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CONTENTS

Posters

Co-Designing Assessment Dashboards with Teachers for Educational Games: A Case of Persistence
Yoon Jeon Kim, Mariah A. Knowles and Grace Lin

When Data Interleaves and Intersects: Threaded Epistemic Network Analysis
Jaeyoon Choi, Zhiqiang Cai, Cody Marquart, A.R. Ruis and David Williamson Shaffer

Does Online Services Improve Social Security Disability Insurance Application Experience?: Analyzing Online Forum Data with Epistemic Network Analysis
Jaeyoon Choi, Brendan Eagan, Nancy Wong, Lydia Ashton and David Williamson Shaffer

Using Tweets to Understand Physicians' Experiences of Discrimination in the Workplace
Sarah Jung

Using Epistemic Network Analysis to Make Meaningful Connections Between First-Year Medical School Courses
Penny S. Edwards

How Does Physician Payment Reform Affect Health Care Quality?
Xiaodan Liang

Epistemic Network Analysis of Reddit Comments Relating to COVID-19 Vaccine News on the r/Coronavirus Subreddit
Jonathan Hansen, Moiz Zaki, Anita Benna and Clara Porter

Marx and ENA? Analyzing Alienation with Epistemic Network Analysis
Karl Vachuska, Stephen Rodriguez-Elliott and Haley Fuhr

Change the Museum: Initial Analysis of Social Media Posts Reflecting on Museum Workplace Experiences
Danielle P. Espino and Bryan C. Keene

Top Tier Talk: How Leaders Conceptualize STEM Diversity Programs in Higher Education
Amanda Barany, Monique Woodard, Mark Petrovich, Yiyun Fan and Aroutis Foster

Doctoral Consortium

Quantitative Ethnography of Cooking to Inform the Design of Smart FMCG Technologies
Gustavo Berumen

Exploring Schooling and Networking on Social Media in COVID-19 Using Twitter Data
Yiyun Fan

ReshapeT1D: Utilizing the Strengths of Quantitative Ethnography in Patient and Clinician Led Research to Understand Type 1 Diabetes Lived Experiences in Alberta
Jamie J. Boisvenue

Supporting Creativity in Black Girls as They Learn to Code Virtual Environments in an After-School Program
Monique Woodard

Analysis of Learning Trajectories in Programming Activities Focused on Data Visualization
Cassia Fernandez

Model Eliciting Activities to Learn Computational Thinking
Beatriz Galarza

Early Career Workshop

Stories of Intellectual Health
Meixi

Using Epistemic Network Analysis to Examine Teachers' Epistemic Practices during Dialogic Argumentation Instruction in Grade 8 Physics Lesson
Getachew Tarekegn

Symposia

Participatory Quantitative Ethnography
Simon Buckingham Shum, Golnaz Arastoopour Irgens, Hollie Moots, Michael Phillips, Mamta Shah, Hazel Vega and Abigail Wooldridge

Special Session

Workshops

Keynotes

Quantitative Ethnography within Learning Analytics: Past, Present, and Future
Vitomir Kovanović

How We Mean, and What that Means for Interpretation in Ethnography
Adam Lefstein

Posters

Perpetuating the Cycle: The Difficulty of Talking about Equity in Mathematics Education

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Abstract. This piece examines equity discourse of mathematics instructors in the United States. Using a Critical Race Theory (CRT) framework, this paper highlights the uncertainty of how math instructors respond to equity concerns in their classrooms. Fourteen mathematics instructors responded to interview questions and scenarios about classroom practices where inequities present issues. Quantitative Ethnography (QE) and Epistemic Network Analysis (ENA) was used to analyze the data. Results displayed strong connections between uncertainty and diversions regarding equity issues. This finding provides evidence of how racism and other forms of inequity continue to manifest in this society due to potential difficulty of having conversations about equity.

Keywords: Diversity, Inclusion, Equity, Racism, Mathematics Education.

1 Equity in Mathematics Education and Critical Race Theory

Concerns of diversity, equity, and inclusion (DEI) have been present in United States (U.S.) for decades; however, societal influence has taught us to refrain from conversing about race, racism, genderism, sexism, ableism, and homophobia [8]. Such suppression has sustained ruthless and unforgiving inequities for marginalized groups [7]. This phenomena also manifests in mathematics education [4] and is problematic because mathematics is a traditionally challenging subject that is a critical gatekeeper for many pursuits in education and thus, demands focal attention towards DEI practices. In mathematics education and beyond, conversations concerning race and racism have been among the most difficult to talk through. A derivative of critical legal studies, Critical Race Theory (CRT) explores how race and racism preserves power and privilege for White people in the U.S. [2, 3]. While conventional civil rights dialogue emphasizes gradual progression and incrementalism, CRT interrogates the foundational structures and constructions of liberal order by delving into root intentions [2, 3]. Using CRT, Sparks and Pole [6] found that most science and math teachers in their study were not prepared to discuss stereotypes, racism, and diversity in their classrooms. Similarly, Crockett & Buckley [1] posit that professional development opportunities centered on equity often occur without meaningful unpacking. In this study, we used a CRT lens and QE to ask the research question of how do U.S. university level mathematics

instructors respond to hypothetical scenarios regarding equity strategies in their classrooms?

2 Methods

For this study, we used semi-structured interview data collected in fall 2020 using Zoom voice transcriptions from 14 mathematics instructors (8 people of color, 10 white; 9 women, 5 men) from various universities in the U.S. Participants were presented scenarios of inequity in the classroom and asked how they would respond. We used Epistemic Network Analysis (ENA) [5] and generated Codes related to how participants responded to questions and scenarios. Validation of Codes will be conducted in future studies.

Table 1. Codebook.

Code	Definition	Example
Avoidances	Participants avoided answers to questions altogether by skipping or apologizing.	"Can I skip this one?"
Discomfort	Participants explicitly expressed discomfort in how they would respond to scenarios requiring an equitable intervention.	"A white guy teaching a class mostly minority students…that was uncomfortable for me."
Uncertainty	Participants used words like: um, don't know, unsure, uncertain, not concern, skeptical, maybe, I think, I guess, and apprehensive.	"I guess it depends on the situation. I like to gather more information to see to see why…"
Poverty	Participants provided responses that associated or categorized inclusion and equity with students from low socioeconomic backgrounds.	"You know, the university is here. So I know the population, you know, I was low income…"
Diversions	Participants diverted the conversation to something not pertaining to the question at hand.	"I'm really good. I'm the current national champion of. I'm not going to answer that question chicken. Sorry, that was silly."
Equity Practices	Participants expressed words of justice, unbiases, fairness, and equity.	"…I'm trying to balance the, like, you know, social justice stuff and the traditional content."
Empathy	Participants showed care, understanding, and concern for students dealing with inequitable situations.	"Also, it's very important to use examples and activities that are inclusive that we're very careful about the context of problems..."

