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## LITERATURE REVIEW

# When Critical Ethnography Leaves the Field and Enters the Engineering Classroom: A Scoping Review

Stephanie Masta<sup>1</sup> and Stephen Secules<sup>2</sup>

<sup>1</sup> Purdue University, US

<sup>2</sup> Florida International University, US

Corresponding author: Stephanie Masta (szywicki@purdue.edu)

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**Background:** Critical ethnography studies power relationships in research settings through in-depth and sustained involvement in research contexts. It is a newly emerging methodological approach in engineering education and should be further explored and understood.

**Purpose:** The purpose of this article is to present how critical ethnography has been used in research in engineering classrooms and to discuss what methodological insights we can gain from reviewing this research.

**Scope/Method:** The purpose of the scoping review is to map key concepts and types of evidence related to the use of critical ethnography in engineering education research from 2005–2020. We assessed articles on their (1) ethnographic methodological design, (2) topics of empirical study, and (3) critical orientation.

**Conclusions:** We found that authors defined ethnography broadly and that a majority of articles centered on student experience and learning in engineering. We also found that out of 35 articles included in the analysis, one study expressly used critical ethnography and 21 other studies employed some form of critical approach or construct. Our review has implications for researchers to expand the use of critical ethnography to understand complex engineering classroom arrangements and interactions.

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**Keywords:** critical ethnography; systematic review

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## Introduction

Engineering instructional contexts have fundamental challenges with equity and inclusion. Faculty who are predominately straight, White, male, and trained in technical rather than social or educational sciences, are tasked with instructing an increasingly diverse student body. Despite ongoing calls for increased diversity in engineering (American Society for Engineering Education, 2014), underrepresentation of Black, Indigenous, and Latinx students persists (National Science Board, 2014). Determining why this underrepresentation continues is a focal point of qualitative and broadening participation engineering education research. Whereas quantitative education research tends to clarify challenges within institutions, qualitative education research offers insight into the interactions and structures that need to change. Original studies of curriculum and pedagogy in engineering were not typically grounded in social science methodology (Shuman et al., 2002; Streveler & Smith, 2006) and therefore did not grapple with complex interaction and cultural dimensions of classrooms related to diversity, culture, and power dynamics. To study these particular components of classroom spaces, researchers have turned to qualitative methodologies from social science disciplines such as ethnography. Ethnography emphasizes prolonged engagement in local settings, utilizing intensive and interactive methods to understand participants' lived experiences in a particular culture. Thus relative to other qualitative methods that center interview or document analysis alone, ethnography has potential to provide rich insight into the interactions and culture that create engineering educational experiences. Despite this potential, ethnography remains an emerging methodological approach in engineering education (Case & Light, 2011), and is worthy of further exploration and understanding.

As a specific subset of ethnography grounded in critical social theory, critical ethnography aims to expose power relationships in research settings through in-depth and sustained involvement in research contexts (Carspecken, 1996). (Throughout this paper we use the word *critical* to connote research approaches, topics, and perspectives that contend with

power relations in society, rather than the colloquial usage as in *critical thinking*.) Critical ethnography requires dedication both to the methods and social theory to illustrate wider power dynamics present in the everyday life of classrooms. As a research methodology, critical ethnography could provide important insight into the everyday mechanisms and practices that recreate inequity and marginalization in classroom environments. The usage of critical ethnography has been limited within engineering contexts. An effort to help identify the existing uses and knowledge base of insights from critical ethnography would help catalyze its utility in engineering education.

In this article we present the results of a scoping review on critical ethnography in engineering education. However, critical ethnography is still relatively new and only one study in the review identified its methodology specifically as a *critical ethnography*. Therefore, we also included papers with a broader definition of ethnography in engineering education in the review, while providing commentary on how the research approaches issues of power. We start with a brief discussion of ethnography and critical ethnography as research designs. Next, we outline the scoping review process used to determine which articles to include in the review. We then describe our findings, which focus on how ethnography and critical ethnography are used in engineering education. Lastly, we discuss the insights we gained from this research, and what opportunities exist for expanded use.

### **Ethnography**

Ethnography is rooted in anthropology and is the study of people, cultures, and values (Patton, 2015; Savin-Baden & Howell, 2013). Although there are many views about what counts as ethnography, broadly speaking, it requires extensive fieldwork to gain a comprehensive understanding of a particular context or setting (Savin-Baden & Howell, 2013; Wolcott, 2008). Key characteristics of ethnography included the focus on everyday environments, immersion of researcher in the field, period of prolonged engagement in the field, use of observations, and in-depth and unstructured data collection (Savin-Baden & Howell, 2013). Although it can be leveraged to examine other topics, a primary focus of both anthropology and ethnography is on understanding culture (McDermott & Varenne, 2006), but there are nevertheless a wide variety of definitions for this central construct. Ethnography has been noted as a promising but underutilized research paradigm in engineering education (Case & Light, 2011) because of its insight into interactional and cultural complexities. Central to ethnographic research is coming to a deep understanding of a person's day-to-day experience within a social environment. Ethnography favors long-term engagement with the phenomenon studied, producing rich, thick descriptions of the contexts under investigation, and is well-suited to understanding complexities of experience, interaction, perception, and culture. Ethnography combines multiple data streams with the embodied positionality of a participant ethnographer to form an overall picture of a social cultural context. Ethnography is not just observation but a way of making meaning and seeing a particular setting (Wolcott, 2008).

### **Critical Ethnography**

Critical research traditions differ from other forms of research because they acknowledge that truth claims are always situated and implicated in power relations (Kincheloe & McLaren, 2003). As such, critical ethnography developed as a methodological approach to address power relations in contexts (Marshall & Rossman, 2011). Similar to ethnographers, critical ethnographers tend to do "intensive empirical investigations of everyday, lived cultural reality" (Foley, 2002, p. 472); however, where an ethnographer would tend to treat the participant accounts and participant observation of that lived cultural reality as an accurate representation, critical ethnographers think about how power relations may impact the perspectives of each account. Beyond this distinction, critical ethnographers generally agree that (1) cultural groups produce a reality that is both inherited and continually reconstructed as it is lived or practiced, (2) well-trained, reflexive investigators can learn that historical, socially constructed reality through in-depth interactions with people who live in these constructions of reality, and (3) investigators who experienced the unfamiliar cultural setting and have discussed at length with people who occupy and practice in this cultural space can portray this space and its occupants in an accurate matter (Foley, 2002). Critical ethnography also tends to emphasize the double nature of social institutions (e.g., education), where institutions play a role in both advancing systemic inequality and producing citizens capable of changing said systems (Carspecken, 2005). Critical ethnography goes beneath surface appearances, challenges the status quo, and "unsettles both neutrality and taken-for-granted assumptions by bringing to light underlying and obscure operations of power and control" (Madison, 2012, p. 5).

