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Draw Education: Graduate Student Perceptions Of Education Using An Arts-Informed Approach

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ABSTRACT

Education has been shifting to foster better learning environments for students with instructors as co-constructors of knowledge in the classroom. Part of this educational transformation has been accomplished through graduate student education in preparing the next generation of educators to adopt student-centered teaching approaches. Change, however, can be slow, and implementation in the classroom looks different across disciplines. The purpose of this study is to gain a better understanding of graduate students' perceptions of education when enrolled in a course on contemporary pedagogy. We seek to answer RQ: How do perceptions of education compare between graduate students in engineering and non-engineering academic disciplines? Arts-informed approaches provide an avenue to understand student perceptions and allow students to express their ideas in a creative and non-traditional way. For this study, we gathered drawings from 38 graduate students from multiple disciplines enrolled in a graduate-level course on contemporary pedagogy. Data were analyzed to compare disciplines along the spectrum of concrete, active, reflective, and abstract. Results from pre-course drawings indicate a breadth of student expressions and perceptions of education, including metaphors and discipline-specific content. Students draw on their prior experiences, but also look to the future in how they envision education to be. Themes include education as: an active- learning approach, cognitive development, futuristic, a global endeavor, knowledge acquisition and transfer, lecture-based, metaphors for education, and influence from personal experiences. Future work will include analysis of post-course drawings and reflections to gain a full understanding of how the course impacted students' perceptions of education.

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1 INTRODUCTION

Despite calls to promote innovation and creativity, engineering continues to struggle with how to prepare engineers to face engineering challenges for a more sustainable future (Murzi et al. 2016). The National Academy of Engineering (NAE 2018) recognizes creativity and design as essential skills for the engineering profession and there is an expectation that the field will drive innovation and technological developments, which overall will improve economies. Yet, engineering education is still shifting from rigid, lecture-based teaching approaches to more culturally responsive, student-centered pedagogy. Part of the issue is often attributed to cultural traits of the engineering field—often characterized as masculine, individualistic, and function-oriented (Dryburgh 1999, Faulkner 2015, Henwood 1998, Tonso 2007). The discipline has also been described as having a "hostile environment" (Zongrone et al. 2021), especially for marginalized groups and those who do not fit the dominant culture of engineering. Hence, this culture can reinforce destructive perceptions of education for students, with an excessive focus on grades, finding the "only right answer" to test questions, and rote memorization (Tonso 2006) - which do not necessarily connect to learning. Learning theories emphasize that students thrive in environments where they feel valued, psychologically safe, and free to express their ideas (Ambrose et al. 2010, Ormrod 1999).

Perceptions of education may look differently depending on the student, their background, and the culture in their academic discipline. Some disciplines outside of engineering may perceive education differently (e.g., focus on constructing knowledge rather than memorization) which can influence how they learn and impact their perceptions of education and on developing innovative thinking and creativity. It is through intentional educational pedagogies that we can develop creative and innovative engineers not at the expense of its discipline-specific technical knowledge and problem-solving skills. One way to bring change to the next generation of engineers is through graduate student education, as some students become faculty members and bring contemporary pedagogical practices to the classroom. By preparing the future faculty members in charge of training the next generations of engineers, we can have a long-term impact to change the culture of engineering and engineering students' perceptions of education. As expressed by (Freire 1996):

> Education either functions as an instrument which is used to facilitate integration of the younger generation into the logic of the present system and bring about conformity or it becomes the practice of freedom, the means by which men and women deal critically and creatively with reality and discover how to participate in the transformation of their world.

While education has been shifting to foster better learning environments for students with instructors as co-constructors of knowledge in the classroom, implementation in the classroom looks different across disciplines. Thus, the purpose of this study is to gain a better understanding of graduate students' perceptions of education based on their disciplinary backgrounds when enrolled in a course on contemporary pedagogy. We seek to answer the following research question:

RQ: How do perceptions of education compare between graduate students in engineering and non-engineering academic disciplines?