3 Results

The ENA model displayed the strongest connectivity between Uncertainty and Diversions than any other codes. For example, one scenario was: *While teaching your*

class online, you ask students to post questions in the chat feature on Zoom, and the entire class is accidentally sent a chat from a student that says, "I'm surprised Shawna [a black student] can speak so eloquently, where is she even from?" How do you proceed with the class? This scenario featured an example of microaggressions towards a Black student. One teacher, Felicia, responded with apprehension, "Yeah, that's making me nervous already." She continued with hesitation, "I don't know if it would be appropriate to… this probably isn't the best answer." Felicia was uncertain about how she would address the racist chat comment: "I almost don't want to acknowledge the student, you know, this step, but on the other hand, I kind of do. So I guess if I did acknowledge, perhaps I would…yeah, and I'm not quite sure. Surely this is something I'd have to think a little bit more about if that's okay?" Ultimately, she avoids the question and revisits it at the end of her interview. **Figure 1** displays a visual depiction that Uncertainty and Diversions are key Codes in the discourse of the mathematics instructors when discussing equity practices.

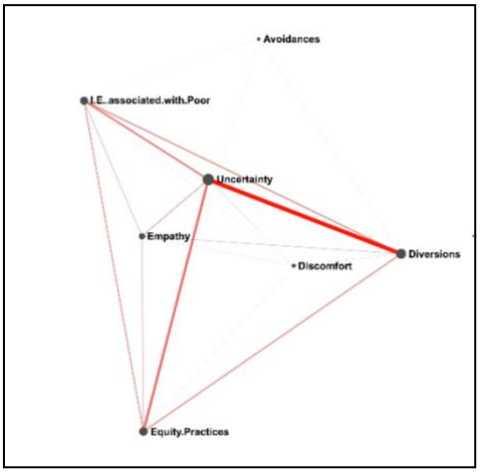

Fig. 1. ENA Model of Average Weighted Network for Discourse of All Teachers.

4 Conclusion

Using QE and ENA through a CRT lens, the results in this study show a strong connection between uncertainty, diversions, and equity practices when mathematics teachers were responding to hypothetical inequitable classroom scenarios. Future work will explore what types of specific equity practices and scenarios are related to uncertainty and discomfort, expanding ENA results to compare individual teachers more extensively. Nevertheless, these preliminary findings highlight how challenging it is to change an educational system fundamentally shaped by racial inequities. However, one step forward would be providing training and interventions for college math educators to increase their confidence when addressing equity concerns and implementing equity practices in their courses. Moreover, math equity researchers can explore ways in which scaffolding can support meaningful unpacking of equity issues.

To address the uncertainty and diversions in discourse about equity practices in college math classrooms, institutional leaders, instructors, and staff will need to become comfortable conversing about such uncomfortable topics themselves.

References

1. Crockett, M., & Buckley, L.:The role of coflection in equity-centered mathematics professional development practices. *Equity & Excellence in Education*, *42*(2), 169–182 (2009).. https://doi.org/10.1080/10665680902724545
2. Delgado, R.: *Critical race theory: The cutting edge.* Philadelphia, PA: Temple University Press. (1995).
3. Delgado, R., & Stefancic, J.: *Critical race theory: An introduction* (3rd ed.). New York University Press. (2017).
4. Reinholz, D.L. & Shah, N.: Equity analytics: A methodological approach for quantifying participation patterns in mathematics classroom discourse. *Journal for Research in Mathematics Education*, *49*(2), 140–177 (2018). https://doi.org/10.5951/jresematheduc.49.2.0140
5. Shaffer, D.W: Quantitative Ethnography. Cathcart Press, Madison, WI (2017).
6. Sparks, D. M., & Pole, K.: "Do we teach subjects or students?" Analyzing science and mathematics teacher conversations about issues of equity in the classroom. *School Science and Mathematics*, *119*(7), 405–416 (2019). https://doi.org/10.1111/ssm.12361
7. Thomas, M., Michaels, E., Darling-Hammond, S., Nguyen, T., Glymour, M., & Vittinghoff, E.: Whites' county-level racial bias, COVID-19 rates, and racial inequities in the United States. *International Journal of Environmental Research and Public Health*, *17*(22), 8695– (2020). https://doi.org/10.3390/ijerph17228695
8. Ticknor, A. S., Overstreet, M., & Howard, C.M.: Disruptive teaching: Centering equity and diversity in literacy pedagogical practices. *Reading Horizons*, *59*(1), 1A–23 (2020).

Is This the Right (or Left) Approach to the COVID-19 Pandemic?

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Abstract. This paper explores two politically partisan media organizations, the Gravel Institute and Prager University, that present themselves as alternative online educational sources. I examine these organizations' discourses about the COVID-19 pandemic on social media through the echo chambers concept. My findings suggest that PragerU focused on questioning experts and evaluating risks while the Gravel Institute emphasized economic and corporate issues. Both organizations discussed the government's failures, though they framed their critiques differently. I discuss the significance for social media echo chambers research.

Keywords: Echo Chambers, Political Polarization, Social Media, Pandemic.

1 Introduction

During the COVID-19 pandemic, partisan organizations on social media shared information to manipulate facts in an 'infodemic' that sowed division and encouraged extremist beliefs [1, 3, 5, 10]. One of these organizations, Prager University (PragerU), aims to bypass traditional classrooms and educate people on issues, like the pandemic, through a conservative lens [11]. The Gravel Institute mirrors PragerU's approach from a liberal perspective, capitalizing on the heuristics-driven information sharing approach from the conservative platform [10]. This paper explores the pandemic discourses of these partisan 'educational' media organizations to understand how they present information to their audiences and how it may contribute to polarization during this global crisis.

2 Theory: Echo Chambers

Echo chambers, groups that reinforce shared beliefs and attitudes, are commonly associated with social media and are nested within group polarization theory [2] and selective exposure theory [1]. These homophilic groups can be sources of political polarization that entrench followers in more extreme viewpoints over time, and much research on this phenomenon focuses on how echo chambers encourage binary thinking on contentious issues [1, 2]. Some scholars claim that echo chambers are overstated and claim high-choice environments mediate the effect [4]. However, platforms like Twitter

are shown to encourage homophilic grouping that fits the echo chambers definition [2]. As such, this concept is a helpful lens for exploring contentious pandemic discourse.

3 Method

For this project, I used tweets and YouTube videos from both organizations. Using SocialStudio [9], I gathered 456 tweets about COVID-19 published between 2/1/2020 and 2/28/21. I also collected and transcribed 16 pandemic-themed YouTube videos, including informational content and interviews with experts and laypeople. In the sample, 456 lines were tweets and 431 lines were from videos, giving the platforms roughly equal representation.

I used an open coding process to develop my initial codes grounded in the data. After refining these, I grouped them into seven codes validated with *nCoder* (see: Table 1). After automatedly coding my data, I applied Epistemic Network Analysis [8] using the *ENA1.7.0 Web Tool* [7]. I aggregated networks with a moving stanza window, applying a binary summation in which the networks for a given line (a tweet or transcript paragraph) reflect the presence or absence of co-occurrences.

Table 2. Codebook.

