performed and used for statistical comparison purposes. The data collected were first cleaned by removing responses that did not complete the entire survey and responses that provided conflicting information regarding the students' academic department and major. Engineering technology and engineering students' responses were analyzed separately once data was cleaned.

The research team utilized inferential statistics to assess the existing differences in the types of intuition levels found in each group based on the means of each intuition type. The data collected satisfied the conditions for the use of ANOVA, in addition to the Tukey method. The Tukey method identified the differences and similarities between the types of intuition. The ranking of the usage for each type of intuition was also determined. T-tests ($\alpha = 0.05$) evaluated the differences regarding each type of intuition used between engineering technology and engineering students — all data analysis utilized statistical software R.

Findings

The data collected had 43 engineering technology students and 361 engineering students' responses from the survey. Figure 1 shows the distribution of the types of intuition used by engineering technology students based on the mean of the individual responses for each intuition type. The boxplots for affective and holistic abstract intuition overlap, which indicates that engineering technology students might have similar usage levels for these two types of intuition. Additionally, engineering technology students are highly dependent on inferential intuition since their overall scoring in inferential intuition was higher among the four types of intuition assessed by the TIntS.

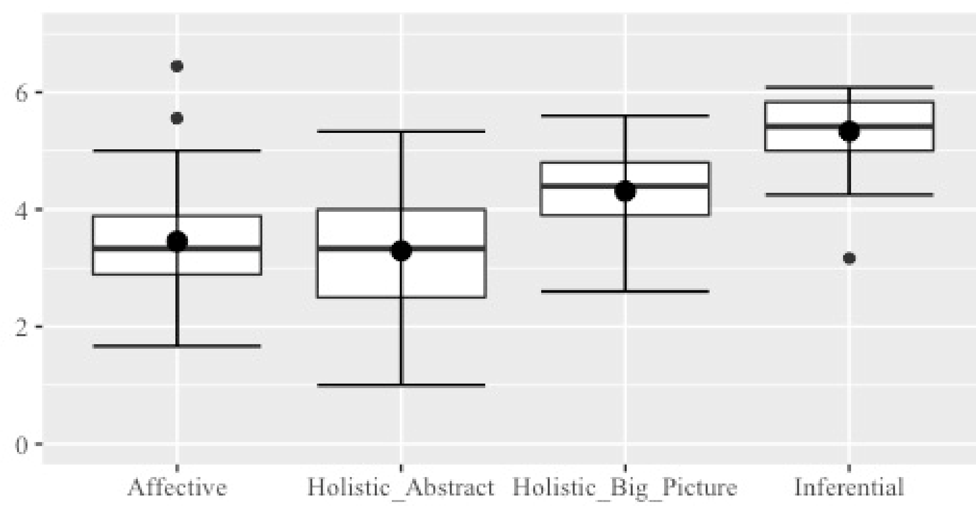

Figure 1. Engineering Technology - Types of Intuition

The effect plot in Figure 2 gives a better visualization of the rankings by each type of intuition's mean values. The greater the mean results in a higher ranking, which indicates a higher usage of that particular intuition type. The effect plot showcases the sample means (M) ranked from highest to lowest as follows according to the type of intuition: inferential (M = 5.33, standard deviation (SD) = 0.60), holistic big picture (M = 4.31, SD = 0.75), affective (M = 3.45, SD = 0.93), and holistic abstract (M = 3.29, SD = 0.93). Visually, each type of intuition varied from the others except for holistic abstract and affective intuition, which have very close mean values.