1.1 Arts-Informed Approaches

To respond to our research question, we took an arts-informed methodological approach. Arts-informed methods in engineering education research have been used to obtain valuable perspectives and insights not evident in traditional data collection approaches. Engineering is often seen as a discipline focused on technical aspects, but incorporating arts-based approaches

can help bridge the gap between technical knowledge and creative expression. By integrating artistic practices, such as drawings, researchers can tap into the visual and imaginative dimensions of learning, enabling students to explore and communicate their understanding of concepts in new ways. Arts-informed approaches have been used in higher education to understand student perspectives both in engineering and non-engineering disciplines. For example, it has been used in engineering education to gain deeper insights of engineering identity development and of first-year students' perceptions of engineering with 'draw an engineer' and 'what is engineering' activities (James et al. 2020, Murzi et al. 2022). These studies used this approach to understand both disciplinary differences and institutional differences through student comparisons and institutional first-year course comparisons. Visual inquiry through freehand drawings has also been used in academic disciplines such as business and political science (Page and Gaggiotti 2012, Donnelly and Hogan 2013). In this study, arts-informed methods are used to understand student perceptions of education and explore disciplinary differences between engineering and non-engineering students.

2 CONCEPTUAL FRAMEWORK

This study takes a stance on education and understanding student perspectives using critical pedagogy and a framework on disciplinary differences. (Bradbeer 1999) uses Kolb's experiential learning theory to conclude that "different disciplines both process and structure knowledge in different and distinctive ways." (p.384-385). Thus, disciplines can be defined along a spectrum of abstract-concrete and active-reflective. For example, Sociology and English are considered concrete and reflective disciplines, while Engineering and Business are considered abstract and active. The orientation of academic disciplines along this spectrum is shown in Figure 1. These disciplines can be further broken down to convey disciplinary differences in engineering.

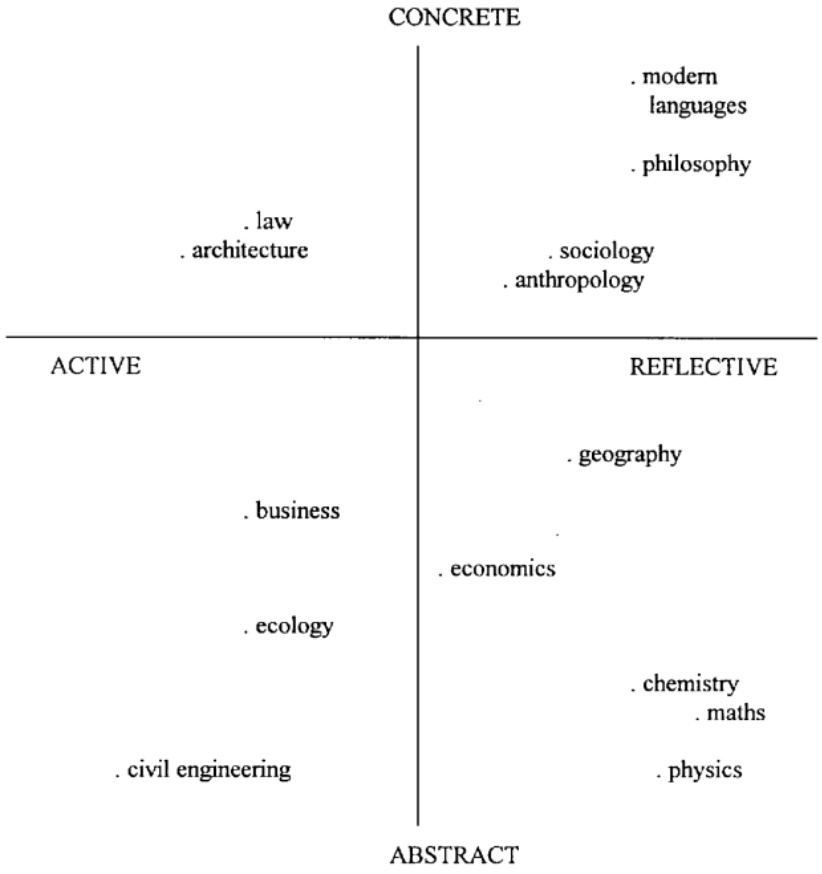

Figure 1: Academic discipline orientations (Bradbeer 1999).