Code	Definition	Example	$\varkappa$ for H1, H2, AC
Economic Concerns	Worries about the economic impact.	*The effects of the #coronavirus shutdown are particularly heartbreaking for small businesses facing financial ruin.*	.97*, .97*, .97*
Media	Distrusts the media and challenges their narrative(s).	*The media cares about narrative more than the truth, exhibit # 58,462*	.91*, .94*, .94*
Government Failings	Critiques the government's response.	*When the politicians say you need to stay home, it is the emperor's new clothes.*	.94*, .91*, .97**
Questioning Experts	Questions (scientific) experts.	*Over 50000 Americans, according to the CDC, died of the flu. Why was there no panic over that?*	.91*, .91*, .91*
Corporate Issues	Examines issues with corporations.	*The real looting in America is the Walton family becoming $53 billion richer during a pandemic.*	.91*, .97**, .97**
Risk/Reward	Evaluates pandemic risks.	*The Horrifying Sadness of destructive hysteria over a pandemic that 99.999% of college-aged Americans survive.*	1.0**, .99**, .99**
Pandemic Victims	Discusses pandemic victims.	*COVID-19 isolation is causing massive mental health problems for Americans.*	.90*, .90*, .91*

*rho ≤.05, **rho < .01

4 Discussion and Conclusion

4.1 Qualitative Findings

These organizations discussed the pandemic along partisan lines, promoting content that reinforces their ideological positions in line with the echo chambers concept. PragerU (conservative) evaluated the purported risks related to COVID-19, questioning experts and the government. For instance, Dennis Prager shared that society portrays scientists as "*the clergy of science*" who claim to be "*unbiased,*" but he believed they "*lie on behalf of goodness*" to "*justify evil*." He believed scientists use their perception as "unbiased" to manipulate significant decisions in the name of "goodness." In this view, the "clergy of science" role enables scientists to take a powerful position with the American public to "justify evil" like lockdowns.

In comparison, the Gravel Institute (liberal) focused on the intersection of economic, classist, and governmental issues, embodied by their tweet: "*People are struggling. Congress doesn't get it […] they used COVID to bail out big corporations and give billionaires a tax break.*" From their perspective, "billionaire" elites and "Congress" served their self-interests while "struggling" Americans were ignored and exploited.

While these organizations framed the pandemic differently, they both blamed the government for being ineffective. PragerU viewed these failings as government overreach, sharing, "*the bigger the government, the less free you are*." Pandemic policies, such as mask mandates, made the government "bigger" and interfered with citizens' daily lives, making them "less free" through literal restrictions on their lives. The Gravel Institute also criticized the government's decisions but felt that the pandemic "*is a national crisis that requires immediate and massive action by Congress.*" While the government failed citizens, they failed because they were not involved *enough,* and "massive action by Congress" was needed.

4.2 Quantitative Findings

The ENA network inspired these qualitative findings. The Gravel Institute (blue) shared economic concerns and their issues with corporations, evidenced by the far-left placement of the nodes and the thick lines connected to government failings. In contrast, PragerU (red) discussed risks and questioned experts. Both emphasized government failings, as evidenced by the code's central position in the network.

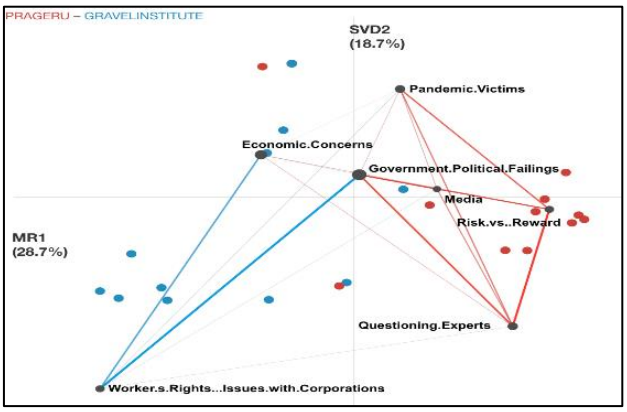

Fig. 2. ENA comparison plot for the Gravel Institute (blue) and PragerU (red).

Statistical tests reflect these findings: Along the X-axis, a two-sample t-test assuming unequal variance showed PragerU (mean=-0.84, SD=0.79, N=12) was statistically significantly different at the α=0.05 level from the Gravel Institute (mean=0.77, SD=0.63, N=13; t(21.08)=5.59, p=0, Cohen's d=2.26).

5 Discussion and Conclusion

Both organizations emphasized different discourses about the COVID-19 pandemic, indicating that social media can serve as an echo chamber that reinforces beliefs and encourages polarization, a clear issue when combating a global pandemic. The content shared in these echo chambers offers room for speculation about potential effects on viewers. For example, PragerU tends to question scientists. I can postulate that followers may think and act in ways that defy expert advice, such as mask mandates, creating divisiveness with compliant citizens. Despite echo chamber characteristics, both organizations focused on the government's failings, demonstrating that even polarized groups can share core beliefs. Thus, this work adds complexity to echo chambers and reflects the need to go beyond binary examinations of this phenomenon. This work is limited in scope to social media, and claims made here cannot be generalized to the actual effects on the organization's followers. Furthermore, social media data is limited in depth and quality. Future research interviewing key figures and followers may elucidate deeper meaning and should explore how partisan echo chambers can share common ground or exist in liminal spaces.

References

1. Barbera, P.: Social media, echo chambers, and political polarization. In: Persily, N., Tucker, J. (eds.) Social media and democracy: The state of the field, pp. 1–20. Cambridge University Press, Cambridge (2020).

2. Cinelli, M., Morales, G., Galeazzi, A., Quattrociocchi, W. Starnini, M.: The echo chamber effect on social media. PNAS, 118(9), 9216-9221. (2021).
3. Cinelli, M., Quattrociocchi, W., Galeazzi, A., Valensise, C., Brugnoli, E., Schmidt, A. … Scala, A.: The COVID-19 social media infodemic. Scientific Reports, 10. (2020).
4. Dubois, E., Blank, G.: The echo chamber is overstated: The moderating effect of political interest and diverse media. Information, Communication, & Society, 5(21), 729-745. (2018).
5. Hart, P., Chinn, S., Soroka, S.: Politicization and polarization in COVID-19 news coverage. Science Communication, 42(5), 679-697. (2020).
6. Jackson, G.: Make PragerU, but good. Vice. (2020).
7. Marquart, C., Hinojosa, C., Swiecki, Z., Eagan, B., Shaffer, D.: Epistemic Network Analysis (Version 1.7.0) [Software], http://app.epistemicnetwork.org. (2018).
8. Shaffer, D., Collier, W., Ruis, A.: A tutorial on epistemic network analysis: Analyzing the structure of connections in cognitive, social, and interaction data. Journal of Learning Analytics, 3(3), 9–45. (2016).
9. Salesforce: Social Studio – Radian6 [Software], https://socialstudio.radian6.com/. (2021).
10. Stroud, N.: Polarization and partisan selective exposure. Journal of Communication, 60(3), 556-578. (2010).
11. Tebaldi, C.: Speaking post-truth to power. Review of Education, Pedagogy, and Cultural Studies, 1-21. (2020).

Whose Report? The Biases of Nigerian #EndSARS Protest Media Coverage

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Abstract. Media coverage plays a critical role in the way people perceive and respond to protests. This study uses quantitative ethnography (QE) to investigate how foreign and domestic media organizations covered the Nigerian EndSARS protest. Results indicated that while domestic media coverage focused on human rights abuses and confrontations during the protest, foreign reports emphasized the role feminists, queer groups, and social media played during the protest. These findings support how the media frames public interpretation of protest events.

Keywords: EndSARS, Media, Coverage, Protest, Framing.