### **Why Review Critical Ethnography in Engineering Education**

Critical ethnography "aims to link social phenomena to wider sociohistorical events to expose prevailing systems of domination, hidden assumptions, ideologies, and discourses" so that environments, such as engineering education can be redefined (Hardcastle et al., 2006, p. 151). However, ethnographers of engineering education have traditionally tended towards empirical observation of an educational setting, and have not taken a critical theoretical approach to examining

power and the recreation of inequities in that context. Contrarily, many scholars focused on inequity have not leveraged methods focused on understanding the everyday reconstruction of marginalizing culture. Critical ethnography can be a unique lens for insight on everyday educational culture and issues of equity, and it has been leveraged substantially in social science and education outside of engineering education. With this review, we recognize the potential of this relatively new methodology for engineering education, while clarifying and commenting on the range of associated approaches currently employed in the discipline.

### **Positionality and Paper Process**

Stephanie Masta is a member of the Sault Ste Marie Tribe of Chippewa Indians and a critical qualitative scholar. Her primary research focuses on marginalization and racialization in educational spaces, which includes using critical and Indigenous methodologies. Masta considers herself *engineering-adjacent*—she has expanded her area of study to include the marginalization and racialization that occurs in engineering spaces. Although she is still a relative outsider, Masta is strongly engaged in engineering education research. Masta conducted, organized, and synthesized the literature discussed in this paper. Stephen Secules is a White gay man, a former engineering professional, and current engineering education researcher who focuses on equity. Relating to topics of equity from primarily privileged, normative, and dominant identities and experiences, he finds power in critical ethnography to help decenter his own and others' senses of normative culture in engineering. Secules was a critical peer and relative insider reference point for the review of engineering education literature and also created summary figures. Although his own research turns up inside this literature review as a highlighted example, this was unintentional and driven primarily by the review criteria and Masta's analysis and judgment.

### **Method**

Research on a particular phenomenon should be situated in the context of previous studies published. However, the increased amount of published research makes it challenging to stay current. To address this need, different disciplines have developed approaches to reviews to synthesize previous studies (Borrego, Foster, & Froyd, 2014). Grant and Booth (2009) assessed fourteen types of reviews employed by scholars to determine their effectiveness is reviewing published literature. The two most common forms of reviews are systematic and scoping. The purpose of a systematic review is to uncover evidence of a particular practice or intervention, confirm current practices and identify new practices, identify and investigate conflicting results, and produce statements to guide decision making regarding particular practices (Munn et al., 2018). However, the purpose of the scoping review is to map “key concepts, types of evidence, and gaps in the research related to a defined area or field by systematically searching, selecting, and synthesizing existing knowledge” (Colquhoun et al., 2014, p. 1294). As such, scoping reviews generally focus on the breadth rather than depth of evidence (Prihodova, Guerin, & Kernohan, 2015). Scoping review studies aim to “map rapidly the key concepts underpinning a research area and the main sources and types of evidence available,” and are useful when “the area is complex or has not been reviewed before” (Mays, Roberts, & Popay, 2001, p. 194). A scoping review has been described as increasingly popular for synthesizing research evidence (Daudt, van Mossel, & Scott, 2013; Egan, Maguire, Christophers, & Rooney, 2017; Levac, Colquhoun & Brien, 2010).

To conduct the scoping review, Masta used Arksey and O'Malley's (2005) five-stage framework. The five stages are: (1) identify the research question, (2) identify relevant studies, (3) study selection, (4) chart the data, and (5) collate, summarize, and report the results. These stages are not linear—this is an iterative process that requires researchers to engage with each stage in a reflective way and to repeat steps if necessary (Arksey & O'Malley, 2005).

### **Stage 1: Identify the Research Question**

The starting point of any review is to identify the research question to be addressed, because the research question determines how one builds their search strategies. Given this, it is important to consider which aspects (CRD, 2001) of the research question are important, such as the population, methodological approach, or outcomes. There were two primary research questions: (1) how has critical ethnography been used in research in engineering classrooms? and (2) what insights can one gain from reviewing this research? We were aware that some researchers might not use *critical* to describe their ethnographic approach, even though their research involved topics that were critical in nature (i.e., involving power, social identity, oppression, etc.). We also had to determine what constituted an engineering classroom as, in general, a large number of critical ethnographies happen in informal learning or counterspaces that may be quite different from typical classroom settings. Defining these parameters and considering the implications of certain positions is important at the start of a scoping study (Arksey & O'Malley, 2005). We also parsed distinctions between studies that consider themselves *ethnography* or *ethnographic*, and considered how the fundamental aspects of ethnography are constituted within the work. In order to provide commentary on this emerging research approach we broadened the definition of each component of *critical ethnography* in *engineering education* to speak to a larger portion of the scholarly literature.

### Stage 2: Identify Relevant Studies

One of the primary goals of a scoping review is to be as comprehensive as possible in order to identify the studies which can answer the research questions. Masta led this effort and adopted a strategy that involved collating research evidence from three sources: search engines for online electronic databases, manually searching of key journals, and including/checking for papers that fit the selection criteria. Certain decisions, such as time span and language, must be made at the start of the review in order to make clear the search parameters. Masta included only those studies published between January 2005 and June 2020. These dates were chosen because this date range covered the emerging use of ethnography and critical ethnography in engineering education. Foreign language articles were also excluded because of the cost and time of translating the materials. Given these choices, some relevant articles might be missed (Arksey & O'Malley, 2005).

To identify relevant studies, Masta first met with both the education and engineering research librarians at Purdue University. During these meetings, Masta determined which databases to use and what would be the most appropriate search terms and phrases. After these meetings, Masta decided to search the following databases: *ERIC*, *Education Source*, and *Engineering Village* (Table 1). The search terms Masta used for each search included: ethnography, critical ethnography, engineering, and engineering education. There were variations in the number of references generated by each database. The entire database search yielded 106 unique references.

After searching databases, Masta manually searched key journals. Manually searching key journals is important in order to identify articles that she might have missed in the database search. This can occur because databases are incomplete, or abstracting services can vary (Arksey & O'Malley, 2005). Masta, in consultation with Secules, identified six journals that required manual searching: *Journal of Engineering Education*, *Engineering Studies*, *Journal of Women and Minorities in Science and Engineering*, *Cultural Studies in Science Education*, *Studies in Engineering Education*, and *Murmurations*. Masta, in consultation with Secules, also created a list of researchers who engaged in ethnographic and critical work to check against the publications yielded from the database and journal searches. Searching through identified journals yielded 71 unique references from the online database search.

### Stage 3: Study Selection

During Masta's initial review of the references, it was evident the search strategy picked up a large number of irrelevant studies. For instance, some results turned up from science education, mathematics education, or design of learning technologies primarily because of writing out the acronym STEM as Science, Technology, Engineering, and Mathematics. While many of these contexts have similarities and relevance to engineering education, Masta excluded them from the analysis for the simplest assessment of work in engineering education, while noting that significant work has been done in educational contexts outside of engineering specifically. This underscores the importance of iteratively defining terminology at the start of the scoping study. Scoping reviews generally include inclusion and exclusion criteria, similar to systematic reviews,

**Table 1:** Three periodical databases and our Boolean search terms used to identify potential articles in the initial step.