3 METHODOLOGY

This exploratory, qualitative study was conducted in a graduate-level course at Virginia Tech, which is a large, research-focused public university in the U.S. Arts-informed approaches provide an avenue to understand student perceptions and allow students to creatively express their ideas in a non-traditional way.

3.1 Population and Data Collection

For this study, we gathered drawings from 38 graduate-level students from multiple disciplines enrolled in a graduate-level course titled GRAD 5114: Contemporary Pedagogy. A breakdown of the academic disciplines of students in the course categorized as engineering and non-engineering are shown in Table 1. Additionally, of the 38 students, 27 students were doctoral-degree seeking and 11 were masters-degree seeking at the time of course enrollment. Student demographic information was collected but not utilized for analysis in this study.

Table 1. Academic disciplines breakdown by engineering and non-engineering

Categorization	Discipline	Frequency	Total
Engineering	Aerospace Engineering	1	15
	Biomedical Engineering	1	
	Civil Engineering	3	
	Engineering Education	4	
	Engineering Mechanics	1	
	Industrial & Systems Engineering	2	
	Mechanical Engineering	3	
Non-Engineering	Architecture	1	23
	Biological Sciences	4	
	Biomed & Veterinary Sciences	1	
	Chemistry	1	
	Communication	1	
	Curriculum and Instruction	3	
	Educ Ldrshp & Policy Studies	1	
	English	2	
	Entomology	1	
	Environmental Design & Planning	3	
	Fisheries & Wildlife	1	
	Forestry	1	
	Geosciences	1	
	Planning, Governance, & Global	1	
	Public Health	1	

On the first day of the course, students were supplied with paper and drawing materials and were prompted to "Draw Education." Some students used paper and pencil, while others used digital mediums. Students submitted their drawings as .jpg, .png, or .pdf files.

3.2 Drawings Analysis and Limitations

Drawings were coded both a priori to compare disciplines along the spectrum of concrete, active, reflective, and abstract, and openly, using thematic analysis. We followed the six-phase process of thematic analysis outlined by (Braun and Clarke 2006), which includes 1) becoming familiar with the data, 2) generating initial codes, 3) searching for themes, 4) reviewing themes, 5) defining and naming themes, and 6) reporting themes using selected excerpts (in this case drawings). As part of this process, a codebook was developed that included initial coding, definitions of codes, example drawings, final themes, and mapping onto disciplinary orientations. Themes were examined for any patterns emerging in comparison between engineering and non-engineering disciplines.

Data limitations include the context of the research site, which may not account for the cultural and personal backgrounds of the graduate student participants enrolled in this course on pedagogy in the U.S. This work could be expanded to compare drawings from institutions across culturally diverse contexts to compare disciplinary differences. Although an arts-informed methodology is used intentionally to gain a deeper understanding of student perceptions of education, it also has limitations. While drawings provide a non-traditional medium for students to express their ideas, analysis of student drawings are limited by the interpretations of the authors. "Art is in the eye of the beholder" - in this case the researchers, which may not accurately represent student interpretations and intention since drawings were not accompanied by a description or explanation. Furthermore, drawing representations only consider current graduate academic disciplines and do not account for students' undergraduate education disciplinary backgrounds, which could impact the representation of ideas and mapping onto the disciplinary orientations.

4 RESULTS

Results from analysis of drawings from the first day of the course indicate a breadth of student expressions and perceptions of education. For example, a comparison of student perceptions from lecture-based to active-learning approaches in the classroom are shown in Figure 2.