1 Social Movements and Media Framing Theory

Mainstream media play a critical role in the sustainability of protests and how protests are perceived by the public [2]. Media outlets use multiple narrative conventions and interpretive structures, known as *frames*, to develop persuasive stories that emphasize certain aspects of a social movement at the expense of others [1, 4]. Media organizations often adopt four key frames when covering protests: (a) debate frame that focuses on protesters' views and agitations, (b) spectacle frame that highlights the drama, celebration, and queer characteristics of protesters, (c) confrontation frame that emphasizes conflicts between protesters and the police, and (d) riot frame that portrays protesters as dissidents and emphasizes the conflict between protesters and the society [4]. Studies [6, 2, 3] have shown that social factors such as the location of protests and media organizations, tactics adopted by protesters, and protest issues also influence how the media frame a protest. The current study uses media framing theory as a theoretical lens to understand how media organizations framed their stories when covering the EndSARS protest. This study asks, *how did local and foreign media organizations connect multiple frames when reporting the EndSARS protest?*

2 Methods

This study used quantitative ethnography (QE) [8] and Epistemic Network Analysis (ENA) [7] to understand and establish connections among the frames adopted by local and foreign media organizations when reporting the EndSARS protest. Reports sampled in this study consisted of 10 online articles published on the EndSARS protest. Articles

were selected through Google search, using the key word #EndSARS. The criteria for inclusion were that the article must (a) have been published by mainstream news sources between October-December 2020 and (b) not be less than 800 words. In all, ten reports by four foreign media organizations (BBC, CNN, The Washington Post, and Al Jazeera) and two domestic ones (Premium Times, Foundation for Investigative Journalism) met these criteria. Each report was segmented into sentences (lines) and each sentence was coded for aspects of media framing theory adapted to fit with the content in the articles (Table 1). The codes will be validated in future studies.

Table 3. Codebook for Media Framing of EndSARS Report.

Primary Code	Secondary Code	Definition	Example
Spectacle Frame	Feminists & Queer	Reference to the experiences and impact of non-dominant populations-specifically feminists and LGBTQ- during the protest.	…the Feminist Coalition spoke up in solidarity with queer protesters…
	Social Networking	Statements highlighting the use of social media for awareness and networking.	#EndSARS: How Nigerians harness social media against police abuse
	Sense of Community	Accounts of celebration, bonding, and volunteering during the protest.	On the first day I was there, there were people making sure everyone got food.
Debate Frame	Youth Activism	Reports stating what triggered youths to start and take responsibility for the protest.	Even when you are not the one experiencing it, it still affects you…
	Call for Change	Statements highlighting the demands of protesters.	All we did was ask for change.
Confrontation Frame	Government Denial	Government agents' denial of protesters death and eyewitnesses accounts.	…the Nigerian Army denied that its personnel fired upon protesters.
	Human Right Abuse	The arrest and killing of protesters by government agents during the protest.	Three arrested, never to be seen again.
Others	Governance and Economy	Statements that refer to socio-economic condition of Nigeria and Nigerians.	Economic inequality has reached extreme levels in Nigeria.

3 Results

Results showed that foreign media outlets were more likely to adopt the spectacle and debate frames than domestic ones. The ENA visualization (Figure 1) of the groups' subtracted network showed that foreign media outlets made stronger connections to protesters' use of social media, their sense of community and the role of feminists and queer groups during the protest. This bias is evident in a headline by Al Jazeera stating "*#EndSARS: How Nigerians harness social media against police abuse*." The

Washington Post also had a headline that pointed out that "*#EndSARS is a huge moment in Nigerian queer history*." Conversely, domestic media outlets made stronger connections between the confrontation and debate frames, emphasizing how youth lost their lives during the protest and continued to be intimidated by the government. A headline by FIJ stated "Portraits of Blood (1): Death Threats, 'Murders', Indiscriminate Arrests…." Similarly, Premium Times tagged their report as "Investigation: *Bullets, Blood & Death*: Untold Story of what happened at Lekki Toll Gate", suggesting that they were more interested in unraveling the violence perpetrated against youths during the protest.

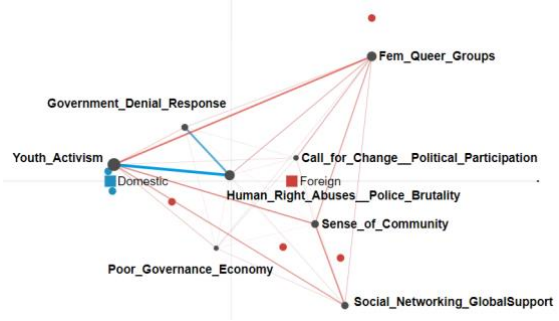

Fig. 1. ENA Subtracted Network for Foreign (Red) and Domestic (Blue) Media.

A closer examination of the foreign outlet, BBC, reveals an emphasis on the youthfulness and attributes of protesters by pointing out that "…the country's massive *young population is finding its voice and demanding reforms* in Africa's most populous country." When reporting the gains of the protest, BBC highlighted the role women and members of the LGBTQ played and suggested that some of them did not receive enough recognition from the public. The outlet noted that "The EndSars protest went as far as it did *because of the role women played*." BBC appeared to have adopted more of the spectacle and debate frames. The consistent description of protesters as "peaceful" also suggests that the outlet tended to use supportive devices in framing protesters. Visualizing BBC's report as an ENA network, aligns with this finding (Figure 1). The outlet's strongest connections were made between feminist and queer group (spectacle frame), youth activism (debate frame), call for change (debate frame), and government denial (confrontational frame). This is evident by the thicker lines between these nodes.

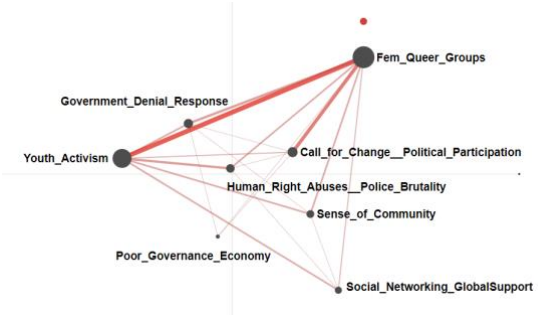

Fig. 2. BBC's ENA Network.

4 Discussion and Conclusion

This study investigated how foreign and domestic news media outlets made connections among multiple frames when reporting the Nigerian EndSARS protest. Overall, foreign media outlets emphasized the role of feminists and queer groups during the protest while domestic ones focused more on the human right abuses that occurred. This suggests that the popular culture of locations of media organization plays a crucial role in their framing of protests. Many of the foreign media outlets sampled in this study are headquartered in the UK and US where queer groups are celebrated. This is in sharp contrast to Nigeria where LGBTQ people face a jail term of up to 14 years and are criminalized under the criminal code act [5]. Moreover, many Nigerians remain opposed to queer rights [5], suggesting why domestic media outlets chose to ignore the LGBTQ community. This tendency of media outlets to promote the norms and popular culture of their own region while covering protests raises a troubling pattern for social movements as protesters' demands and activities are likely to be underreported if they do not fit into popular biases and culture. Additionally, the results showed that domestic media outlets made stronger connections among codes in the confrontation and debate frame. However, their stories were more critical of the Nigerian government and delegitimized the approach of states security agents, suggesting a push-back against studies that predicted that media organizations would likely delegitimize protests and protesters when using the confrontation frame [6]. All in all, this preliminary work used media framing theory to further understand the role of domestic and foreign media in shaping the perceptions of the public during social movements.