Subjects	Databases (Description)	Combination of Search Terms and Word Strings
Education	ERIC (EBSCO Interface—Bibliographic database sponsored by the US Department of Education, is the premier source for education-related research, documents, and journal articles. Link: <a href="http://guides.lib.purdue.edu/db/ericebsco">http://guides.lib.purdue.edu/db/ericebsco</a> )  Education Source (The most complete collection of full-text education journals, monographs, yearbooks and more, covering scholarly research and information to meet the needs of education students, professionals, and policy makers. It covers all levels of education—from early childhood to higher education—as well as all educational specialties, such as multilingual education, health education, and testing.) Link: <a href="http://guides.lib.purdue.edu/db/edsources">http://guides.lib.purdue.edu/db/edsources</a> )	Search 1: (ethnographic or ethnography or critical ethnography) AND engineering  Search 2: (ethnographic or ethnography or critical ethnography) AND engineering. Limiters: Date Published: 20050101-20200631; Education Level: Higher Education; Publication Type: Collected Works - Proceedings, Dissertations/Theses (All), Journal Articles; Language: English  Search 3: (ethnographic or ethnography or critical ethnography) AND engineering education. Limiters: Date Published: 20050101-20200631; Education Level: Higher Education; Publication Type: Collected Works - Proceedings, Dissertations/Theses (All), Journal Articles; Language: English
Engineering	Engineering Village (Compendex and INSPEC Combined—Engineering Village is the information discovery platform to search across both Compendex and INSPEC databases. This search platform includes engineering-related articles. Link: <a href="https://www.engineeringvillage.com/search/quick.url">https://www.engineeringvillage.com/search/quick.url</a> )	Search 1: ((((((ethnographic or ethnology or ethnography) WN KY) AND ((engineering) WN KY))) AND (((engineering education) WN CV) AND (((ja) OR {cp}) WN DT) AND ((english) WN LA))) AND ((2020 OR 2019 OR 2018 OR 2017 OR 2016 OR 2015 OR 2014 OR 2012 OR 2011 OR 2010 OR 2009 OR 2008 OR 2007 OR 2006) WN YR))

although this criteria was devised ad hoc, based on the familiarity with the literature (Arksey & O'Malley, 2005). Masta then applied this criteria to all the citations in order to determine which articles to include in the study. For this scoping review, Masta used inclusion criteria centered on study population, methodological approach, and use of critical constructs. For study population Masta included all studies focused on engineering. If papers mentioned ethnography in the abstract, keywords, or body of the paper they were included. Lastly, papers that mentioned critical constructs (e.g., critical theory, feminist methods) were also included. All articles that fit the review parameters were downloaded for further review. If it was unclear from the abstract if a study should be included, that paper was downloaded as well. After Masta determined which articles to read, she read the full article to determine if it should be included in the review. Abstracts are not always representative of, or capture the scope of, an article (Badger et al., 2000). Out of her original 177 references, Masta downloaded 77 for further review. Having read the full articles, Masta chose 35 articles for inclusion in the study (**Table 2**). Studies

**Table 2:** Included Studies.

Author(s)/Year	Location	Population	Critical Definition/ Application	Ethnography Definition/Application
Banerjee & Pawley (2013)	USA	Faculty	Feminist methods (critical construct)	Institutional ethnography—defined as developing knowledge systems that transcends day-to-day lives and delves deeper into the ordinary world
Beddoes (2012)	USA	Self-identified academic feminists	Feminist theory (critical construct)	Ethnographic interviews
Bernhard et al. (2019)	Denmark	Undergraduate students—design course	—	Video ethnography—students wore cameras during data collection
Bornasal et al. (2018)	USA	Practicing engineers	—	Ethnography—described methods as observations, interviews, artifacts
Buch (2016)	Denmark	Practicing engineers	—	Did not use the word ethnography but described being embedded in site, collected field notes, observations, interviews
Burt (2019)	USA	Graduate students in engineering research group	—	Ethnography—defined as aims to uncover the culture embedded in human activities
Campbell et al. (2019)	Canada	Undergraduate students—engineering teams	—	Ethnography—described methods as observations, interviews, immersion in field
Carroll (2014)	USA	Undergraduate student mentors in STEM afterschool program	—	Ethnographic journal reflections
Chorev & Anderson (2006)	Israel	Practicing engineers	—	Ethnographic life history interviews
Cicek et al. (2019)	Canada	Professor and research group team	—	Ethnographic action research—defined as a combination of ethnography and action research
Convertino (2018)	USA	Latinx undergraduate students in pre-engineering course	Borderwork and new mobilities paradigm (critical constructs)	Ethnography—defined as the immersion of researchers into everyday activities/experiences to see firsthand how people grapple with uncertainties
Convertino & Mein (2017)	USA	Undergraduate students in pre-engineering course	Sociocultural theory and cultural historical activity theory (critical constructs)	Ethnography—defined as the immersion of researchers into everyday activities/experiences to see firsthand how people grapple with uncertainties

(Contd.)

<b>Author(s)/Year</b>	<b>Location</b>	<b>Population</b>	<b>Critical Definition/ Application</b>	<b>Ethnography Definition/Application</b>
Crede & Borrego (2013)	USA	Graduate student engineering research groups	—	Ethnography—defined as a strategy of inquiry in which researchers study intact cultural groups over time
Danielsson et al. (2019)	Sweden	Working-class men in engineering	Masculinity and identity work (critical constructs)	Ethnography—methods described as observations, interviews, participant diaries
Eastman et al. (2017)	USA	Four freshmen in engineering	Critical race theory and critical pedagogy	Ethnography—methods described as observations, interviews, artifacts
Foor et al. (2007)	USA	Multi-racial woman undergraduate engineer	Critical cultural theory	Ethnography “of the particular”—described as a single student narrative from larger ethnographic study
Foor & Walden (2009)	USA	Undergraduate students in engineering	Borderlands and post-structural feminist approach (critical constructs)	Ethnographic interviews
Gilbert (2009)	Switzerland	Engineering departments	Gendered differences (critical constructs)	Ethnography—defined as a method of analysis of local contexts in varying institutional contexts to gain firsthand information about a community
Hou & McDowell (2014)	England	Chinese and British undergraduate engineering students	International student experiences (critical construct)	Longitudinal ethnographic study—methods described as interviews, observations, document analysis
Khandekar (2013)	USA	Indian graduate students in USA	Colonialism and neoliberalism (critical constructs)	Multi-sited ethnographic study—methods described as interviews and observations
Malish & Ilavarasan (2016)	India	Indian students in engineering program	Scheduled caste differences (critical construct)	Ethnographic accounts—described methods as interviews, observations, documents
Martin et al. (2008)	USA	Undergraduate students in engineering	—	Ethnographic interviews
Martin & Garza (2020)	USA	Black woman graduate student and white professor	Critical race theory (critical construct)	Collaborative autoethnography—defined as connecting the personal to cultural constructs
McLoughlin (2009)	USA	Undergraduate women in engineering	Feminist standpoint theory (critical construct)	Ethnography—described methods as interviews and participant observations
Mein & Esquinca (2014)	USA	Transfonterzio students	Bilingualism and bilingual literacy (critical construct)	Ethnographic approaches—defined as the immersion of researchers into everyday activities/experiences to see firsthand how people grapple with uncertainties
Mein et al. (2020)	USA	Latinx students in engineering	Discourse analysis on identities (critical construct)	Ethnographic in orientation—defined as the immersion of researchers into everyday activities/experiences to see firsthand how people grapple with uncertainties
Ramey & Uttal (2017)	USA	Undergraduate students at summer engineering camp	—	Cognitive ethnography—defined as interaction between participants’ internal cognitive processes and other people in the environment

(Contd.)

