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Visual Thinking Strategies (VTS) for Promoting Reflection in Engineering Education: Graduate Student Perceptions

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Visual Thinking Strategies (VTS) for Promoting Reflection in Engineering Education: Graduate Student Perceptions

Abstract

Visual Thinking Strategies (VTS), an educational technique that uses art to foster visual literacy through facilitated group discussion, has been shown to promote the development of skills that transfer to other domains. In this paper, we report findings from our use of VTS in an experimental graduate course in environmental engineering that aims to foster students' capacities for reflection. Using data from writing samples with methods of thematic analysis, we explore students' perceptions of their own learning from the VTS portion of this semester-long course called Developing Reflective Engineers through Artful Methods. One significant theme identified was "Knowledge/Skills", in which students identified specific knowledge gained or skills developed through their VTS experience, including skills of group discussion, listening/ paraphrasing, observation, imagination/creativity, and critical thinking. Another key theme identified was "Appreciating Others' Perspectives", in which students expressed appreciation of the differences in perspective that VTS discussions tend naturally to draw out. This finding highlights the potential of VTS as a tool for promoting and supporting diversity in engineering. Based on these data and a brief, associated survey, we learned that students found VTS to be highly effective at helping them become more reflective and was one of the most effective methods we have attempted for the development of reflective thinking in graduate engineering.

1 Introduction

As a multidisciplinary team of educators, we have been pursuing an experimental, innovative graduate curriculum that fosters engineering students' capacities for reflection. Reflective thinking is an increasingly necessary skill in the complex work of engineers, who need to consider various contextual factors such as local, social issues, environmental impacts, and sustainable, long-term outcomes when addressing multifaceted problems of global significance. The training of engineers has traditionally focused on technical rationality at the expense of preparing students for the complexity of professional practice in the real-world (Schön, 1983, 1987). Our premise, consistent with Eisner (1986) and Bertram (2019), is that incorporating the arts and humanities into the engineering curriculum will facilitate and enhance reflective thinking in engineering students. To this end, we have explored various arts- and humanities-related approaches, including Visual Thinking Strategies (VTS), art making activities, autobiographical writing, visual storytelling, and more, and have already provided some evidence to support this premise (e.g., see Kim, Campbell, et al., 2019 and Campbell et al., 2020).

In this paper, we focus on one of those approaches, Visual Thinking Strategies (VTS), which is used widely by K-12 teachers and museum educators to engage people of all ages in skill-

building discussions about works of art (see e.g., Yenawine, 2013). While some university groups in other fields of study, such as medicine (Reilly et al., 2005), have adopted VTS in the training of their students, it has received almost no attention in engineering education to date. Although VTS might be perceived as too far removed from engineering for relevance, we have deployed it as a core innovative pedagogical method along with several other artful methods in an experimental graduate course with promising results. The purposes of this paper are to (1) explore how VTS contributes to the development of reflective thinking skills in graduate engineering education, and (2) share insights of interest to educators considering adopting VTS in their courses and curricula.

The course in which we have experimented is a 3-credit elective offered through the department of civil and environmental engineering. It is led by two co-instructors with engineering backgrounds (a postdoc and a tenured professor) and is sustained by contributions from guest speakers from a variety of other fields, including education, cognitive psychology, technical communication, visual art, interdisciplinary studies, and media/communications. Given their additional roles in course design and research on the project, two of these guests are coauthors on this paper along with a graduate research assistant and a museum educator who provided VTS training workshops at our university over the past few years for our core team and other interested faculty, postdocs, and students. As part of a larger study funded in part by the National Science Foundation (see Acknowledgments), this paper reports ongoing work to explore students' perceptions of their own learning from the VTS-related activities in which they participated last year over several class periods devoted to the topic.

2 Literature Review

Visual Thinking Strategies (VTS) is a teaching/learning method in which visual art is used to foster students' aesthetic development and visual literacy (Hailey et al., 2015; Yenawine, 2013; Yenawine & Miller, 2014). VTS was developed and tested over the course of several decades starting in the 1980s through a collaboration between a cognitive psychologist (the late Abigail Housen, formerly at Harvard and the Massachusetts College of Art) and a museum educator (Philip Yenawine, formerly at the Museum of Modern Art in New York).

VTS involves facilitated group discussion about intentionally selected art images and supports participants in the development of certain skills. It is distinctive in that it enables and encourages participants at many levels of experience and language ability to participate, and it also serves to privilege diversity in many of its forms. Specifically, the VTS protocol guides facilitators as follows (adapted slightly from Hailey et al., 2015):

A. Present a carefully selected image that accounts for the ages, levels of experience with art, and the backgrounds of the specific group, plus contains subjects of interest and imagery that represents both familiarity and newness, strong narratives that are accessible but layered, accessible but intriguing, and with enough ambiguity to puzzle and inspire debate.