References

1. Ardèvol-Abreu, A.: Framing theory in communication research in Spain. Origins, development and current situation. *Revista Latina de Comunicación Social*, *70*, 423-450 (2015).
2. Boyle, M. P., McLeod, D. M., & Armstrong, C. L.: Adherence to the Protest Paradigm: The Influence of Protest Goals and Tactics on News Coverage in US and International Newspapers. *The International Journal of Press/Politics*, *17*(2), 127–144 (2012).
3. Harlow, S., Kilgo, D. K., Salaverría, R., & García-Perdomo, V.: Is the whole world watching? Building a typology of protest coverage on social media from around the world. *Journalism Studies*, *21*(11), 1590-1608 (2020).
4. Hertog, J. K., & McLeod, D. M.: A Multiperspectival Approach to Framing Analysis: A Field Guide. In S. Reese, O. Gandy, and A. Grant (Eds.), *Framing Public Life: Perspectives on Media and Our Understanding of the Social World*, (pp.139–161). Erlbaum. (2001).
5. Human Dignity Trust. Nigeria. https://www.humandignitytrust.org/country-profile/nigeria/. (2021).
6. Kilgo, D. K., & Harlow, S.: Protests, Media Coverage, and a Hierarchy of Social Struggle. *The International Journal of Press/Politics*, *24*(4), 508–530 (2019).
7. Marquart, C. L., Hinojosa, C., Swiecki, Z., Eagan, B., & Shaffer, D. W.: Epistemic Network Analysis (Version 1.7.0) [Software]. Available from app.epistemicnetwork.org. (2018).
8. Shaffer, D. W.: Quantitative ethnography. Cathcart Press, Madison (2017).

Using Quantitative Ethnography to Understand Betsy DeVos's Relationship with The Press

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Abstract. In this paper, I analyzed Betsy DeVos's relationship with the media. I obtained five interviews from liberal and conservative-leaning news media/organizations between 2017 and 2020. Drawing from Social Identity Theory (SIT), this study examined how DeVos, and her media interlocutors emphasized ideas and policies that elevated their political leanings. Using Quantitative Ethnography (QE), the study's findings suggested that DeVos and the interviewers show partisanship during policy discussions. Liberal and conservative social issues were top policy concerns, and they engendered the most debate and emotions during the interviews.

Keywords: Social Identity Theory, Media, Political Partisanship.

1 Political Partisanship and Social Identity Theory

Betsy Devos had a complicated relationship with mainstream media as the 11th United States Secretary of Education from 2017 to 2021. This relationship represents the polarization and partisanship that have been the default setting for America's polity and news media. Most popular media organizations are political mouthpieces for elected officials and owe their survival to political contributions [1, 2]. Generally, news media react favorably to their politician's opinion of choice and negatively to the opinion of those they oppose [3, 4]. Politicians include their ideologies in policy discussion with news media, bolstering their partisan identity [3]. This action is consistent with the "Party Loyalist" identity DeVos embodies. In this study, we used social identity theory (SIT) as a lens to examine how interviewers and DeVos handled their socio-political identity as they discussed policy issues. SIT informs our broad understanding of the complex social processes of interacting with others as individuals and as group members [5, 6]. In turn, it offers a valuable perspective to understand how political party members promote their ideologies. The research question explored in this study was *What socio-political identity did Betsy Devos and interviewers maintain as they engage in interview discussion on American policy issues?* This study presents the intersection between the media, identity, and politics.

2 Method

In this study, we used Quantitative Ethnography (QE) and Epistemic Network Analysis (ENA). We obtained five interview transcripts from CNN, Education Writers Association (EWA), CBS, CPAC, and The Associated Press because of the length and focus of the interviews. Interviews were segmented by the turn of talk and coded for commonly occurring themes related to political identity and social interactions (Table 1). This is an ongoing study; therefore, IRR will be obtained in subsequent work. When using ENA, data were segmented into stanzas, which were statements (questions and responses) from the interviewer and Devos. In the first round of coding, eight codes and five subcodes were generated. However, it became apparent after this round of coding that future code refinement was needed because the codes and subcodes did not produce the connections that can be used to make a reasonable explanation of the data. In the second round of coding, five codes were generated. In the third round of coding, we decided to create codes specific to the two main political parties in the United States and show how Betsy Devos and the interviewers align with these political parties' ideologies.

Table 4. Codebook.

Code	Definition	Example
Limited government responsibilities	The Federal Government allows State Governments to take more control of educational decisions, policies, and activities.	"We really believe that states are the best laboratories of democracy on many fronts and…,"
School Voucher	Parents have the opportunity and choice to choose schools for their children.	"When parents are choosing the school, they are proactively making that choice, empower and allow all families the same kind of opportunities I've had for my kids."
Social issues – conservative	Hardline on immigration, rejection of Critical Race Theory, support of cross-examination of sexual assault victims, rejection of Obama's disciplinary policy and support for Guns.	"President Trump rescinded the Obama guidelines on transgender, and [applause] and let's be very clear why he did that. President Obama acted lawlessly…."
Expansive government responsibilities	Federal Government talking the central role in education and enacting education policies	"Shouldn't FG be doing more on affirmative action programs in college admissions?"
Social issues – liberal	Issues that include affirmative action, more representation for LGBTQ, minority, and underserved students. Gun control and debt forgiveness.	"But the black kids are, you know — they call in the cops. I mean, that's the issue: Who and how the kids who disrupt are being punished."
Support for public schools	Issues related to public schools – standardized testing, more funding and representation for public schools	"Why do people say you are a public school denier?"

Casual/friendly tone of voice	Being supportive and agreeable during exchanges	“One thing I loved about you when you were President Trump's pick is the work you have done on behalf of children in poverty."
Confrontational tone of voice	Being argumentative, generating conflict and disagreement on issues being discussed.	"Because this sounds like talking- instead of acting."

3 Results

Four interviews were tagged as liberal-leaning: EWA, CBS, CNN, AP, and one as conservative-leaning: CPAC. The interviewers asked and often repeated questions, while DeVos either avoided the questions or used antithesis. Devos's vocabulary was simple; she repeated herself over and over. For example, during the interview with CNN on school reopening during the COVID-19 pandemic, she ended most of her statements by saying, "children need to go back to school," and the interviewer repeated, "can reopening be done safely?" This example indicated how both Devos and the interviewers rarely deviated from a script that reinforced their values by showing an ideological firm person to the public.

Perhaps not surprisingly, the tone of voice was confrontational with liberal-leaning news networks and friendly with the conservative news network. The liberal interviewers also interrupted DeVos several times while she spoke, prompting her to react in anger. For example, when talking about CDC guidelines for reopening schools with CNN, Dana Bash abruptly interrupted DeVos, "to have CDC guidelines on the one hand…." Devos sternly replied, "can I finish my statement?" During the CBS interview, Stahl accused DeVos of not being proactive with finding a solution to school shootings "because this sounds like talking- instead of acting." This tone of voice is a sharp contrast to what was used in the interviews by CPAC, a conservative-leaning organization.

The mean difference network between Devos and conservative news interviewer shows a cordial relationship between them. The interviewer was casual and friendly, mainly on conservative social issues, limited government responsibilities in education, school voucher, and choice. The mean difference between Devos and liberal news interviewers show that the interviewers were confrontational on almost all the talking points - Liberal & conservative social issues, limited and expanded government responsibilities in government, support for public schools, and school voucher.