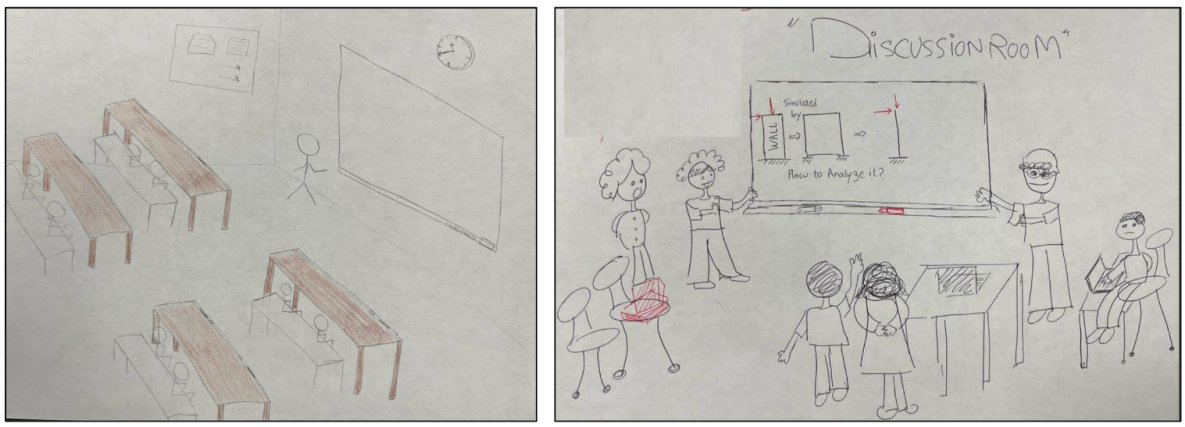

Figure 2: Lecture-based and active-learning drawing examples.

Themes that emerged from drawings analysis include: active-learning approaches, cognitive development, futuristic, global perspective, knowledge acquisition and transfer, lecture-based, metaphors for education, and personal experiences. These themes and their definitions and codes are shown in Table 2 and varied from concrete to abstract and by engineering and non-engineering disciplines.

Table 2. Codebook with themes, definitions and abstract-concrete orientation.

Theme	Codes	Definition	Orientation
Active-learning approaches	Applying knowledge	Encompasses active learning approaches with communication and discussion in the classroom	Concrete
	Co-construction of knowledge		
	Discussion		
Cognitive development	Brain	Focus on cognitive thoughts and the brain	Concrete / Abstract
	Light bulb		
Futuristic	Advancing technology	Looking towards the future; focus on growth and/or technology as a component of education. Also focus on making a difference and the world a better place	Concrete / Abstract
	First day of school		
	Growth mindset		
Global endeavor	Earth/Globe	Perspectives of education as a global endeavor and impact across the world	Abstract
Knowledge acquisition and transfer	Books	Focus on acquisition of knowledge and transfer of knowledge through communication via people or books	Concrete
	Communicating ideas		
	Transfer from one generation to the next		
Lecture-based	Classroom setup	Traditional views of the classroom, instructor hierarchy	Concrete
	Instructor		
Metaphors for education	Garden	Metaphors that are used to describe education or the process of education	Abstract
	Time process		
	Tree		
Personal experiences	Discipline-specific	Includes the personal interests and connections that students bring to their educational experience.	Concrete
	Hobbies		
	Lived experiences		
	Personal interests		

Some select themes are shown in Figure 3, including knowledge acquisition and transfer, metaphors for education, and global endeavour.

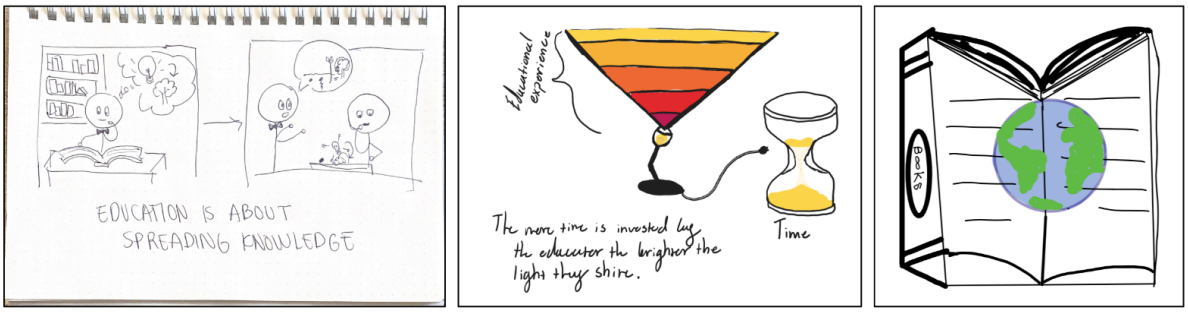

Figure 3: Knowledge transfer, metaphors for education, and global endeavour themes.