Author(s)/Year	Location	Population	Critical Definition/ Application	Ethnography Definition/Application
Smith & Lucena (2016)	USA	Low-income and first-generation students in engineering	Social identity (critical construct)	Ethnography—described methods as observations, interviews
Tonso (2006a)	USA	Undergraduate engineering students	Cultural production theory (critical construct)	Ethnography—described methods as observations, interviews
Tonso (2006b)	USA	Undergraduate student engineers	—	Ethnography—described method as extensive participant observation
Vickers (2007)	USA	Undergraduate engineering students	—	Ethnography—described method as participant observations
Walden & Foor (2008)	USA	Undergraduate student engineers	—	Ethnographic interviews
Wilson-Lopez et al. (2016)	USA	Latinx adolescents in engineering design process	Social identity (critical construct)	Ethnography—described methods as interviews, observations

included for review used ethnography as a primary data collection method, focused on engineering, and/or referenced critical approaches or theories. It is important to note that the inclusion of articles is not an exhaustive process and reflects the author's interpretations. For example, Masta excluded articles that were methodologically designed as case studies, but had included ethnography as a keyword or descriptor in the text.

#### **Stage 4: Organize the Data**

The next stage of the framework is to organize the data. First Masta assigned each article a unique identifier (Daudt et al., 2013). By assigning each article its own number, it made it easier to discuss the articles included in the review. Next Masta took a uniform approach to assessing each article (Pawson, 2002). This approach provided for a broader view that included recording useful or relevant information beyond the specific parameters of the inclusion/exclusion criteria. Using Excel, Masta also recorded the following information about each article: (1) author, (2) year of publication, (3) study context, (4) definition and application of the word critical, and (5) definition and application of ethnography. This information formed the basis of the analysis. Masta sought a uniform approach to the 35 studies we included in the review, although it is often impossible to include everything because some articles failed to include the relevant material.

#### **Stage 5: Collate, Summarize, and Report the Results**

In creating a framework for collating and summarizing the results, the scoping study forced Masta to prioritize certain aspects of the literature, which emerged as the most salient way of organizing the review. We chose three dimensions for analysis: how researchers defined and used the word critical, how researchers defined ethnography or ethnographic methods, and what topics the researchers focused their studies on (Daudt et al., 2013). This step reflects Levac et al.'s (2010) recommendation to add qualitative data analytical techniques to the analysis process. The analysis included multiple challenges such as insufficient descriptions, range of definitions used by authors, and incommensurate approaches to research (Arksey & O'Malley, 2005).

#### **Limitations and Affordances of Scoping Reviews**

Scoping studies present a review of all articles reviewed, and there is no attempt made to weigh certain articles against each other. Other strengths include the ability to study broad questions, to provide background information before conducting a systematic review, and to include a wide range of publications. However, scoping studies do not seek "to assess the quality of evidence and consequently cannot determine whether particular studies provide robust findings" (Arksey & O'Malley, 2005, p. 27), a weakness of the method. In addition, the review cannot parse between a variety of root causes for the patterns found, including author knowledge, author preference, review process, word count, and so on.

#### **Findings**

The scoping review on the use of critical ethnography in engineering education yielded 35 articles from eight countries. Of these, 26 studies came from the United States, two from Canada, two from Denmark, one from Israel, one from Sweden, one from Switzerland, one from Great Britain, and one from India. In this section, we discuss the dimensions identified

**Table 3:** Overall Assessment of Articles by Theme.

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Ethnographic methodological design (n = 35)
Ethnography as a study of culture (n = 9)
Ethnography as not defined (n = 11)
Ethnography adjacent (n = 7)
Additional types of ethnography (n = 8)
Topics of empirical investigation (n = 35)
Student experiences (n = 12)
Student learning (n = 11)
Engineering culture (n = 6)
Other (e.g. faculty, practicing engineers) (n = 5)
Critical Orientation (n = 22)
Critical ethnography (n = 1)
Critical theories/approaches (n = 5)
Critical constructs (n = 16)

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after analyzing the articles: (1) ethnographic methodological design, (2) topics of empirical study, and (3) critical orientation. To present our findings we include paraphrased quotes from each article and note the authors of each paper. **Table 3** represents the overall assessment of articles. Although Masta identified that 22 articles involved a critical component, she included the remaining articles in the analysis to demonstrate how ethnography and ethnographic methods are used in engineering education research. The inclusion of all 35 articles in the analysis also illustrates that how one views and understands ethnography is not always neat and clear-cut. The following discussion primarily represents Masta's interpretations of the articles based on her positionality and experience as a critical qualitative scholar.

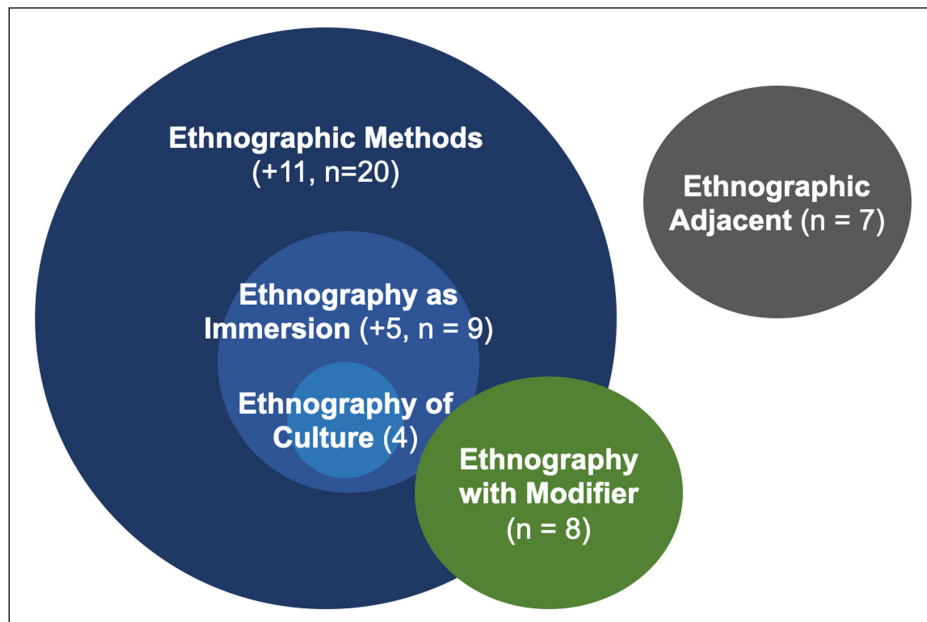
### ***Dimension 1: Ethnographic Methodological Design***

We focused part of the review on how researchers described ethnography, because it was evident that researchers had varying definitions and applications of this methodological design (see **Figure 1**). Out of the 35 total studies, nine studies conducted an ethnography and defined their understanding of the methodology in some explicit way. Of the nine studies, five (Bornasal, Brown, Perova-Mello, & Beddoes, 2018; Burt, 2019; Crede & Borrego, 2013; Gilbert, 2009; Secules et al., 2018) used definitions that involved studying a type of culture. Each paper included detailed descriptions on how their field work contributed to their understanding of the culture within their research. For example, Bornasal et al. (2018) posited that intensive fieldwork and participant observation gave researchers opportunity to discern the culture of a group. Burt (2019) pointed out that extended time in the field promoted greater rapport with participants allowing for more authentic insights into the phenomenon. Related, extensive engagement was also important to better understand the cultural norms of engineering groups as well as the language they used to describe their engineering experiences (Crede & Borrego, 2013). Also important to fieldwork was the ability to gather information first-hand and to discuss participants' decisions in the moment (Gilbert, 2009). Fieldwork also provided the opportunity for researchers to see how culture constructs and constrains, even in small class interactions (Secules et al., 2018). This first group represents some of the clearest examples of the methodology of ethnography as focused on culture and can provide valuable reference points for the field.