B. Allow a few moments of silently looking before beginning the discussion using three very specific, research-tested questions to motivate and maintain the inquiry:
    1. What is going on (or happening) in this picture? (Asked once to initiate the discussion.)

    2. What do you see that makes you say that? (Asked whenever an interpretive comment is made.)

    3. What more can we find? (Asked frequently throughout the discussion to encourage, broaden and deepen the search for meaning.)

C. Listen carefully (as facilitator) to catch everything each student says, paraphrase all comments, link related comments, and remain neutral through careful use of pronouns and by treating everyone and each comment in the same way.

D. Conclude by thanking students for their participation and by citing behaviors that are particularly appreciated.

In brief, the VTS protocol involves facilitated group discussion to encourage people "to look carefully, put their observations and ideas into words, and actively "scaffold" on the thoughts of others" (Reilly et al., 2005).

As Hailey et al. (2015) contend, VTS has been implemented or tested in Pre-K to grade 12 in the United States and internationally. Variations have been devised for use in "museum teaching, university classes (Miller & Yenawine, 2014; Hailey, 2014), medical education […], and the professional world" (p. 57). Hailey and her colleagues also present research on the impact of VTS intervention on elementary school students and students in medical training programs, which showed increased aesthetic growth in students that transfers to a broader range of skills including critical thinking whereby, for example, students habitually provide evidence to back up inferences and speculate among various possible interpretations. Those skills, particularly for medical students, are expected to be translated into their professional world. For instance, Agarwal et al. (2020) evaluated the impact of participating in VTS workshops on first-year medical students. They found that VTS training using museum art increased the following measures on the clinical-image-based pre/post assessment: (a) the total number of words the students used to describe the images, (b) the time they spent analyzing the images, and (c) the number of clinically relevant observations they had.

Thus, VTS has been used primarily in K-12 and museum education and has been adopted by some medical schools (Reilly et al., 2005), but it has seen very little mention in the engineering education literature to date. In fact, other than our work, starting with a conference paper about VTS from a pilot workshop we conducted with a group of upper-level undergraduate students over four years ago (Campbell et al., 2017), the paper repositories for the American Society for Engineering Education (ASEE) Annual Conference (peer.asee.org) and the IEEE Frontiers in Education (FIE) conference (ieeexplore.ieee.org) show no other studies involving VTS.

Furthermore, a search of the Ei Compendex database (a.k.a. Engineering Village by Elsevier) returns just one other paper involving VTS: another 2017 paper from another conference that makes a strong conceptual (i.e., non-empirical) case for using VTS as part of an art-oriented pedagogical approach to teaching optics and photonics to any age groups (preschool through university and the general public) (Pompea & Regens, 2017).

3 Methods

With support from one of the guest instructors who also has experience with VTS, the course's co-instructors led two mini-workshops at the university's museum in weeks 4 and 5 of the 17-week course to discuss tangible works of art. On the first day, the class met in a classroom at the museum where the postdoc co-instructor presented an overview of VTS, demonstrated its facilitation using images projected on screen while providing brief training on how to lead a VTS discussion, communicating the expectation to the students that they would soon lead VTS sessions themselves (with guidance from a trained facilitator). The class then formed three groups and went into the museum galleries to practice VTS led by the co-instructors and guest instructor, with students taking turns facilitating. Students were encouraged to choose the art for which they wished to lead a VTS session and effort was made to obscure the title and artists-statements next to each piece because ambiguity facilitates better discussions. On the second day, the class again met in the museum classroom. This time the postdoc co-instructor led a brief, group discussion on the experiences in the galleries from the previous class and then re-formed the groups, who went back into the museum galleries to practice VTS facilitation, ensuring all students had a chance to lead at least one discussion. The rationale for having students practice facilitating these discussions comes from evidence gleaned from experience of the VTS community that students notice more about the process, are active rather than passive participants, and are more invested in mastery when they have this opportunity from the start.