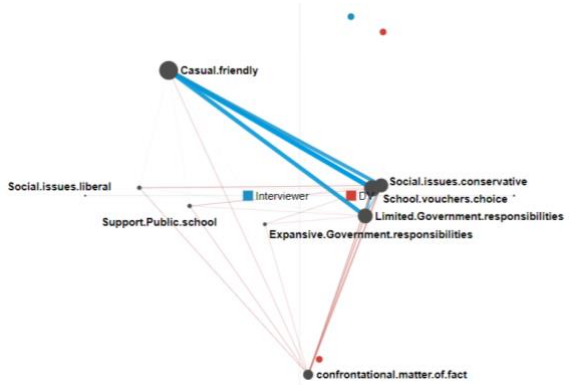

Fig.1. ENA difference graph for Devos (red) and conservative news interviewer (blue).

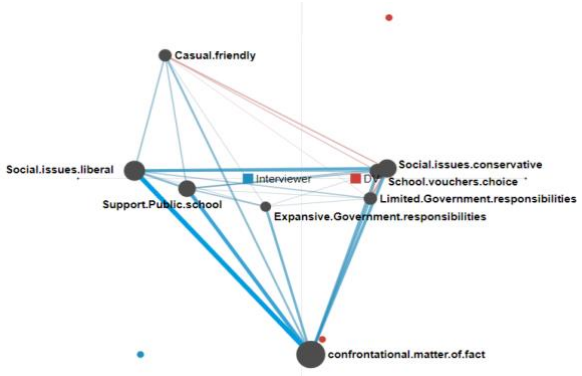

Fig. 2. ENA difference graph for Devos (red) and Liberal news interviewers (blue).

4 Conclusion

Generally, the interviewers and DeVos made stronger connections with policies that aligned with their political ideologies. When asking DeVos questions, interviewers made a strong connection with confrontational tone and liberal social issues. This suggests that both DeVos and her media interlocutors remained in character to maintain a positive social identity with their political party and affiliated news organizations. Politicians and media representatives main this identity to defend and elevate their party's political and networks' ideological position [7]. Opposing voices and dissent seem like a victory for democracy; however, these strident conflicts could fuel mistrust and physical tension among citizens [8]. Fierce political debate leaves the audience less trusting of political and media actors [7]. In this study, discussion on social issues generated much tension and led to confrontation and antagonism during the interview. SIT explains how individuals in a group are emboldened to pursue substantial conflict with other groups (out-group) [6]. Using SIT as a lens, this study shed light on how

politicians and the media strive to maintain positive socio-political identities in public displays. Further work could expand this lens to other politicians or media venues.

References

1. Dickinson Jr., W. B.: Politicians and the press. Editorial research reports 1964, vol. II, (1964). http://library.cqpress.com/cqresearcher/cqresrre1964090200
2. Matthes, J., Maurer, P. & Arendt, F.: Consequences of Politicians' Perceptions of the News Media, Journalism Studies, 20(3), 345-363 (2019).
3. Van Der Pas, D. J., Van Der Brug, W., & Vliegenthart, R.: Detroit Free Press. (2017) https://www.freep.com/story/opinion/columnists/stephen-henderson/2016/12/03/betsy-devos-education-donald-trump/94728574/
4. Shaffer, D. W.: Quantitative Ethnography. Cathcart, Madison WI (2017).
5. Soontjens, K., Van Remoortere, A., & Walgrave, S.: The hostile media: politicians' perceptions of coverage bias, West European Politics, 44(4), 991-1002 (2021).
6. Larson, D.: Social Identity Theory: Status and Identity in International Relations. *Oxford Research Encyclopedia of Politics.* (2017). https://oxfordre.com/politics/view/10.1093/acrefore/9780190228637.001.0001/acrefore-9780190228637-e-290.
7. McLeod, S.: "Social Identity Theory." Simply Psychology (2008).
8. Hogg, M. A., & Abrams, D.: Social identifications: A social psychology of intergroup relations and group processes. New York: Routledge (1988).
9. Huddy, L. & Bankert, A.: Political Partisanship as a Social Identity. Groups and Identities, Political Psychology. (2017).

Identifying Differences in Care Network Engagement Between Child and Spousal Caregivers

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Abstract. Epistemic network analysis was conducted on transcripts of interviews with informal dementia caregivers to model how caregivers utilize their care network. Results suggest that spousal caregivers place more value on identity affirming care, while child caregivers engage their support network for more functional tasks.

Keywords: Epistemic Network Analysis, Caregiving, Dementia.

1 Introduction

Informal caregivers such as family and friends provide the majority of care work to patients with Alzheimer's Disease and related dementias, spending 18 billion hours of work per year on care activities [1]. These informal caregivers must work with minimal support and training, commonly relying on a social network of people around them to assist in providing care. In order to design interventions that accurately address caregivers' needs, it's important to understand how different types of caregivers engage the resources within their own network.

2 Theory

To date, caregiving literature has focused predominantly on tasks performed to maintain the health of the care recipient, however the field is beginning to recognize that there are additional emotional and social components to caregiving that impact a caregiver's perception of workload. Bowers (1987) outlines five conceptual categories of caregiving which expand upon this task-based definition of caregiving work [2]. The greatest source of stress for caregivers in Bowers' study was protective caregiving, which involves protecting the care recipient's sense of self and maintaining their identity by shielding them from a full awareness of their disease or the level of care being provided. Though Bowers' work focuses on family caregivers such as spouses and adult children, there has been little research on the way that perceptions of work and use of support networks vary between the two roles. Here, we use Epistemic Network Analysis (ENA) to identify and measure how spousal and adult child caregivers make connections between their care network and the types of care they provide, to understand differences between those roles.

3 Methods

The data analyzed came from a cohort of 30 semi-structured interviews with informal dementia caregivers focused on their lived experience, which were recorded and transcribed into Word documents. We segmented the interview transcripts into sentences and applied codes derived from existing taxonomies of caregiver tasks, as well as codes developed from the data through grounded analysis, including prior identity and appreciation [4]. Codes were applied using an automated coder and had Cohen's $\kappa > 0.9$ and Shaffer's $\rho(0.9) < 0.05$. Activities of daily living were validated as subcodes of functional tasks (κ=0.95, ρ=0.01) and clinical tasks (κ=0.96, ρ=0.01) and combined into one code. Individual interviews were operationalized as a unit of analysis, with a moving stanza window of 4 lines and caregiver role (child versus spouse) as comparison groups. We also excluded lines spoken by the interviewer, in order to focus on the perspective of the caregivers.

Table 1. Codebook and inter-rater reliability statistics between rater 1 and automated coder.

Name	Definition	Example	Kappa	Rho
CARE NETWORK	Reference to another person in the primary caregiver's social network	*"My daughter agreed too that, you know, he needed more one-on-one with rehab."*	0.96	0.01
APPRECIATION	Expression of gratitude or appreciation for help	*"So they were very helpful"*	0.96	0.01
ACTIVITIES OF DAILY LIVING	Functional and Clinical Activities of Daily Living such as medication tasks, daily hygiene and ambulation	*"They came in, they all went in the bathroom with him and gave him a shower."*		
IDENTITY	Reference to care recipient's identity and preferences in the past or present	*"She was always a wonderful artist"*	0.94	0.04

4 Results

Table 2 demonstrates the difference in the way that caregivers make connections between their care network and the care work performed. The spousal caregiver expresses approval (APPRECIATION) of a volunteer (CARE NETWORK) because of his effort to engage her husband, the care recipient, on an aspect of his identity outside of being a patient (IDENTITY). In contrast, the child caregiver's discussion of the helper (CARE NETWORK) centers the functional and clinical tasks that need to be accomplished for the care recipient (ACTIVITIES OF DAILY LIVING).