Four studies (Convertino, 2018; Convertino & Mein, 2017; Mein & Esquinca, 2014; Mein, Esquinca, Monarrez, & Saldaña, 2020) defined ethnography as a type of immersion into everyday experiences but did not explicitly connect everyday experiences to a particular culture. All four studies described immersion as an opportunity to understand how participants make meaning of their lived experiences by witnessing first-hand how individuals handle uncertainty, how meanings emerged from group interaction, and how one's interpretations and perspectives changed over time. In this group of studies, a general approach of ethnographic immersion provided researchers the opportunity to observe and describe everything taking place in their respective contexts.

An additional 11 studies (Buch, 2016; Campbell, Roth, & Jornet, 2019; Danielsson, Gonsalves, Silver, & Berge, 2019; Eastman, Christman, Zion, & Yerrick, 2017; Khandekar, 2013; McLoughlin, 2009; Smith & Lucena, 2016; Tonso, 2006a; Tonso, 2006b; Vickers, 2007; Wilson-Lopez, Mejia, Hasbún, & Kasun, 2016) referenced what ethnographies involved, but did not explicitly define or operationalize ethnography philosophically, or as a methodology. The primary methods used in these studies included participant observations, semi-structured interviews, focus groups, and document analysis.





**Figure 1:** Infographic of Dimension 1 – Ethnographic Methodological Design (relative size and position convey number and relationship of papers in category).

The use of participant observation featured heavily in these articles and researchers defined and used it in multiple ways. For example, Campbell et al. (2019) defined participant observations as intensive and naturalistic, while Eastman et al. (2017) indicated their participant observation occurred through videos of lectures and group project work. Buch (2016) stated that observations described real-time participant actions and relationships. Despite the difference in description of participant observation, all 11 studies that conducted participant observations included details about the locations, length of observations, and subject of observations. In addition to participant observations, each of the 11 studies conducted participant interviews, although these often received less description than participant observations. Researchers labelled interviews as semi-structured, formal, informal, or a combination thereof. This group of articles could be characterized by naming a focus on a particular ethnographic method or methods, but did not make clear how they conceptualized ethnography as a guiding methodology.

Eight articles referred to a specific form of ethnography including institutional (Banerjee & Pawley, 2013), video (Bernhard, Carstensen, Davidsen, & Ryberg, 2019), action research (Cicek, Ingram, Friesen, & Ruth, 2019), ethnography of the particular (Foor, Walden, & Trytten, 2007), longitudinal (Hou & McDowell, 2014), collaborative autoethnography (Martin & Garza, 2020), cognitive (Ramey & Uttal), and critical ethnographic historicizing (Secules, 2019). In each of these articles, the authors defined the particular form of ethnography employed. Institutional ethnography involved researchers studying worlds they know to reveal ideas generally taken for granted, and allowed researchers to transcend the day-to-day experiences of individuals and offer deeper insight into the ordinary world (Banerjee & Pawley, 2013). Ethnographic action research combined both ethnography and action research, and functions on both a macro and micro level by providing a broad understanding of a context and targeted understanding of individual's experiences (Cicek et al., 2019). One article made the distinction that their field work was longitudinal, although the length of time (15 months) was roughly similar to other studies included in this review (Hou & McDowell, 2014). Foor et al. (2007) described their study as an ethnography "of the particular," which meant they singularly focused on one participant in a larger ethnography study. In addition to the ethnographies, one study included was a collaborative autoethnography. Martin and Garza (2020) defined collaborative autoethnography as both a process and product and focuses on the experiences of both authors. In a critical ethnographic historicizing approach, the researcher investigated the present-day culture in relationship to the historical context to provide enhanced meaning of particular phenomena (Secules, 2019). Lastly, one study used video ethnography (Bernhard et al., 2019), while another used cognitive ethnography (Ramey & Uttal, 2017), although neither paper offered a description as to how their approaches were ethnographic. The modifiers this group of articles used to describe their particular types of ethnographies suggest ways that ethnography can be malleable or modifiable in its enactment by particular researchers, although adding the word *ethnography* to an approach does not make it inherently ethnographic.

The remaining studies reflected what Masta labelled as *ethnographic adjacent*. In these studies, the authors added *ethnographic* to different research methods but provided no explanation for how that particular method was ethnographic. Five studies (Beddoes, 2012; Chorev & Anderson, 2006; Foor & Walden, 2009; Martin, Hands, Lancaster, Trytten, & Murphy, 2008; Walden & Foor, 2008) used the term *ethnographic interviews*, but there was no explanation as to what made these

interviews ethnographic. One study (Carroll, 2014) referred to *ethnographic journal reflections* but did not provide details as to what made the journal reflections ethnographic. Lastly, one study (Malish & Ilavarasan, 2015) stated they used *ethnographic accounts* in their data collection, which seemed mostly closely aligned with *ethnographic interviews*. Several of these articles in this group mentioned presenting results from larger, qualitative studies, which might explain why the researchers added ethnographic as a descriptor for a specific method. Nevertheless, this group of studies could benefit from a stronger operationalization of ethnography and ethnographic methods.

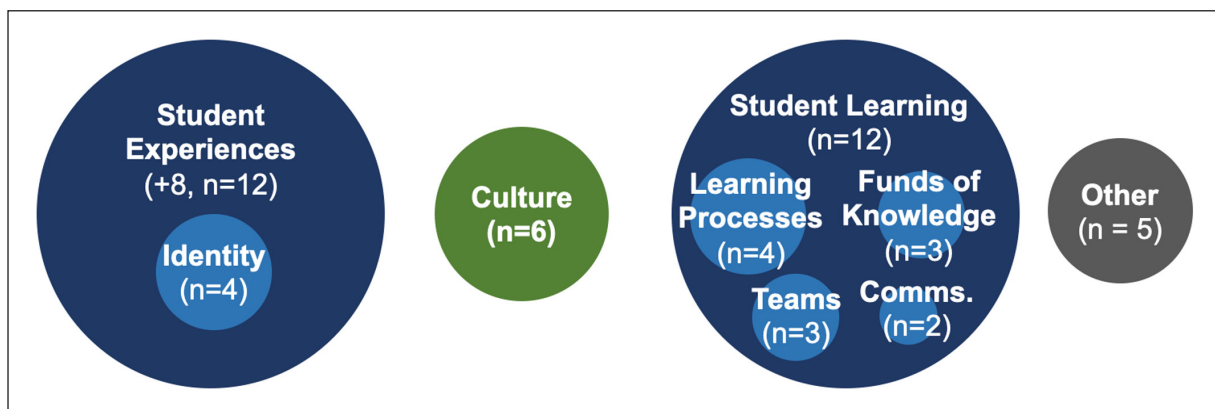
### Dimension 2: Topics of Empirical Investigation

One of the primary purposes of ethnographic research is to do an in-depth examination of a particular culture. Ethnography provides researchers with the opportunity to study the daily practices and contexts of people within a particular culture. In this review, the topic of empirical investigation (see **Figure 2**) of most articles fell into one of two categories: student experiences and student learning. The remaining articles were connected to engineering but did not focus specifically on students.