The knowledge acquisition and transfer example shows a drawing of a person reading a book and then explaining to another person with the caption "Education is about spreading knowledge." Two other examples in Figure 3 show education as a metaphor with a caption that says "the more time is invested by the educator, the brighter the light they [the student] shine"

and education as a global endeavor with an illustration of a globe on a book.

Drawings in the cognitive development theme varied by discipline, with contrast between engineering and non-engineering disciplines. Cognitive development included drawings of the brain with variation between abstract and concrete. Engineering discipline perceptions of education in the cognitive development theme were concrete (as shown in Figure 4), while non-engineering discipline perceptions of education were abstract (as shown in Figure 5).

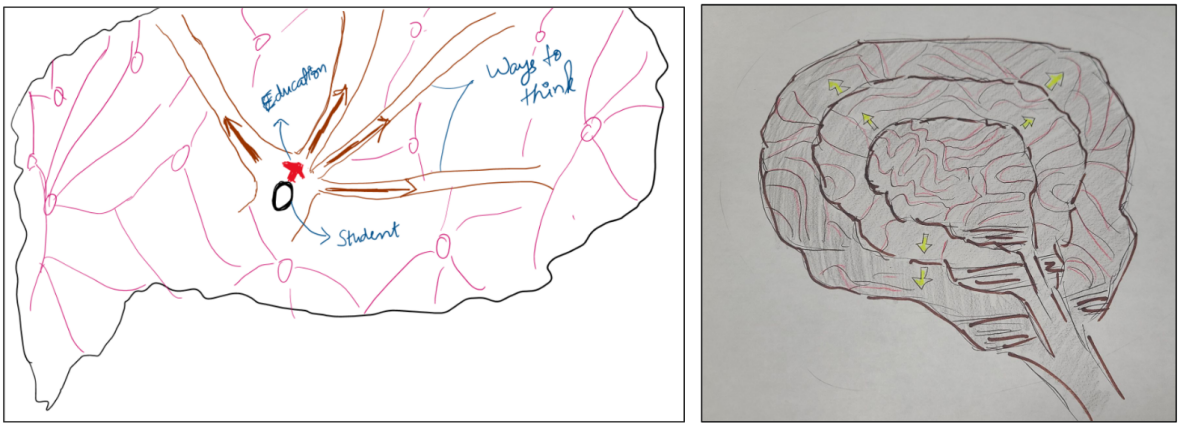

Figure 4: Engineering discipline drawings in the cognitive development theme.

The non-engineering disciplines that included more abstract perceptions of education as cognitive development were English, Chemistry, and Public Health.