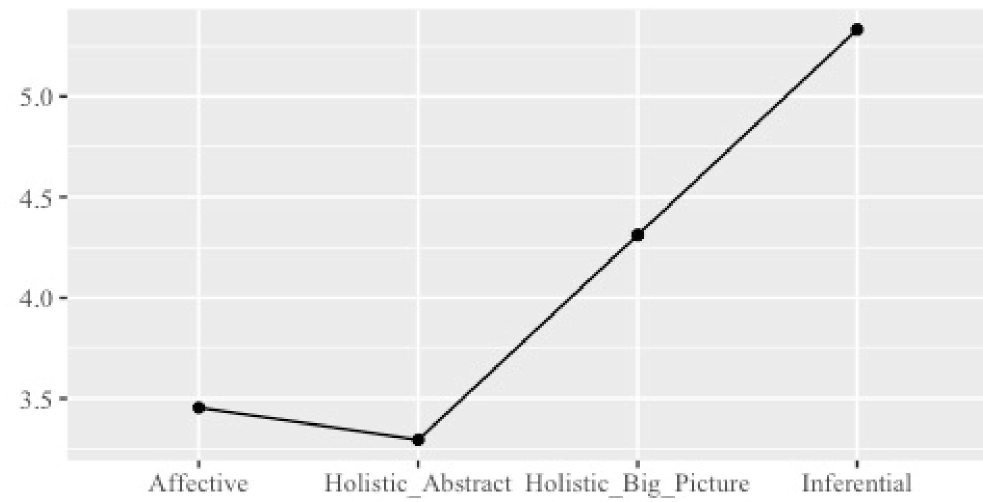

Figure 2. Engineering Technology - Types of Intuition Effect Plot

The differences in each type of intuition used by the engineering technology students were then assessed with ANOVA. Strong statistical evidence was found from the data that at least one of the intuition types is different from the rest regarding the degree of usage (F-statistic = 51.12, $p = 2x10^{-16} < \alpha = 0.05$). The Tukey method (t = 3.16) showed that only holistic abstract and affective intuition were statistically the same ($p = 0.82 > \alpha = 0.05$). The remaining intuition types resulted in being statistically different from each other. The Tukey method's output also provided the lower and upper bound at a 95% confidence interval, giving additional support that two types of intuition are statistically different if zero is not contained in the interval. The summary of the Tukey test is shown in Table 1.

Table 1. Engineering Technology - Tukey Comparison Method

Types of Intuition Comparison	Difference	Lower Bound	Upper Bound	p-value
Holistic Abstract - Affective	-0.16	-0.75	0.42	0.82
Holistic Big Picture - Affective	0.86	0.27	1.44	$4.29x10^{-5}$*
Inferential - Affective	1.88	1.29	2.46	0.00*
Holistic Big Picture - Holistic Abstract	1.02	0.43	1.60	$8x10^{-7}$*
Inferential - Holistic Abstract	2.04	1.45	2.62	0.00*
Inferential - Holistic Big Picture	1.02	0.43	1.60	$8x10^{-7}$*

* Statistically significant (p-value < $\alpha = 0.05$) shows that the data provided evidence of differences in the means of each intuition type.

The following diagram (Figure 3) depicts the relationship of the types of intuition for engineering technology according to the means' rankings from lowest to highest. Holistic abstract and affective intuition have the same usage for engineering technology students, as shown using the Tukey method. These two intuition types also ranked the lowest compared to the inferential and holistic big picture intuition. The line shown in Figure 3 represents that both holistic abstract and affective intuition are considered the same level of usage by engineering technology students.

Holistic Abstract	*Affective*	*Holistic Big Picture*	*Inferential*
3.29	*3.45*	*4.31*	*5.33*

Figure 3. Engineering Technology - Comparison of the Means Levels of Each Intuition Type

The researchers evaluated practicality by calculating the mean percentage difference in each type of intuition. The percentage difference shows that holistic big picture, and affective/holistic abstract (27.76%), inferential and holistic big picture (23.65%), and inferential and affective/holistic abstract (57.98%) are considered different as the variation with the percentages showed a relevant percentage difference.

Data provided by the engineering students were evaluated similarly. Inferential intuition, as seen in Figure 4, is also most favored by engineering students. Affective and holistic abstract intuition have similar usage levels compared to the holistic big picture, and inferential intuition since both boxplots directly overlap. Additionally, holistic big picture intuition is the second type of intuition that engineering students rely on after inferential intuition.

