Board 45: WIP: Epistemologies and Discourse Analysis for Transdisciplinary Capstone Projects in a Digital Media Program

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WIP: Epistemologies and Discourse Analysis for Transdisciplinary Capstone Projects in a Digital Media Program

Abstract: This work in progress explores the epistemologies and discourse used by undergraduate students at the transdisciplinary intersection of engineering and the arts. Our research questions are focused on the kinds of knowledge that students value, use, and identify within the context of an interdisciplinary digital media program, and exploring how their language reflects this. Our theoretical framework for analyzing epistemology draws upon qualitative work in STEM epistemology [1]–[3], domain specificity [4], [5], and epistemological camps [6]. Further, to analyze the language used by participants, we employ the use of discourse analysis as the study of language-in-use [7]. Six interviews were conducted with students pursuing a semester-long senior capstone project in the School of Arts, Media and Engineering undergraduate degree program at Arizona State University. Preliminary findings show that students showcase a variety of epistemologies including positivism, constructivism, and pragmatism while engaged in their studies. "Border epistemologies" are introduced as a way to think and/or construct knowledge that may receive different value from discipline to discipline. Future research aims to synergistically combine these two methods of epistemological and discourse analysis as well as compare and contrast our findings to students pursuing more traditional engineering capstone projects to understand more deeply knowledge generation and utilization in these transdisciplinary arts and engineering programs.

Motivation: A recent thrust in transdisciplinarity for engineering education is the emphasis on STEAM, or STEM and the arts which can help foster creativity and divergent thinking models for STEM students [8], [9]. Transdisciplinarity, as opposed to interdisciplinarity or multidisciplinarity, synthesizes tools and knowledge from different domains of expertise so that they are no longer recognizable by any single domain [10]. Such synthesis encourages effective thinking skills, development of multiple perspectives, and the ability to traverse domain boundaries comfortably. STEAM has also been lauded for broadening participation and diversity in gender, race, socio-economic class, and viewpoint by acting as an on-ramp for underrepresented groups into STEM.

Yet the literature also contains some critiques of STEAM. Artists have argued that STEAM makes value judgments about art by adopting positivist positions which STEM fields typically ascribe to. The utilitarian use of arts as a way to benefit STEM can feel like instrumental justification [11]. Further, actual interactions with engineers and artists can yield individual discomfort or tense interactions [12]. These issues require us to reconsider how to incorporate the arts into STEM education without reducing or diminishing the arts.

Overview: In this work in progress, we focus on the particular transdisciplinary space of engineering and the arts. Our key idea is to first understand the underlying epistemologies present for students in integrated engineering and arts educational settings. We hypothesize that the discomfort and tension underlying engineering and art interactions may stem from varying epistemological differences for participants. Further, we believe we can identify these differences in the discourse of conversations and language utilized in these contexts.

To study a transdisciplinary engineering and arts learning environment, we collect and analyze qualitative data from students in the Arts, Media and Engineering (AME) program at Arizona State University. This department, a joint venture through the Schools of Design and the Arts as well as Engineering, trains the next generation of media artists and scientists in digital technologies and experiential media systems [13]. Students undertake a one-year Digital Culture Capstone project that reflects a culmination of their skills and experiences in the undergraduate major. Sample projects include game design and storytelling in virtual reality, and immersive audio-visual media installations. This program is a suitable testbed for our proposed study.

Research Questions: Our research questions in this study are the following: What epistemological orientations do students use to approach coursework that is a blending of arts and engineering, two traditionally epistemologically disparate fields? How do students' personal beliefs and epistemological alignments inform the way that they navigate their AME coursework? To approach these research questions, we used a method blending deductive coding with discourse analysis to analyze the student transcripts we collect in this study.

Theoretical Framework: Our theoretical framework is situated in previous work on qualitative research into STEM epistemology [1]–[3], domain specificity [4], [5], and the identification of epistemological camps [6]. We analyze participants' language (as well as the interviewers themselves), using discourse analysis as the study of language-in-use [7] to explore the intersection of personal epistemology and identity as well as epistemological tensions in this digital media program. For qualitative research, one of the most difficult challenges is between providing rich, context-specific descriptions at the individual level while determining knowledge or frameworks which are generalizable outside of this said context. To address this, we adopt several qualitative researchers' approach to emphasize transferability rather than generalizability of our methods, specifically case-to-case transferability [14].

Method: To answer our research questions, we used a deductive coding scheme [15] followed by discourse analysis [7] with six student interviews. We found that this helped us to enter the world of the participant's epistemologies by first coding for epistemological camps [6], and then using discourse analysis to analyze these epistemologies even if students themselves were unaware of their epistemological identities. Below, we detail the context of the study as well as the data collection and analysis procedures.

Participants and Context: Six participants have thus far taken part in this study. They are all undergraduate students within the AME program. Student demographics included 5 female and 1 male participant, race/ethnicities include white (2), Hispanic or Latino (2), Native American (1), and multiracial (1). While the gender diversity in this study is not representative of the gender dispersion in the AME program, we thought it important to overrepresent a female perspective. In this particular program, 40% of the population is comprised of women, a stark contrast to the small percentage of women represented in more traditional engineering programs. We felt that interviewing a proportionally larger number of women in a context different than traditional engineering programs might provide insight into their construction, understanding, and valuing of knowledge(s). We acknowledge that this might risk having the male student having token representation, and a follow-up study and analysis plans to address this gender imbalance.