Of the 35 articles reviewed, 12 articles involved research on various forms of student experiences (e.g., with identity, with learning, with marginalization). For example, a study on the experiences of Swedish working-class men in an engineering program added to identity negotiation research, which often centers on women (Danielsson et al., 2019). Another study centered on the experiences of a Black woman in engineering education (Martin & Garza, 2020). Foor et al. (2007) used the experiences of a single student to examine the broader influence of engineering identity on individual diversity. McLoughlin (2009) discussed the importance of recruiting and supporting women from non-strong STEM backgrounds in undergraduate engineering programs, stating that their experiences as engineers were comparable to those with strong backgrounds. Tonso (2006a) highlighted how the identity production of student engineers is a complex process. Student experiences also extended to international students. One study focused on the experiences of Chinese and British students in an articulation engineering program (Hou & McDowell, 2014), while the other article described the experiences of Indian engineering students who attend education abroad in the U.S. (Khandekar, 2013). As student experience is both salient to many aspects of learning and broadening participation, and is best understood through multiple data sources and prolonged engagement, ethnography is well-suited to this group's topic of study.

Other key components of student's experiences highlighted research groups and role models (Burt, 2019), mentoring (Carroll, 2014), access to engineering majors (Eastman, et al., 2017), and family recruitment into engineering (Mein et al., 2020). Burt (2019) studied how research groups and role models at the graduate level play a role in students' identifying with faculty careers and can contribute to their decisions to pursue a career as a professor. A design-based after-school program provided undergraduate students with the opportunity to learn how to mentor students, create STEM experiences, and communicate their own STEM professional development (Carroll, 2014). In retention and recruitment efforts, barriers beyond financial support and diverse cohort participation contributed to underrepresented students not pursuing engineering degrees (Eastman et al., 2017). Some underrepresented students are recruited into engineering through family influences, early childhood experiences with engineering activities, and teacher support (Mein et al., 2020). Topically, this group of studies extends beyond the bounds of the traditional classroom, highlighting the ethnography's flexibility to cast its gaze in naturalistic settings and its capacity to conceptualize the complex interweaving of multiple contexts.

Six articles focused on the culture of engineering on campus. Tonso (2006b) indicated that campus culture influenced social interactions in engineering teams via engineering identity on campus. For example, Foor and Walden (2009) found



**Figure 2:** Infographic of Dimension 2 – Topics of Empirical Investigation (relative size and position convey number and relationship of papers in category).

that the culture of industrial engineering did not follow the traditional gendered norms of other engineering departments, which made it more inviting to men and women, although required different identity projects from each. Walden and Foor (2008) also found creating a department culture that welcomed immigrants, promoted a clear image of the discipline's identity, and had committed and dynamic individuals could lead to sex parity in the department. Similarly, Gilbert (2009) argued that disciplinary cultures in material science and mechanical engineering are both gendered and have a gendering effect of their own. Malish and Ilavarasan (2016) used the concept of institutional habitus, which is the influence of one's cultural group on their behavior as mediated through an institution, to explain how institutions impact marginalized students. Taking a different approach to culture than the previous studies, Secules (2019) contextualized engineering educational culture broadly as both masculine and competitive. Secules et al. (2018) also studied how the everyday aspects of classroom culture can send messages that students are not cut out for engineering. As culture is central to ethnography, this is another appropriate and valuable usage of the methodology.

Student learning was also a major emphasis in 12 of the articles we reviewed. Several studies used ethnography to understand how students learned and/or applied particular ideas, but without an emphasis on identity or culture. Ramey and Uttal (2017) focused on a specific cognitive domain of spatial reasoning. Another study focused more broadly on the process of learning, like understanding how faculty create student learning experiences that highlight the role of engineering concepts to solve engineering problems (Bornasal et al., 2018). Research focused on student perceptions of classroom learning argued that creating micro communities of practice leads to deeper engagement with course material (Cicek et al., 2019). Another study found that students often enjoyed challenging classes but did not enjoy classes where meeting challenges was beyond the scope of their ability (Martin et al., 2008). Generally articles in this group centered primarily on learning processes and cognition, rather than critical topics associated with equity and power.

Similarly, a group of studies focused on student learning in engineering teams and design, but not on topics of identity or culture. Findings included how design-based teams allowed students to use a range of epistemic tools to jointly understand and imagine solutions to their projects (Bernhard et al., 2019). Collaborative design also allowed teams to make decisions through social and situated work in a series of processes (Campbell et al., 2019). Convertino and Mein (2017) detailed that bridgework is a major factor in teams. When collaboration is used in teams and includes no reflection on how established roles and norms function, it inhibits the use of diversity to solve problems. However, when students in teams engaged in bridgework and addressed contradictions that stem from diversity, they are positioned to transform established roles and norms to focus on deeper collaboration. This category was focused mostly on the functional and epistemic aspects of teamwork, rather than equity or cultural aspects.

A category of funds of knowledge emphasized the ethnographic methodological roots of the funds of knowledge framework that initially involved K-12 teachers and researchers collaboratively investigating the knowledge and practice resources of the homes and communities of students in the southwestern United States (Moll et al., 2009). One example found that low-income first-generation engineering students used their funds of knowledge in engineering problem solving in ways that made visible the social justice dimensions of engineering (Smith & Lucena, 2016). Similar results were found with Latinx adolescents' familial, community, and recreational funds of knowledge map to engineering practices (Wilson-Lopez et al., 2016). Although not directly linked to funds of knowledge in student learning, Convertino (2018) studied how students drew from authorized border crossing activities to understand mobility in both robotic design and in the context of transnational higher education. The ethnographic approaches of this group of studies are particularly consistent with their theoretical foundations, where ethnographic embedded observations and interviews provide clear affordances for investigating the resources of students' homes and communities. Communication efforts in the classroom also reflected a component of student learning that was a topic of focus. Two studies focused on communication efforts in the classroom involving second language learners. For some second language learners, membership into engineering teams occurs after the second language learner was socialized to use the language patterns of other members on the team (Vickers, 2007). In other cases, it was important for students to use their bilingualism to understand and learn engineering concepts in teamwork (Mein & Esquinca, 2014).