By the end of that week, the students completed a reflective writing assignment to explore how they experienced the VTS method. The writing assignment used a guiding structure built on Foucault's notion of *askēsis* (from the Greek language, meaning exercise, practice, or training) (Foucault, 2005). Foucault's *askēsis* provides a conceptual framework for wholistic development of the self (*Bildung*) through deliberate reflection involving three forms of reflexivity: Memory, Meditation and Method (Kim, Morrison, & Ramzinski, 2019). Specifically, students were asked to reflect on (1) what they learned from the VTS activities (Memory), (2) whether or not what they learned might change or challenge them (Meditation), and (3) how they might want to apply what they learned to their development as professionals and/or to their daily lives (Method). Additionally, students were asked to (4) rate, on a scale of 0 (*not at all*) to 6 (*extremely*), the extent to which they thought this portion of the course helped them to become more reflective, and to (5) provide optional open-ended comments or explanations about the rating question. The full assignment prompt is provided in Appendix A, which also serves as sample prompt for the other units in the course (i.e., a similar prompt was used for approximately weekly writing assignments associated with each unit of the course). Following the guidance and approval of our

university's Institutional Review Board (IRB), the students' responses were de-identified and compiled for analysis. For the sake of brevity in this work-in-progress paper, we focus only on responses to the first, fourth, and fifth questions.

Data analysis was performed by the lead author, who employed methods of thematic analysis to derive common themes inductively and iteratively from the data. First, each response was read to get an overview of the data, then qualitative data analysis software called Quirkos (see www.quirkos.com) was employed to formally code the responses. Rather than segmenting the data rigidly by phrase or sentence, semantic units (i.e., units of meaning) were used, which sometimes included sentence fragments, whole sentences, or multiple sentences. Multiple codes would overlap depending on the text and every word of every sentence was ultimately included in at least one code. After an initial, iterative coding pass, the quotes associated with each code were reviewed and the code definition revised to better describe the key idea captured. Furthermore, for those themes that were the most prevalent, all responses not coded with that theme were also re-read to ensure that nothing was missed. Additionally, when a new code was added, full-text searches were run to find key words with alternative endings, synonyms, and similar expressions to help ensure nothing was missed. Selected quotations were chosen for inclusion in this paper based on the expert, subjective assessments of the lead author for their clarity and "representativeness" of the theme. Although there are many possible approaches to thematic analysis, Braun and Clarke (2006) provide a good introduction for the interested reader.

4 Findings

The course enrolled 20 graduate students, three-fourths of whom were women. More than three fourths of the students majored in Environmental Engineering, and the rest majored in Chemical Engineering and Bioengineering (two each). Three of the students were in Ph.D. programs, two were in traditional master's programs (with options for thesis or coursework only), while the majority were in their final years of a five-year coursework/project-based professional master's program. The group also included a number of international students, though most were from the United States. Demographics about race/ethnicity or country of origin were not explicitly collected, though some such information appeared in other writing samples and was removed as part of the de-identification process to protect the identities of the students. The following sub-sections present the themes emerging from the students' responses with respect to (1) student learning and (2) impact of VTS on reflective thinking, which helps to fulfill the main purpose of our paper, namely, to explore how VTS contributes to the development of reflective thinking skills in graduate engineering education.

4.1 Student Learning: Responses to Question 1 (reflect on what you learned / Memory)

As detailed in Appendix A, the assignment prompt first briefly reminded students about Foucault's framework for *askēsis* (reflective exercise/training), followed by a short summary of

the activities of the two days devoted to VTS. The first question then read:

> 1. Reflect on what you learned from these aspects of the course. (Memory)
> *In the box below, describe what you learned and indicate the most important thing(s) you took away.*

What the students reported learning is summarized in Table 1 and described in more detail with illustrating quotations below, either in the sub-sections that follow, or in Appendix B for those that are more mundane, less prevalent, and likely to be of interest to fewer readers.

Table 1: Summary of All Themes

Theme	**Description**	**Prevalence (# of students)**
Roles (Facilitator/Participant)	indications of the roles of facilitator and/or participant in the VTS experience	19
Knowledge/Skills Learned	specific knowledge gained or skills developed as a result of the VTS experience	16
Appreciating Others' Perspectives	appreciation of the differences in perspective that VTS discussions draw out	14
Outliers*	codes that were poorly aligned with any of the other codes or themes	2
Purpose of VTS*	perceptions or thoughts on the intended purpose of VTS	8
Comments/Sentiments*	comments and/or sentiments about the VTS activity, the museum, the artwork viewed, etc.	5

* See Appendix B for details about these themes.

4.1.1 Theme: Roles (Facilitator/Participant)

Given the focus of the question analyzed in this paper and the novelty of the VTS technique for our engineering students, most responses were provided in the context of the students' roles as facilitators of VTS sessions and/or in their roles as participants. Specifically, just over three quarters of the students referred to the facilitator's role, just under three quarters of the students referred the participant's role, and only one student indicated neither role. Many students wrote about the mechanics and procedures of facilitating and/or participating in VTS along with providing insights learned as to the reasons VTS is conducted in these ways. Given the over-lapping nature of the semantic units used for coding and the fact that some of the students' take-aways were expressed either outside the context of either role or were ambiguous in this regard, illustrating quotations for this theme will appear implicitly in the subsequent themes below.