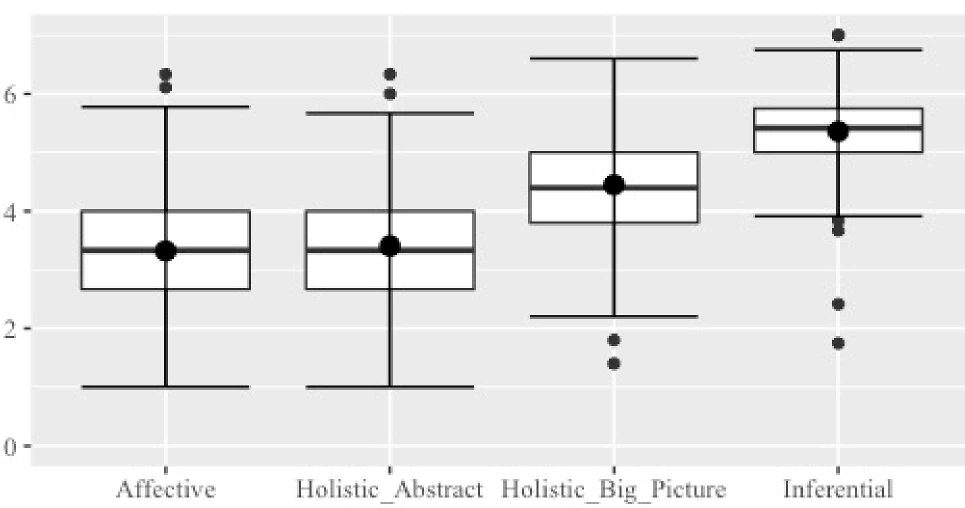

Figure 4. Engineering - Types of Intuition

Figure 5 presents the effect plot of engineering students with each type of intuition's preference according to the mean values. The sample means of the values are ranked from highest to lowest as follows according to the type of intuition: inferential (M = 5.36, SD = 0.66), holistic big picture (M = 4.45, SD = 0.87), holistic abstract (M = 3.41, SD = 1.08), and affective (M = 3.32, SD = 0.95). The effect plot shows the ranking comparison of the preferences in the usage between each intuition type. Engineering students rely the most on inferential intuition and depend less on the use of practical intuition.

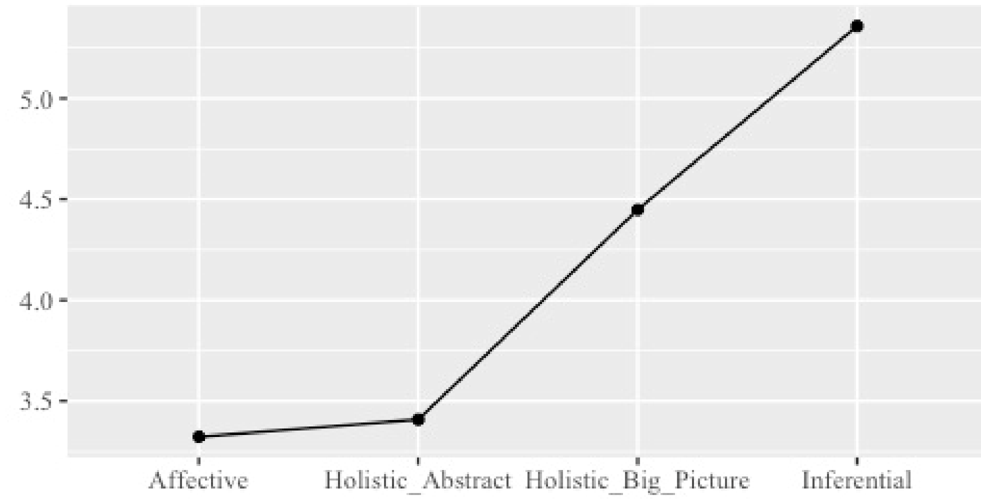

Figure 5. Engineering - Types of Intuition Effect Plot

The data analyzed by ANOVA indicates there is strong evidence that at least one type of intuition possesses a different level of usage than the rest of the intuition types (F-statistic = 410.6, p = 2x10-16 < α = 0.05). The Tukey comparison test (t = 3.12) shows that the usage regarding each of the intuition types is different from each other except for holistic abstract and affective intuition (p = 0.58 > α = 0.05). Table 2 displays the Tukey test summary for engineering students and the upper and lower 95% confidence interval bounds supporting the p-value results. An interval not containing zero indicates a difference between the usage of each type of intuition.