Other research topics stretched further beyond the traditional classroom and students, and focused on faculty, scholars, professionals, and graduate student researchers. For example, the promotion and tenure process is best described using the metaphor of the foggy climate, which presents the lack of clear information faculty receive about the process (Banerjee & Pawley, 2013). Closely related to the purpose of this review, scholars who engage in feminist scholarship in engineering education encountered barriers, challenges, and tensions to its use in the academy (Beddoes, 2012). Thinking through engineering teams at the professional level, engineers who took a holistic approach to engineering do best in environments designed to support holistic development (Buch, 2016), whereas engineers who are also entrepreneurs experienced different barriers based on their social and historical position (Chorev & Anderson, 2006). There was also demonstration of using ethnography to design and implement a quantitative survey on engineering graduate student retention because ethnography gave rich detail on language and culture (Crede & Borrego, 2013). While this group of articles was somewhat adjacent to our specific definitions of education in the classroom, they represent a wider variety of available topical foci for critical ethnographic research.

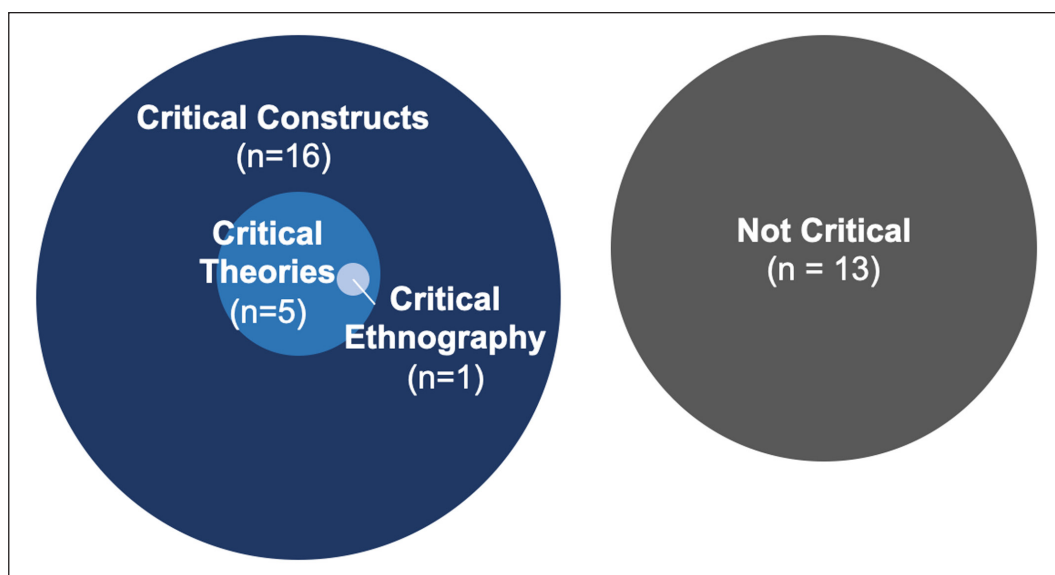
### Dimension 3: Critical Orientation

The overarching purpose of this review was to understand how critical ethnography was used in engineering education. Given the newness of ethnography in engineering education, we reasoned there would not be a large number of articles expressly using critical ethnography. Therefore, Masta reviewed each article for any acknowledgement of the role of power dynamics in the context of education within the research setting. Overall, one article used critical ethnography explicitly, while five articles referenced critical approaches or theories within the research, and 16 articles used other critical constructs in their research (see **Figure 3**). The remaining 13 articles did not include any mention or discussion of any critical orientation.

Surprisingly for this review, Secules (2019) was the only author who used *critical* to describe his ethnographic approach. In this study, he situated present-day ethnographic observations of engineering culture and critically considered how the historical context extends the observations. However, other authors did reference some form of critical approach in reference to their research, even if they did not apply it directly to ethnography. For example, Martin and Garza (2020) stated that the purpose of their autoethnographic study was to use critical race theory to make meaning of Garza's experiences. Eastman et al. (2017) also used critical race theory and critical pedagogy to study student experiences at a technical university. Secules et al. (2018) described his approach in this study as a *careful, critical, qualitative analysis*, while Foor and Walden (2009) stated they used a *critical examination of multiple discourses*. Foor et al. (2007) used critical cultural theory in the analysis. Although not explicitly tied to methodology, these articles used a critical lens in their work. Naming critical in these instances is important because even if the authors did not describe their methodology as critical, the research itself still reflected the goals of critical research.

In terms of critical constructs, the most frequently employed were feminist approaches. Banerjee and Pawley (2013) used institutional ethnography, which draws on feminist methods to better explore women's experiences from different perspectives. In another study, Beddoes (2012) outlined the barriers and challenges self-described feminists encountered when engaged in feminist initiatives in engineering education. McLoughlin (2009) also used feminist methods in her study, which detailed the importance of recruiting women into engineering who do not necessarily have strong STEM backgrounds in high school because they tended to be just as successful and happy as women who do. Three other studies focused on the different forms of gendering that occurred in disciplinary cultures such as mechanical engineering and material sciences (Gilbert, 2009) and industrial engineering (Foor & Walden, 2009; Walden & Foor, 2008). All three studies found that gender parity in programs is possible when programs shift disciplinary culture to be more equitable.

Studies centered on social identity were also critical in nature. As mentioned above, Martin and Garza (2020) used critical race theory and counter-storytelling to make meaning of the experiences of a Black woman in engineering education. Four articles focused on the experiences of Latinx and Mexican students. Of the four, two studies addressed different challenges experienced by *transfronterizx*, students who must cross the U.S.-Mexican border daily to attend college (Convertino, 2018; Mein & Esquinca, 2014). The other two studies focused on the role of families, teachers, and communities in creating pathways for Mexican students in engineering (Mein et al., 2020) and in creating funds of knowledge for Latinx students



**Figure 3:** Infographic of Dimension 3 – Critical Orientation (relative size and position convey number and relationship of papers in category).

to use in engineering (Wilson-Lopez et al., 2016). Both Smith and Lucena (2016) and Danielsson et al. (2019) focused the experiences of low-income, first-generation students in engineering and how those students leveraged their backgrounds and funds of knowledge to support their development as engineer, which is understudied in engineering education. Lastly, several studies explored different experiences of international students. Malish and Ilavarasan (2016) studied how the caste system influences Indian students' experiences, while Hou and McDowell (2014) explored how cultural differences between British and Chinese students influenced their experiences in an engineering articulation program. This group of studies highlights possibilities for a critical analysis of social identities within ethnographic research.

The remaining five articles used critical theories in their research, although did not tie this to their methodology. Convertino and Mein (2017) used sociocultural theory to study diversity and collaboration in an undergraduate pre-engineering course. Khandekar (2013) drew from the theories of neoliberalism and colonialism to understand the experiences of Indian engineers abroad. Eastman et al. (2017) used critical race theory and critical pedagogy to understand the obstacles students faced in pursuing STEM majors despite financial and diversity support. Foor et al. (2007) used critical cultural theory to argue that engineering identity has a raced, classed, and gendered history that reflects White, male, privileged perspectives. Lastly, Tonso (2006a) relied on cultural production theory in her ethnography on engineering identity on campus as a figured world. This group of studies illustrates that even if one does name their methodological approach, the research reflects a critical orientation.

## Discussion

After conducting the scoping review, we identified several questions about the role of ethnography and critical ethnography in engineering education research. Our discussion considers the following synthesizing questions: What does ethnography mean in the current literature and what more can ethnography as a methodology offer? What are the reasons that researchers do or not do critical ethnography (or critical research in general)? How does the field of engineering education encourage or limit critical ethnographic research?