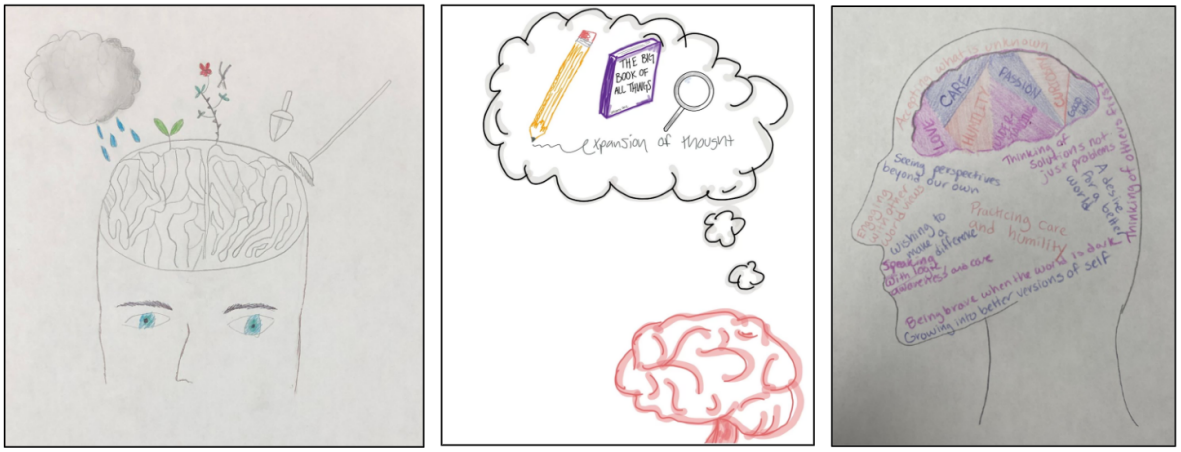

Figure 5: Non-engineering discipline drawings in the cognitive development theme.

5 DISCUSSION

Understanding graduate student perceptions of education is a critical first step for the transformation of our educational systems with contemporary pedagogical practices. It is important to note that student perceptions of education may not be explicitly or wholly expressed through student drawings, however, there are some notable interpretations between disciplines. We do not wish to define or stereotype students by their academic disciplines. While some disciplinary differences emerged, this did not include detailed analysis of individual differences within disciplines or separation of engineering disciplines. Students drew on their prior experiences to represent education and included traditional lecture-based views of the classroom with the instructor at the front and students in rowed desks, while others drew more discussion-based and

co-learning environments. Although this paper did not include the full analysis of individual student perspectives of education, overall, a majority of engineering disciplines captured concrete experiences, while non-engineering disciplines expressed their views more abstractly. This is shown for example when comparing the cognitive development theme between engineering and non-engineering students in Figure 4 and Figure 5. This is opposite of what would be expected from the disciplinary orientations shown in Figure 1. It should be noted that these disciplinary differences developed by (Bradbeer 1999) focuses on learning and may not capture the way students creatively express themselves or their views on education in their respective disciplines. Furthermore, this framework may look different based on cultural contexts, and this study does not take into consideration the cultural and academic background of the graduate students who participated in this study. A study by (Ubidia, Guerra, and Murzi 2022) considers the differences between architecture and civil engineering students. An understanding of disciplinary and cultural differences is important for educational strategies to better prepare students to collaborate and communicate across these disciplinary divides.

Additionally, it should be noted that this arts-informed approach can be used as both a pedagogical tool and as a research methodological component. In the classroom, it is used to engage students in critical thinking and interpretation of self and others' perspectives. Students also co-construct knowledge as they see, interpret, listen and learn from their peers and can also gain a better understanding of education through the eyes of their peers.

6 CONCLUSION

Arts-informed approaches provide an avenue to understand student perceptions and allow students to express their ideas in a creative and non-traditional way. For this study, we gathered drawings from 38 graduate-level students from multiple disciplines enrolled in a graduate-level course on pedagogy at Virginia Tech. Data were analyzed to compare disciplines along the spectrum of concrete, active, reflective, and abstract and identify themes across disciplines. Drawings indicate a breadth of student expressions and perceptions of education, including metaphors and discipline-specific content. Students draw on their prior experiences, but also look to the future in how they envision education to be. Some themes include education as: a global endeavor, lecture-based, social interaction, processes, cognitive development, making a difference, active-learning, and influence from personal interests and experiences. This work demonstrates the richness of non-traditional research methods such as arts-informed approaches for gaining a deeper understanding of student perspectives.

7 FUTURE WORK

This work is only in its initial steps in uncovering student perspectives of education and there is more left to be done. Through co-construction of knowledge together with students, we can gain a deeper understanding of their perceptions of education. Thus, this work will be expanded to include student reflections alongside the drawings to improve interpretation of students' expression of ideas. Future work will also include analysis of post-course drawings and reflection data to gain a full understanding of how the course impacted students' perceptions of education. By comparing pre-course and post-course drawings, we can also gain insight into how graduate students' perceptions of education evolve through the course. "Looking at the past must only be a means of understanding more clearly what and who they are so that they can more wisely build the future." (Freire 1996)

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