Table 2. Engineering - Tukey Comparison Method

Types of Intuition Comparison	Difference	Lower Bound	Upper Bound	p-value
Holistic Abstract - Affective	0.09	-0.12	0.30	0.58
Holistic Big Picture - Affective	1.13	0.92	1.34	0.00*
Inferential - Affective	2.04	1.83	2.24	0.00*
Holistic Big Picture - Holistic Abstract	1.04	0.83	1.25	0.00*
Inferential - Holistic Abstract	1.95	1.74	2.16	0.00*
Inferential - Holistic Big Picture	0.91	0.70	1.12	0.00*

* Statistically significant (p-value < α = 0.05) shows that the data provided evidence of differences in the means of each intuition type.

The data provides evidence on the different levels of usage for each type of intuition for engineering students. Holistic abstract and affective intuition are statistically the same. Figure 6 highlights the ranking by mean values and the similarities and differences in each type of intuition usage. The line below, found in Figure 6, indicates that affective and holistic abstract intuition have the same statistical ranking, signifying that engineering students have the same usage levels of affective and holistic abstract intuition.

Affective	Holistic Abstract	Holistic Big Picture	Inferential
3.32	3.41	4.45	5.36

Figure 6. Engineering - Comparison of the Means Levels of Each Intuition Type

Utilizing each intuition type's mean values, the percentage difference is used to assess the results' practicality. The percentage difference indicates how much two measurements differ from each other, which assesses the difference in each type of intuition's usage. The percentage difference of holistic big picture and affective/holistic abstract (32.18%), inferential and holistic big picture (20.45%), and inferential and affective/holistic abstract (59.21%) showed substantial differences indicating a difference from each other.

The data collected, as seen before, shows that engineering students and engineering technology students have the same ranking of preference for each intuition type. From highest to lowest, the order included inferential, holistic big picture, and affective/holistic abstract. It is interesting to assess statistical differences between each type of intuition regarding engineering technology and engineering since both majors provided similar results. T-tests were conducted to analyze possible differences between engineering technology and engineering students regarding intuition level (Table 3).

Table 3. Engineering Technology and Engineering Student Comparison

Types of Intuition	**Engineering Technology**		**Engineering**				
	Mean	**SD**	**Mean**	**SD**	**t-statistic**	**95% CI**	**p-value**
Affective	3.45	0.93	3.32	0.95	2.01	(-0.43,0.17)	0.38
Holistic - Abstract	3.29	1.08	3.41	1.08	2.01	(-0.24, 0.46)	0.52
Holistic - Big Picture	4.31	0.75	4.45	0.87	2.00	(-0.11, 0.38)	0.27
Inferential	5.33	0.60	5.36	0.66	2.00	(-0.17, 0.22)	0.79

* Statistically significant (p-value $< \alpha = 0.05$) shows that the data provided evidence of differences in the means of each intuition type.

The mean values for each intuition type involving engineering technology and engineering are similar. The t-tests conducted for each type of intuition were not significant (p-value $> \alpha = 0.05$). The data collected did not show a significant difference between the usage of each intuition type among engineering technology and engineering students. However, both groups of students presented the same rankings of preference in the use of each intuition type.

Discussion

The data collected for this study showed that both undergraduate students pursuing engineering technology and engineering majors prefer inferential intuition. Inferential intuition uses past knowledge that becomes routinized overtime to make intuitive judgments suggesting that students prefer to solve problems using an analytical approach. Students will rely on intuition when encountering a familiar problem or in a situation of exhausting all analytical approaches. The results of this study support previous work [7], [8], in which measurements evaluated engineering technology students' perception and ordering ability. The study also showed that these students like to experiment, take risks, and use intuition while others like order, logical sequence, and following directions.

Engineering technology students ranked from highest to lowest according to intuition: inferential, holistic big picture, affective, and holistic abstract. Affective and holistic abstract intuition was found to be statistically the same in the degree of usage. Even though these students rely less on affective and holistic abstract intuition than the other types, affective and holistic abstract intuition were not used to their highest potential. Affective intuition is heavily based on emotions to make decisions, while holistic abstract intuition uses non-analytical approaches to relate experiences to make decisions. Even though studies have found evidence that engineering technology students show a higher preference for a holistic type of intuition [9], [10], the teaching style and curriculum at this midwestern university may differ from others leading to a higher development on inferential intuition.