### ***What Does It Mean to Do Ethnography and What Can it Offer?***

The scoping review demonstrated that many scholars use ethnography or ethnographic to describe their research, but that the scope of ethnography was somewhat limited. Rarely was it used to study culture outside of narrow parameters (e.g., engineering classrooms, disciplines), or separate from individual student experiences. This is not to say that culture was not a factor, but it often was secondary to understanding experiences at an individual level. Studying culture broadly is a central purpose of ethnography that engineering education could take up when conducting educational research. Ethnography is also uniquely useful for providing insight about culture due to its embedded researcher positionality, its multiple data streams, and its associated cultural theories and frameworks. The articles in the scoping review often used ethnography to describe what Masta identified as prolonged engagement with data collection, over the course of a few months to a year. However, ethnographic studies in other fields often lasts multiple years. It is thus possible that engineering educational researchers use *ethnographic* rather than *ethnography* as a way of describing an approach while hedging on whether all of the formal criteria of ethnography are adhered to. One such reason for this could be the difference between how researchers employ *methodology* and *method*. While both concepts reflect distinct parts of qualitative research design, they are sometimes used interchangeably. Although many of the studies looked like ethnographies many of them lacked the focus on culture and the prolonged engagement in the field.

Ethnography focuses on the lived experiences and meaning making individuals share within a particular culture. Ethnographic data collection is heavily centered on participant observation and uses interviews to follow up, confirm, or clarify what the researcher observed. Researchers may also collect documents or artifacts to learn about the culture of the site. Adding components of triangulation with embedded observation helps an ethnographer think about issues of power in representing truth, partial perspectives on reality, and the unspoken dimensions of experience more than relying on most researchers' most common single method—the qualitative interview. Even when the studies we considered used multiple forms of data, a bulk of their findings were based on interview data and did not include observations or artifacts. However, while interviews are a component of ethnographic research, many of the interviews described in the studies served primarily as generic qualitative interviews. Researchers should expand their use of observation since formalized interviews are just not at the heart of ethnography.

### ***To Engage or Not to Engage in Critical Ethnographic Research***

Although we anticipated a low number of critical ethnographic studies given the newness of ethnography in engineering education, it was surprising to have only one study identified by Masta and explicitly defined by the authors as a critical ethnography. There may be multiple reasons that researchers do not use, or highlight their use of, critical ethnography (or critical theories generally) in engineering education. To start, there is the possibility of critical being confusing as a communication term to other engineering education scholars and practitioners, for whom *critical* may mean *criticizing* rather

than contending with power relations and inequity. Another possibility is that authors might be unfamiliar with different critical theoretical traditions and afraid of using them incorrectly. Describing different contexts for research can be safer than ascribing specific attributes of the methodology.

It is also possible that critical approaches, including critical ethnography, lack momentum in engineering education research. For example, engineering education journal and grant reviewers may be unfamiliar with critical research, requiring authors to go into great detail to explain their methodological choices. Researchers might be concerned that conducting critical research make them controversial or political so they use terminology such as *social justice* or *diversity* or *liberatory* to label their research. Critical research might be overly new in engineering education, so there are few examples other scholars can use to model and build from.

### ***The Role of Critical Ethnography in Engineering Education***

Throughout the review process, it was evident that some research questions and research designs explored in engineering education are fundamentally not critical. For example, spatial reasoning as an explanation for gender inequity is grounded on similar logic to IQ as an explanation for racial inequity. A critical lens on the construction of spatial reasoning tests would call to mind that history and seek to deconstruct, upend, or reimagine the very notion of spatial reasoning and gender in a classroom. A truly critical ethnography of spatial reasoning would not use the multiple data sources of an ethnography to look for confirmatory evidence about individual differences.

Also, engineering identity as a construct can dilute issues of equity and marginalization into a single dimension, whether or not you identify as an engineer, which may not be many students' most pressing concern (Berhane et al., 2020). Although prioritizing engineering identity undergirds a significant portion of engineering education research, it seems hegemonic to assume that an engineering identity should be all students' primary goal. A critical ethnography of engineering identity would start from the student experience looking outward to question the goals and motives of the institutional system, examining them for oppressive contours. It would not use the multiple data streams of ethnography to investigate what contributed to an identity valued by the system, but perhaps not the student.

Lastly, ethnography historically studied the *other*, but a crucial advance in critical ethnography has been an ability to cast a critical gaze at mainstream society and institutions of power. Although several studies in the scoping review focused on underrepresented populations, most of the studies described student learning or experience within the classroom in ways that were neutral, not implicating oppression or power. The overall lack of diversity in engineering education research and practice may contribute to the sense that these classroom events are truly neutral, as privilege can tend to mask one's view of identity, privilege, and marginalization. Without the voices of a substantial population of underrepresented individuals, many engineering education researchers seem to be unaware of the need to do critical research in predominately White spaces. Studying power and how power contributes to oppression should not be the focal point only for underrepresented researchers and underrepresented student populations.

### **Implications for Researchers**

Critical ethnography requires dedication both to the methods and social theory to illustrate the wider power dynamics present in the everyday life of classrooms. There is engineering education research focused on differences of race, class, gender, sexual orientation, and culture (see Cech & Waidzunus, 2011; McGee et al., 2016; Pawley, 2009); however, far fewer studies address the overlapping power relationships that exist in their particular contexts. Given that engineering classrooms are unique cultures where students interact through the lenses of their various social identities, this scoping review identifying critical ethnographic studies has provided a foundation for understanding the use of critical ethnography in classroom settings. The scoping review has implications for researchers hoping to understand the gaps in existing knowledge about engineering classrooms.

Oftentimes the methodological choices made by researchers reflect their perspectives on knowledge and reality. Researchers who focus on proof and confirmation are more drawn to quantitative approaches. Others might focus on studies involving multiple truths. For researchers interested in using critical ethnography, we have several suggestions. First, we encourage researchers to align their study with the core principals of critical ethnographic research prior to data collection. Core principals include extensive participant-observation and analyses of power relationships within the study site. Second, doing critical research involves familiarity with critical theories and perspectives. Engineering educational researchers without a critical background might consider collaborating with other educational scholars who examine education settings with critical lenses. Third, use critical ethnography to study macro cultures, such as institutions or professional organizations, rather than focus on individual student experiences. Critical ethnography has the power to expose issues of oppression and marginalization at all levels in educational contexts and should be utilized across all levels. Fourth, researchers should use critical lenses when studying cultures often viewed as neutral, such as engineering classrooms or engineering curriculum. Lastly, we encourage engineering educational researchers to challenge institutional and field constraints (e.g., publishing, grant funding) that may discourage scholars from conducting critical ethnographic work.

Critical ethnography can serve as an important lens for insight into everyday educational culture and issues of equity. Although critical ethnography has been leveraged substantially in social science and education, our scoping review revealed its lack of use in engineering education. This may be due to a variety of personal and systemic constraint. Nevertheless, we encourage engineering educators to expand use of this new methodology to help catalyze change toward a more just educational system.

### Competing Interests

The authors have no competing interests to declare.

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