Table 2. Qualitative Examples.

Role	Interview Excerpt	Code(s)
Spouse	"She connected us with a **volunteer** who comes once a week… And so they hang out together and kind of listen to recordings of **stuff my husband had recorded in the past** when he could still do that. And my husband…. In his mind, that's become his music student, so he loves it, **it's been a very good match."**	CARE NETWORK IDENTITY APPRECIATION
Child	"I **hired one person**. Come in first thing in the morning, help her **get her dressed**, you know, see that she can get dressed because sometimes she'll put things on backwards because she can't see the tags, and **make sure she takes her, you know, pills."**	CARE NETWORK ACTIVITIES OF DAILY LIVING

4.1 Quantitative Results

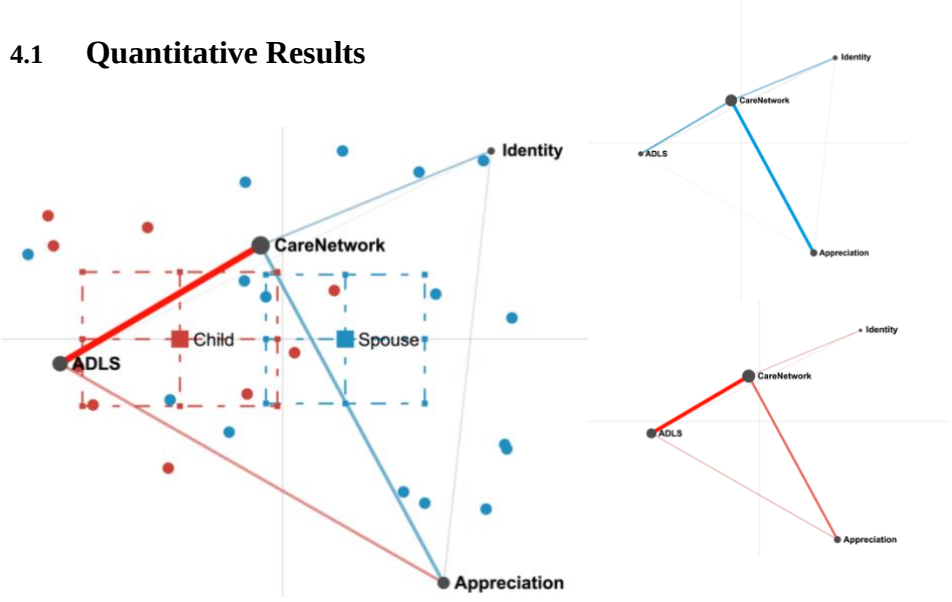

Figure 1. Left: ENA network of subtracted connections for spousal caregivers (blue) versus child caregivers (red). Right: ENA network for spousal caregivers (top) and child caregivers (bottom).

Along the X axis, a two sample t test assuming unequal variance showed child caregivers (mean=-0.69, SD=0.97, N=11 were statistically significantly different at the alpha=0.05 level from spousal caregivers (mean=0.42, SD=1.07, N=18; t(22.89)= -2.87, p=0.01, Cohen's d=1.07). Both groups made strong connections between CARE NETWORK and APPRECIATION, however spousal caregivers (blue) made more connections between CARE NETWORK and IDENTITY, as opposed to child caregivers (red) who made more connections between CARE NETWORK and ACTIVITIES OF DAILY LIVING tasks.

5 Discussion

Using ENA, we found that child caregivers more frequently connected references to their care network with information about functional and clinical care activities, representing a task-based perspective of care work, as opposed to spousal caregivers, who made more frequent connections between their care network and identity, indicating value placed on the protective aspect of caregiving. This may be because spouses have known the care recipient for longer and have more intimate knowledge of their personalities and goals, and are therefore more invested in protecting their identity as part of caregiving. These results build on Bowers' categories of care work by identifying a difference between the motivations of spousal and child caregivers when engaging their support network. Such differences could inform future interventions which more accurately target the needs of distinct caregiver roles.

Our findings support suggestions from the intergenerational caregiving literature that a more purpose-driven perspective of caregiving work captures more nuance in how caregivers approach their role than a measure of tasks performed. In addition, ENA emerged as a valuable method for exploring these nuances. The connection between CARE NETWORK, IDENTITY and APPRECIATION allowed for a deeper understanding of the caregiver's relationship to her care network and the type of support she values, encouraging the use of ENA in future caregiving work studies.

References

1. Gaugler, J.E., James, B., Johnson, T., Marin, A. & Weuve, J.: Alzheimer's disease facts and figures. ALZHEIMER'S & DEMENTIA (2019).
2. Bowers, B.J.: Intergenerational caregiving: adult caregivers and their aging parents. Advances in Nursing Science 9(2), 20-31 (1987).
3. Shaffer, D., Collier, W., & Ruis, A.: A Tutorial on Epistemic Network Analysis: Analyzing the Structure of Connections in Cognitive, Social, and Interaction Data. Journal of Learning Analytics 3(3) 9-45 (2016).
4. Ponnala, S., et al: Towards an Understanding of Informal Care Networks of Persons with Dementia: Perceptions of Primary Caregivers. Proceedings of the Human Factors and Ergonomics Society Annual Meeting 62(1) 561-562 (2018).

Discussions of Antidepressant Side Effects and Withdrawal on Reddit

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Abstract. Antidepressant use or withdrawal can lead to side effects such as weight changes and sexual dysfunction. These effects, as well as depression and antidepressants themselves, are stigmatized topics. Reddit is a social media platform which encourages discussion of such stigmatized topics by providing semi-anonymity and therefore increasing self-disclosure. This study collects data from the subreddit r/depression and identifies potential antidepressant side effects, withdrawal effects, and symptoms of depression. Epistemic network analysis (ENA) is applied to the data set as an exploratory analysis. It is well-suited for this study because ENA focuses on relationships between themes in the text, and these relationships are key to untangling the potentially similar effects of depression, antidepressant use, and antidepressant withdrawal. The size and structure of this data set and others from social media pose both opportunities and challenges. This work provides an example of potential applications for tools such as ROCK, justifier and threaded ENA which are designed for use with social media data.

Keywords: Antidepressant, Epistemic Network Analysis, Reddit.

1 Introduction

The American Psychological Association recommends selective serotonin reuptake inhibitors (SSRIs) or other antidepressants as an initial treatment option for depression [1]. However, side effects pose a barrier to antidepressant use and may lead to medication discontinuation. Common side effects vary based on medication and may include weight changes, sexual dysfunction, and gastrointestinal effects. Antidepressant withdrawal can lead to similar effects and occurs for 54% of people who stop taking antidepressants [2, 3]. Depression, antidepressant use, and side effects are stigmatized topics. Social media platforms such as Reddit present unique opportunities to collect data on these topics. Because users can choose an anonymous username, these platforms encourage self-disclosure and disinhibition, and their size provides vast amounts of data [4]. To elucidate the side effects typically discussed based on a given antidepressant, posts and comments from r/depression were coded for antidepressants and potential side effects or withdrawal symptoms. Epistemic network analysis (ENA) was performed to create a visual network of relationships between codes and identify patterns for further study.