Similarly, undergraduate students pursuing engineering majors ranked the highest in the reliance on inferential intuition followed by the holistic big picture, holistic abstract, and affective intuition. Engineering students scored slightly higher in holistic abstract than affective intuition, but holistic abstract and affective intuition also showed that, statistically, there were no differences in the reliance of holistic abstract and affective intuition.

Both engineering technology and engineering students showed the same rankings in each type of intuition, only having holistic abstract and affective intuition flipped. However, both groups of students showed that the level of affective and holistic abstract intuition is statistically the same. Studies have shown that engineering technology and engineering are often studied together; however, these two disciplines should be analyzed separately [2]. Engineering technology is a more application-based major, while engineering is a more theoretical-based major. However, the data collected showed that engineering technology and engineering students' reliance on each type of intuition is similar. It is not unexpected to observe that engineering technology and engineering will yield similar results [5]. The data revealed significant trends regarding engineering technology students despite having a small sample size and not providing enough statistical evidence for existing differences. These results suggest that engineering technology students are more likely to have a better learning experience if educators aim to create an educational environment that relies on the use of past knowledge.

Conclusion

The data showed that undergraduate engineering technology and engineering students utilize intuition, particularly inferential intuition. The results indicate that these groups of students make decisions based on past experiences and solve problems from an analytical approach, which turns this knowledge into intuition. The differences in the types of intuition used by undergraduate engineering technology and engineering students were that both groups rank similarly in the reliance of each type of intuition with higher usage of inferential intuition followed by holistic big picture intuition. However, engineering technology students ranked slightly higher on affective intuition than engineering students. Engineering technology and engineering students ranked lowest in affective and holistic abstract intuition, and the level of usage for these two types being statistically the same. The data collected did not provide evidence of a difference in each intuition type's usage when analyzing each intuition type's differences for engineering technology and engineering students. This outcome may suggest that both groups of students have similar thought processes and ways of dealing with the unknown.

Future Work and Limitations

The findings presented in this study focus on a small sample size of engineering technology and engineering students at one specific university. Larger sample size from a wide variety of universities will be warranted for the future to gain a better representation of engineering technology students' experiences in the use of intuition. Another set of factors to consider are age, ethnicity, year of classification, and GPA to determine the influence these characteristics have on intuition preferences among engineering technology students. Broadening the study's scope by comparing engineering technology students to other STEM and non-STEM fields will be insightful as academic majors can train students to develop the needed skillset impacting one's way of thinking. The new comparison will help determine the impact that majors have on intuition levels. Therefore, a study focused on the relationship between a student's major and how students from various majors perceive and solve problems.

References

[1] ABET. (n.d). *What Programs Does ABET Accredit?* https://www.abet.org/accreditation/what-is-accreditation/what-programs-does-abet-accredit/, (accessed February 2020)

[2] Grinter, L. E. (2014). Engineering and Engineering Technology Education. *Journal of Engineering Technology, 31*(2), 8-11. http://search.ebscohost.com/login.aspx?direct=true&db=asf&AN=103651915&site=ehost-live

[3] Christe, B., & Feldhaus, C. (2013). Exploring Engineering Technology Persistence and Institutional Interventions: A Review of the Literature. *Journal of Engineering Technology, 30*(2), 44-53. http://search.ebscohost.com/login.aspx?direct=true&db=asf&AN=101808357&site=ehost-live

[4] Froyd, J. E., Wankat, P. C., & Smith, K. A. (2012). Five Major Shifts in 100 Years of Engineering Education. *Proceedings of the IEEE, 100*(Special Centennial Issue), 1344-1360. DOI:10.1109/JPROC.2012.2190167

[5] Frase, K. G., Latanision, R. M., & Pearson, G. (2016). *Engineering Technology Education in the United States*. Retrieved from Washington, DC: http://www.nap.edu/23402

[6] Liebowitz, J., Paliszkiewicz, J. O., & Gołuchowski, J. (2018). *Intuition, trust, and analytics*. Boca Raton, FL: CRC Press, Taylor & Francis Group.