Data Collection: Participants were recruited from the AME capstone course and were chosen because the course is only taken by students approaching graduation; we felt that these students had ample experience with the program, completing art- and engineering-heavy projects. All students enrolled in the Spring 2018 capstone course were sent an email explaining the nature of the study. Six responded and ultimately agreed to be interviewed. Interviews began with simple "warm-up" questions such as the amount of time they had spent in the program, to ease participants into more difficult and abstract questions [16], [17], moving to questions about instances they remembered in their program and questions about the nature of knowledge itself.

Deductive Coding: Coding occurred in two parts. As many students lacked the vocabulary to speak about epistemology as such, we had to identify when epistemologies/beliefs about knowledge were being referred to within the interviews. Two of the authors collected quotations from the interviews that they felt offered insight into student epistemologies. Then, we had to determine what specific epistemological beliefs were present in them. Saldaña [15] suggests that at times one may develop a list of codes "to harmonize with [a] study's conceptual framework, paradigm, or research goals" (p. 62). Our deductive coding scheme was a list of epistemological stances: positivism, empiricism, rationalism, representationalism, constructivism, skepticism, and pragmatism. This scheme provided structure as we inferred epistemological stances from students' descriptions about the nature of knowledge and approaches to problem solving.

Discourse analysis: Discourse analysis occurred after identifying student epistemological stances and was used to better understand how student epistemological identities operated within the AME program. Given the importance of alignment between identity, epistemology, and coursework in science [18], as well as the potential for various epistemological frameworks to be adopted in the AME program, we wanted to better understand the ways that students identified with and worked within the program. Discourse analysis may be used for questions regarding how individuals construct and present their identities within social settings [7]. With the epistemologically rich quotations, we used several tools from Gee's discourse analysis toolkit, including breaking the quotations into stanzas, examining deictic words and phrases, speculating about the motivation behind word choices, and analyzing how utterances enact behavior/identity.

Preliminary Findings: Our initial findings suggest that students used a number of epistemologies as they engaged in their studies, most notably positivism, constructivism, and pragmatism. However, students did not solely use one type of epistemology, but rather shifted their understanding of what knowledge they deployed and utilized in context for each project/assignment. To better describe this concept, we employ the concept of "boundary epistemologies," taken from Star and Griesemer's [19] idea of "boundary objects." A boundary object is information that might be used or understood differently from discipline to discipline. Just so, a boundary epistemology is a way of thinking or constructing knowledge that might receive different value from discipline to discipline. Their epistemological approaches must be malleable to fit across the boundaries that students are required to navigate to understand knowledge in different ways.

We saw this epistemological bordering as students began to describe learning different art- and engineering-based tasks within the AME program:

> With engineering it seems a lot easier because it's, like, just a matter of being taught it and doing it enough to where you don't have to think about it. Understanding in an artistic perspective though is harder to teach because I think it requires critical thinking skills.

We interpret the above quotation as bringing two epistemological stances into conversation with each other. The student recognizes the dominant, positivist epistemology that underlies much engineering work, seeing it as "easier" because there is a stable truth to learn: that truth exists, it must be integrated into one's existing knowledge structure, and it is a transcendental form of knowledge. On the other hand, the student contrasts this stable knowledge to that of art, which is interpretivist and "requires critical thinking" to approach. This student elaborates on the idea of critical thinking, describing it as thinking "about like what you're creating and what it conveys." The student sees art as a rhetorical negotiation between the product and the way that the audience will interpret it--it requires that one consider one's social environment as well as the message that one wants to produce through artistic representation. This anticipates a constructivist epistemology, one wherein meaning and knowledge are a construction between social entities.

Our discourse analysis used both tools that analyzed local linguistic and grammatical choices (e.g. deictic terms, breaking responses into stanzas) as well as analyzing larger themes of discourse including identity and world building [7]. One observation included the use of words "force" and "to make/made" for engineering, while "creativity" was used almost exclusively for artistic projects. By analyzing student responses as stanzas, we observed that most students describe a progression of learning engineering starting from novice and slowly becoming more comfortable. Also, it was observed that the notions of identity, particularly of "artist" and "engineer" were prominent in the discourse of the students, intersecting with other identity issues including gender. A final consideration is that maintaining boundary epistemologies is difficult; students perceived professors as valuing certain epistemologies over others (primarily positivism), and expressed difficulty in aligning beliefs and knowledges that were more constructivist- and representationalist-leaning with those of their professors.

Future Work: We have begun the preliminary work of utilizing both our deductive coding for epistemologies along with discourse analysis to perform triangulation of general themes in the data. This is methodologically interesting because the two approaches complement one another: the coding can capture broad themes across individuals while the discourse analysis (particularly at the small scale) can capture the linguistic choices used by these individuals. We think this is a promising avenue of study. Further, we have begun conducting our study on students from a traditional electrical engineering senior design course. We hope this study will help provide interesting parallels and contrasts with our AME participants and provides a way to see how our methodology transfers to a slightly new context.

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