4.1.2 Theme: Knowledge/Skills Learned

Many students identified specific knowledge gained or skills developed as a result of their VTS experience. These included:

- Group Discussion
- Listening/Paraphrasing
- Observation
- Imagination/Creativity
- Critical Thinking

The most prevalent code here was "Group Discussion," which indicated VTS helped the students with leading and/or participating in group discussions. For example, Student 11 wrote about learning to lead VTS in a neutral manner that does not discriminate:

> *I learned strategies for opening dialogue and leading discussions in a non-discriminative way.* —*Student 11*

This idea of inclusiveness also appeared in the writing of Student 8, who wrote of avoiding bias:

> *I learned how to no* [sic] *inject a bias into a group as a facilitator in order to create a flexible yet create thinking environment for the group to operate in.* —*Student 8*

Another prevalent sub-theme was "Listening/Paraphrasing," which indicated VTS helped students develop listening skills and/or paraphrasing. Student 1 wrote about listening deeply to understand others:

> *Through the exercise we are taught to really listen and understand what others are saying.* —*Student 1*

Student 20 expanded on this, calling the VTS sessions "reflective conversations" and adding the skill of paraphrasing:

> *I learned how to be a medium for reflective conversation. Although it was awkward at first and difficult at times, asking your peers questions, listening to them, paraphrasing what they said.* —*Student 20*

Skills of "Observation" was another common sub-theme here. Student 14 used the phrase "observation skills" specifically and tied it to the idea of first taking things at face value and then looking for deeper meaning. Student 11 developed this idea further in the following quote, which shows deep insight into the artwork and an awareness of social justice issues:

> *One particularly interesting perspective that I gleaned was implanting a mores* [sic] *subtle meaning in a piece behind the more obvious themes and beauty of the art. There were several pieces that depicted beautifully painted figures from the old West, with themes of heroism, and rugged beauty. However, hidden beneath the obvious forms were more subtle, yet powerful messages of the subjugation of nature by man, and the brutal colonization of indigenous people.* —*Student 11*

Beyond application to artwork, a couple of students wrote about VTS as helping them with creativity and/or imagination. Student 18 wrote:

> *This strategy will also help me to think outside of the box and become more creative in my daily activities especially in my profession.* —*Student 18*

Student 18 also tied VTS to the ideas of cognitive skills and critical thinking important in environmental engineering:

> *Visual Thinking Strategies is a unique method to use art to enable someone to use existing visual and cognitive skills to explore other complex subject matter. … Visual thinking strategies help me to get familiar with critical thinking which is very important for me as an environmental engineer.* —*Student 18*

4.1.3 Theme: Appreciating Others' Perspectives

The other prevalent theme found in the students' responses to the first question was an appreciation of the differences in perspective that VTS discussions draw out. Nearly three quarters of the students mentioned this in their responses. For example, Student 16 wrote that her peers' perspectives helped her perceive things from different angles:

> *"I felt as though listening to my peer's* [sic] *thoughts and opinions on them helped me look at things from all different angels* [sic]. —*Student 16*

For Student 17, a key take-away was the value of group discussion for providing a broader, more holistic view:

> *I also learned that by discussing what is going on in a picture instead of looking at each aspect individually, you can gain new perspective. Listening to other people talk about paintings mad* [sic] *me rethink my thoughts and see it from different views.* —*Student 17*

Student 19 made an interesting observation that highlights the value of diversity in some of its different forms, including neurodiversity and international educational experience:

> *I was also very surprised at how everyone saw something different and it got me thinking about how everyone's brain works differently, and how their experiences shape the way they see things. There were people in my group who didn't take history classes in the US, so when we went to a section of the museum that had pieces depicting past US wars, they saw something completely different than the rest of us.* —*Student 19*

Similarly, Student 9, marveled at the diversity of perspectives in her group and further observed that the discussions were all the more human because of the assumptions built into these perspectives:

> *I was amazed at the variety of opinions when everyone was looking at the same image, but what was equally interesting was the human connection still present in the discussion. Everyone brought their own unique perspective to the images, but each were gained from human experiences. These experiences come in the form of presuppositions, and these different experiences facilitate different possibilities for each image we discussed.* —*Student 9*

It is worth mentioning here that the quotations above include students from all three groups, each of which was led by a different co-instructor or guest instructor, and that although Students 17 and 19 were in the same group, they had rather different takeaways from the VTS experience even within this theme, with one focusing on their own response to diverse perspectives, while the other drew attention to how diversity is manifest in other people.