[7] Lucietto, A. M., Moss, J. D., & French, R. M. (2017). *Examining Engineering Technology Students: How they perceive and order their thoughts*. Paper presented at the ASEE Annual Conference, Columbus, OH.

[8] Lucietto, A. M., Moss, J. D., Efendy, E., & French, R. M. (2017). *Engineering Technology vs. Engineering Students Differences in Perception and Understanding*. Paper presented at the FIE Frontiers in Education Annual Conference, Indianapolis, IN.

[9] Taleyarkhan. M. R., Lucietto, A. M., & Azevedo, T. M. (2021). How Engineering Technology Students Perceive Mathematics. *Journal of Research in Science, Mathematics and Technology Education, 4*(1), 183-203. DOI: 10.31756/jrsmte.412

[10] Lucietto, A. M., Taleyarkhan, M. R., Hobson, L. F., Azevedo, T. M. (2020). Math Anxiety: Engineering Technology Students Problem Solving Through Rational or Experiential Context. *American Society for Engineering Education (ASEE)*.

[11] Pretz, J. E., Brookings, J. B., Carlson, L. A., Keiter Humbert, T., Roy, M., Jones, M., & Memmert, D. (2014). Development and Validation of a New Measure of Intuition: Types of Intuition Scale. *Journal of Behavioral Decision Making, 27*(5), 454-467. DOI: 10.1002/bdm.1820

[12] Pretz, J. E. & Totz, K. S. (2007). Measuring individual differences in affective, heuristic, and holistic intuition. *Personality and Individual Differences, 43*(5), 1247-1257. https://doi.org/10.1016/j.paid.2007.03.015

[13] Wang, Y., Highhouse, S., Lake, C. J., Petersen, N. L., & Rada, T. B. (2015). Meta-analytic Investigations of the Relation Between Intuition and Analysis. *Journal of Behavioral Decision Making, 30*(1), 15-25. DOI: 10.1002/bdm.1903

Appendix A - Types of Intuition Scale Items (TIntS) [11]

The following list presents the 29 items of the TIntS used in the survey that was distributed to the participants.

Holistic Big Picture (HB) Items

HB1. When tackling a new project, I concentrate on big ideas rather than the details.
HB2. (R) It is better to break a problem into parts than to focus on the big picture.
HB3. (R) When working on a complex problem or decision, I tend to focus on the details and lose sight of the big picture.
HB4. I try to keep in mind the big picture when working on a complex problem.
HB5. I am a "big picture" person.

Holistic Abstract (HA) Items

HA1. I would rather think in terms of theories than facts.
HA2. (R) I prefer concrete facts over abstract theories.
HA3. I enjoy thinking in abstract terms.

Inferential (I) Items

I1. I trust my intuitions, especially in familiar situations.
I2. Familiar problems can often be solved intuitively.
I3. There is a logical justification for most of my intuitive judgements.
I4. My approach to problem solving relies heavily on my past experience.
I5. My intuitions come to me very quickly.
I6. My intuitions are based on my experience.
I7. When I have experience or knowledge about a problem, I trust my intuitions.
I8. When making a quick decision in my area of expertise, I can justify the decision logically.
I9. I've had enough experience to know what I need to do most of the time without trying to figure out from scratch every time.
I10. If I have to, I can usually give reasons for my intuitions.
I11. (R) I rarely trust my intuition in my area of expertise.
I12. When I make intuitive decisions, I can usually explain the logic behind my decision.

Affective (A) Items

A1. I prefer to use my emotional hunches to deal with a problem, rather than thinking about it.
A2. (R) I rarely allow my emotional reactions to override logic.
A3. I tend to use my heart as a guide for my actions.
A4. I often make decisions based on my gut feelings, even when the decision is contrary to objective information.
A5. When making decisions, I value my feelings and hunches just as much as I value facts.
A6. I believe in trusting my hunches.
A7. (R) I generally don't depend on my feelings to help me make decisions logically.
A8. (R) I prefer to follow my head rather than my heart.
A9. (R) It is foolish to base important decisions on feelings.