4.2 Impact of VTS on Developing Reflective Thinking: Response to Question 4 (extent to which this helped you become more reflective)

As shown in Figure 1, most of the students felt the two class meetings devoted to learning, practicing, and facilitating VTS helped them to become more reflective. Eleven of 20 students rated it as 6 (*extremely*) and the lowest rating was 3 (*moderately*) by one student. The mean value was 5.4 (out of 6) and the standard deviation was 0.8. As shown in Figure 2, when compared to the other learning activity units in the course, the VTS unit received some of the highest ratings of all, comparable only to the *Bildung* unit, which involved autobiographical writing, companion art creations, and class presentations and is the subject of a future paper.

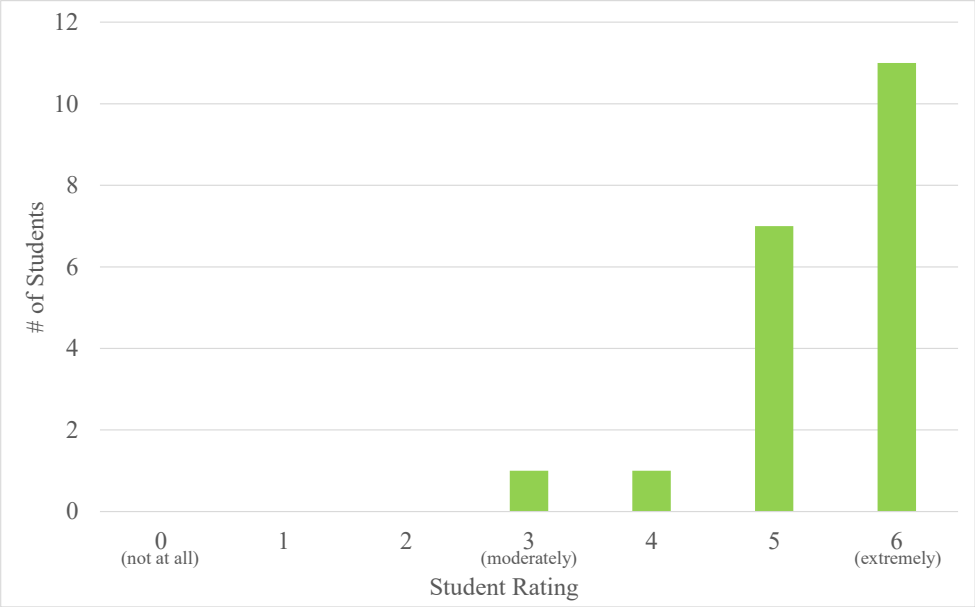

Figure 1: Overall Student Ratings for the VTS Unit (responses to Question 4)

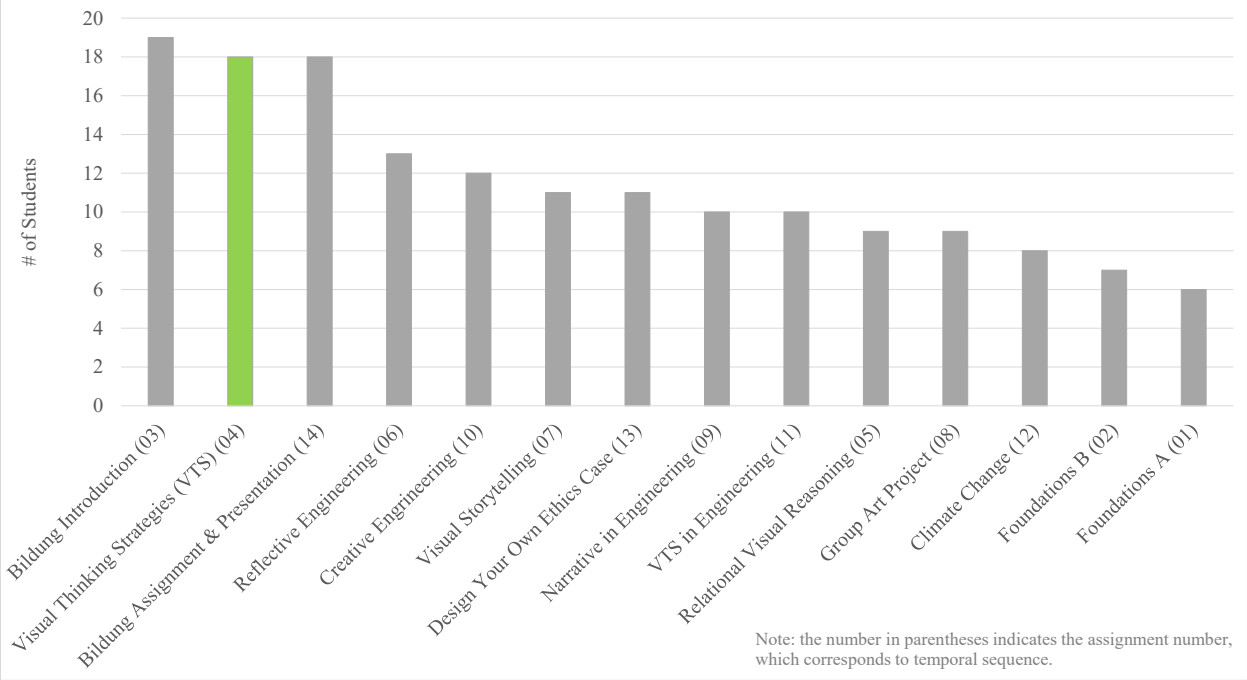

Figure 2: Overall Student Ratings for Each Course Unit if Greater than or Equal to 5 (compiled from responses to Question 4 for each unit)

5 Discussion and Conclusions

As illustrated above in the Findings, our graduate engineering students reported the Visual Thinking Strategies (VTS) unit of the course to be highly effective at helping them become more reflective (see Figure 1) and that it was one of the most effective methods in the course for the development of reflective thinking (see Figure 2). Based on the portion of the writing samples we analyzed, we have shared what our engineering students learned from the VTS method in just two class periods. While our own instructional experiences and revelations with VTS over the past few years are certainly worth sharing, this paper has focused on the perceptions of our students, whose ideas and perspectives we value and wish to give a larger voice.

One of the key takeaways to which we wish to draw attention is the theme of "Appreciating Others' Perspectives" described in Section 4.1.1, which highlights the potential value of VTS for promoting and supporting diversity in engineering. The fact that this theme summarizes a key takeaway for the majority of our graduate students should speak for itself, but we wish to further emphasize this point because it supports our own experiences both learning VTS with other groups of faculty and staff, as well as teaching it to others at conferences and workshops. Due to the open-ended and participant-driven nature of discussions using the VTS method, all students are naturally drawn into the discussion. The practice of the facilitator paraphrasing the statements of each participant serves to both clarify and validate the perspectives of all participants and creates an atmosphere in which diversity is clearly valued and appreciated. We have experiential

knowledge of this, though we are unaware of existing scholarship on the use of VTS for promoting diversity, so future studies are necessary to qualify such possible effects of VTS training.

Another significant theme we noted was "Knowledge/Skills Learned", in which students identified specific knowledge gained or skills developed through their VTS experience. These included skills of leading or participating in group discussions, listening/paraphrasing, observation, imagination/creativity, and critical thinking. At face value, each of these have clear value in professional engineering practice and the fact that some students further recognized the value of VTS for encouraging inclusiveness and limiting biases (see "Group Discussion" in Section 4.1.2) is particularly encouraging and worthy of note. Although engineering faculty with whom we have interacted sometimes have trouble seeing the value and relevance of VTS in engineering, many engineering students seem to little trouble doing so. We have previously reported this observation about students anecdotally in Campbell et al. (2017, p. 12) and the quote by Student 18 in Section 4.1.2 above highlighted this by connecting VTS to thinking "outside the box … especially in my profession" and helping him "get familiar with critical thinking which is very important for me as an environmental engineer."

Finally, an important takeaway for faculty and instructors who are considering adopting VTS in their courses or programs is the value of having the students themselves learn to lead VTS sessions. This has proven to be a valuable experience for our graduate students, as suggested by the large number of responses written in the context of facilitating VTS (see Section 4.1.1 above). It has also shown promise with undergraduate students with whom we have used VTS (see Campbell et al., 2017). Building on the present study, analysis of the remaining responses from the other two questions of the Foucault-based prompt (see Appendix A) is ongoing and planned for future publication. Preliminary findings show student recognition of the value and relevance of the VTS approach for such things as engineering management (e.g., via listening skills) and problem solving (e.g., by making space for a diversity of perspectives). Moreover, when the students learn to lead VTS sessions, they also learn to accept multiple interpretations and thus to be more aware of multiple truths, which is aligned with Yenawine and Miller's (2014) proposal that, "When students look at art together, they contend with uncertainty and with the ethical aspects of truth telling and truth finding—a major enterprise at the college level" (p. 8).

Limitations of the study include the small sample size (due to a cap on course enrollment for manageability), from which generalizable findings would be inappropriate. We also recognize it would be helpful in interpreting the survey question findings described in Section 0 if we had insights into how the students understood the meaning of the phrase "become more reflective" from Question 4 of the writing prompt. Data on this has been collected from our most recent course offering and analysis is ongoing. Furthermore, it would be valuable to know whether the students expect their learning of VTS to be applicable to their work as engineers, to their personal lives, or both. Analysis of Questions 2 and 3 will shed some light on this and is planned for a future publication.

Future work also includes exploring the data for trends based on student demographics, such as sex/gender, age range, or type of degree program. For example, we hypothesize that the time constraints imposed by other classes and the job-search process on the students in the five-year professional master's program would have affected the depth and/or quality of their reflective writing as compared to the students in the thesis-based programs who would presumably have had more unstructured time to engage in reflection and writing as well as exploring optional suggested readings or seeking out other supplemental information.

Another line of research that is important to explore, and for which parallel efforts are underway for a future publication, involves case-based analysis of the collected writings of individual students to better understand their stories, motivations, reasons for participating in the class, and key takeaways. By understanding the students as individual people rather than in the aggregate, we can better design course materials and recruiting materials to serve the needs of future students. Furthermore, some students may already be receptive to learning about reflection and the integration of the arts and humanities into engineering, and some may need to be convinced of the value of these ideas. By better understanding our audience, we can better understand what works, what needs to be improved, as well as the why and how of doing so.

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Appendix A: Reflective Writing Assignment Prompt (adapted from Kim, Morrison, & Ramzinski, 2019)

This assignment is based on Foucault's three forms of reflection (reflexivity): Memory, Meditation, and Method.

Memory involves reflecting on what happened (recollecting).
Meditation involves reflecting on why the experience has affected you, if at all.
Method involves reflecting on how you want the experience to transform you, if at all.

Instructions

Use the prompts below to complete the assignment. You should aim for 100-200 words for each box, but if you need more words to express your thoughts, feel free to use them.

For this assignment, please focus on the following aspects of the course:

i) The 2/6 (Thursday) class meeting at the Museum, including the VTS Introduction by Dr. [author/co-instructor], the VTS sessions as a whole class, the handout (What is VTS? & How to Facilitate VTS?), the smaller-group VTS sessions in the Museum galleries led by Dr. [co-author/co-instructor], Dr. [co-author], or Dr. [author/co-instructor].

ii) The 2/11 (Tuesday) class meeting at the Museum, including the whole-class debrief/discussion, and the smaller-group VTS sessions led by Dr. [co-author/co-instructor], Dr. [co-author], or Dr. [author/co-instructor].

1. Reflect on what you learned from these aspects of the course. (Memory)
   In the box below, describe what you learned and indicate the most important thing(s) you took away.

2. Reflect on why what you learned may change or challenge you, if at all. (Meditation)
   In the box below, please explain.

3. Reflect on how you might want to apply what you learned to your development as a professional and/or to your daily life. (Method)
   In the box below, please explain with a specific example or two.

4. To what extent do you think this portion of the course helped you become more reflective?
   (Note: there are no right or wrong answers here and your honesty and candor are greatly appreciated.)

5. Comments (optional)
   Please add any explanation or comments here to explain your thinking on the previous question.

Appendix B: Additional Themes and Outcomes from the Analysis

The contents of this section also originated from the analysis. Although more mundane, less prevalent, and likely useful to fewer readers, they are included here for the interested reader and for the sake of methodological completeness.

B.1 Theme: Outliers

As often happens with thematic analysis, there were a couple of codes that were poorly aligned with any of the other codes or themes. In this study, one student (Student 6) seems to have come away with some unusual and possibly inaccurate lessons learned. He wrote about learning how the "prompting strategy [of VTS] can help people connect with artwork," which is certainly true; however, he then continued "and retain more information after leaving the museum." Although

this could be possible depending on how VTS is used in the museum (e.g., as a prelude to a talk by an art historian or knowledgeable docent about the piece), it is generally not the point of VTS and is not how we used it in this class. The primary purpose of VTS is really to make art more accessible, interesting, and engaging to people, rather than to teach art history; however, hopefully after engaging with the art, they will then become motivated to learn about it further.

Another unusual lesson also learned by Student 6 was the idea that "visual literacy isn't necessarily important if the viewer possesses creative thinking." His point here seems to be that it does not matter what you know about the art you are viewing in a VTS discussion, what matters is your ability to imagine creative possibilities for interpretation of the art. This assumes his use of the term "visual literacy" refers to knowledge about art from the perspective of an art expert. While we can see where this idea comes from (e.g., some students occasionally suggest fanciful and creative interpretations of the art to stimulate discussion), it seems to miss the point that by exercising the skills of observation and communication as a participant and the skills of listening and open-mindedness as a facilitator, one can become better at noticing the details and contextual clues that are manifested by art experts. Furthermore, it has been our experience that knowledge of the art or artist by one or more participants usually hampers the discussion because it tends to remove much of the ambiguity in the artwork once it is shared. The art normally selected for VTS is intentionally ambiguous, leaving it up to the viewers' interpretations rather than artist's intended meaning (if any) to help show that different interpretations, grounded by visual evidence, are worth considering and can contribute to understanding of the piece and/or of each other.

Our experience has shown that group members will tend to defer if they sense that one or more people have "expert knowledge." The VTS process works best when the group consists of relative peers in this regard. If there is participant with special knowledge and the group becomes passive and allows that person to make all the comments, it can be challenging for the facilitator to get things back on track. One does not want to diminish or discredit the comments of the more experienced participant but must find a way to assure the group that other perspectives are still important. It can be difficult, but a skilled facilitator can do it. One tactic is to always paraphrase a seemingly "expert" interpretation and then ask, "What do you see here that makes you say that?" The key is to always take it back to the evidence in front of the group.

B.2 Theme: Purpose of VTS

Another theme found in students' responses to the first question involved their understandings of the purpose of VTS. Eight students wrote about this, and included short definitions VTS, such as the following:

> *Visual Thinking Strategies is essentially a means to encourage discussion and learning.*
>
> *—Student 9*

Visual Thinking Strategies are ways to provoke and facilitate thought on pieces that are visually stimulating, such as paintings, photography, sculptures, and the like. —*Student 13*

Two students went on to tie their perceptions of purpose to the activity of facilitating VTS, such as Student 1 who wrote about the importance of listening and understanding that is achieved by the facilitator paraphrasing the participants' thoughts:

The Visual Thinking Strategies (VTS) that we have been learning in class is about understanding what others are saying. While we all may be looking at the same art piece, we are all thinking of different stories and interpretations. The lead in this exercise is tasked with paraphrasing everyone else's interpretations without interjecting their own opinions. Through the exercise we are taught to really listen and understand what others are saying. —*Student 1*

Thus, this quote was coded under multiple themes, including this one (Purpose of VTS), Appreciating Others' Perspectives, and Knowledge/Skill Learned (i.e., Listening/Paraphrasing).

B.3 Theme: Comments/Sentiments

Another theme found in six students' responses to the first question was that of comments and/or sentiments about the VTS activity, the museum, the artwork viewed, etc. Three of the students expressed positive sentiments about the VTS portion of the course:

I really liked this portion of the class. —*Student 3*
I learned a lot through this exercise. —*Student 14*
I really enjoyed the visual thinking strategies. —*Student 16*

Student 16 then went on to explain why she enjoyed it:

I found it to be a lot more "freeing" and [I was] *able to say whatever I felt* [about what] *the painting or sculpture represented when there really is no right or wrong answer.* —*Student 16*

Two of the students (including Student 16) also expressed positive sentiments about the opportunity to visit the museum:

It was fun to be able to explore the museum too… —*Student 11*
I really enjoyed going out and being able to look at different types of pieces… —*Student 16*

One student observed qualitative differences in the artwork on display in the museum and expressed appreciation for art that was complex/abstract rather than simple/realistic:

The art that we viewed within the museum was either straightforward or very abstract. I preferred the more complex art because i [sic] *think it left more for the viewer to interpret than the more straightforward art.* —*Student 6*

Finally, one student commented specifically on the novelty of the VTS experience for them:

This is the first time I have ever participated in a group discussion where VTS strategies were emphasized and fostered. —*Student 8*

B.4 Responses to Question 5 (open-ended comments)

The optional Question 5, which prompted students for comments on or explanations about their thinking on the previous question (see Appendix A), was addressed by four of the students. None chose to respond directly to the prompt, but instead all expressed positive sentiments about VTS, as indicated below:

> *I really enjoyed visiting the museum and looking at the artwork.* —*Student 17*
>
> *Liked this course content extremely*[.] —*Student 18*
>
> *I loved visiting the art museum. My favorite part of the course so far.* —*Student 20*
>
> *I really enjoyed the two days in the museum. I have never had a class, other than art appreciation, that centers itself around the consumption of art. I feel that it was extremely engaging and an overall unique experience.* —*Student 8*

When these are combined with the quotations from the "Comments" theme above, clearly the students enjoyed the VTS portion of the course in addition to learning from it.

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