2 Methods

2.1 Data Collection and Curation

Data was scraped from r/depression using the Python wrapper for Reddit API in February 2021 [5, 6]. r/depression was chosen for this study because it has more subscribers than other subreddits that discuss general antidepressant use. Threads were scraped if they contained generic or brand names of drugs approved to treat depression by the Food and Drug Administration (FDA) [7]. This analysis was a pilot study which focused only on sertraline/Zoloft data because it was the most commonly discussed antidepressant. These data include 7566 threads with a post containing the word "Zoloft" and 2706 threads with "sertraline" in the post.

Documentation is an important part of any study, particularly when working with large data sets. Decisions on methodology, data processing and management, and codebook development were recorded with the documentation standard justifier [8].

2.2 Coding

Threads were automatically separated into individual sentences with the R package corpus so that coding could be performed at the sentence level. Using sentences as utterances (the smallest unit of analysis in ENA) allowed for more precise, granular coding than could occur at the level of a comment, post, or thread. Antidepressant generic and brand names were used as codes to allow identification of clusters of effects, symptoms, and drugs. Other codes were developed iteratively and inductively (Table 1). Coding was performed using the Reproducible Open Coding Kit (ROCK) webtool iROCK, an open-source, intuitive system designed to allow flexible coding. Hand-coded files were then parsed into data tables suitable for ENA using the ROCK R package [9].

Table 5. Code names, definitions, and examples (excluding antidepressant codes).

Name	Definition	Example
Depression	Depression, bipolar disorder, or premenstrual dysphoric disorder	"I never really had a sex drive for ages before (probably due to depression)"
Dose	Current dose or dose changes	"…a small dose won't be as bad side effect wise."
Emotional flattening	Apathy, feeling "numb" or "empty"	"Does anyone else on antidepressants feel numb that it's almost impossible to cry?"
Gastrointestinal	Constipation, diarrhea, nausea, vomiting	"Reacted very negatively to the Zoloft and had a couple days of vomiting."
Memory, brain	Memory issues, brain zaps	"My own meds (an SSRI) cause memory loss…"
Physical pain	Headaches, migraines, soreness	"The immediate side effects were the headaches."
Sexual	Sexual dysfunction	"… must tell you that it kills your sex drive."
Sleep	Issues with energy or sleep	"Taking the pills at night helps with the drowsiness"
Weight	Changes in weight	"Anyway, I'm very apprehensive about the weight gain factor as a side effect"
Withdrawal	Stopping medication	"…Pristiq is known for it's horrible withdrawal…"

To develop regular expressions for eventually automatically coding the full data set, a subset of threads with posts containing "sertraline" (53, or 1.96%) and those containing "Zoloft" (137, or 1.81%) was set aside to create a test set (fig 1). A validation set was created using another 79 (2.91%) "sertraline" threads and 226 (2.99%) "Zoloft" threads. Test and validation sets were coded by hand. Despite the small percentage of threads in the test set, common themes quickly emerged. The potential side effects identified (Table 1) are consistent with commonly-reported antidepressant side effects and with categories in a previous study of antidepressant side effects which used Twitter data [10]. Regular expressions will be developed for each code. If necessary, expressions will be modified and re-validated using an additional, hand coded validation set of previously unused threads until all codes reach inter-rater reliability > 0.85 and Shaffer's rho < 0.05. The remaining data will be automatically coded using these regular expressions and the R package nCodeR [11].

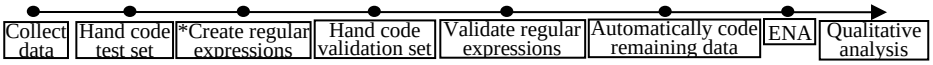

Fig. 1. Methods timeline. Asterisk (*) indicates current state of this pilot project.

3 Epistemic Network Analysis and Preliminary Results

Epistemic network analysis (ENA) has previously been applied to social media data scraped from Twitter [12, 13]. By focusing on relationships between codes, ENA allows for a detailed picture of related concepts. In this case, that detailed network may provide information about which effects are related to medication use (potential side effects) for specific medications.

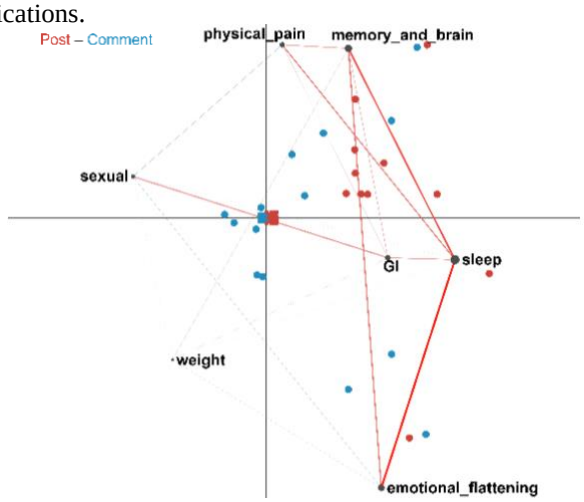

Fig. 2. Subtracted weighted network plot for the test data set. Posts (red) differ significantly from comments (blue), suggesting that posts and comments discuss different potential side effects (Mann-Whitney U = 33235.5, p = 0.0025).

Social media data has a hierarchical, branching structure in which conversations ("threads") begin with a post, followed by a direct reply ("top-level comment"). While this structure provides valuable information, it also presents a challenge for tools which have been developed for more linear conversations. To address this challenge, the ROCK package allows the use of the ~ character as a threading marker, where ~ indicates a top-level comment, ~~ indicates a reply to that comment, etc. A threaded version of ENA has also been recently developed to analyze social media data.

Figure 2 shows the subtracted weighted network plot for posts (red) and top-level comments (blue) in the hand coded test set. The groups are significantly different along the X-axis, suggesting that compared to top-level comments, posts are more likely to discuss emotional flattening, sleep, and memory or brain issues (Mann-Whitney U = 33235.5, p = 0.0025). This may suggest that posters discussing sertraline are concerned about or experiencing sleep difficulties along with either emotional flattening or memory issues. Clusters of data points indicate groups of posts and comments which warrant further analysis. Once these clusters are identified, a key analysis step will be "closing the interpretive loop." This will entail using the quantitatively identified data clusters as the starting point for a more in-depth, qualitative analysis of posts and comments in each cluster. In this way, the network will act as an exploratory tool to identify patterns within a large, structurally complex data set.

4 Future Work and Potential Topics for Discussion

Once the data is coded automatically, an epistemic network will be created for the full sertraline/Zoloft data set. This study will be expanded to include other antidepressants and depression treatments such as electroconvulsive therapy. Future work will also incorporate Reddit-specific metadata such as the number of upvotes (an indication of community approval) for each post or comment. This work may spur conference discussions related to threaded ENA and the application of other quantitative ethnography methods to social media data. Topics of conversation could include ways in which threaded ENA could make fuller use of Reddit's nested comment structure or methods to identify co-occurrences of codes between a post and a top-level comment. Discussions could also cover the use of tools such as justifier and ROCK for social media data. This study provides an example of the way in which innovative ENA techniques could be applied to better understand an aspect of health-related discussions on social media.

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References

1. American Psychological Association, Clinical Practice Guideline for the Treatment of Depression Across Three Age Cohorts. (2019).
2. Anderson, C. and Roy, T.: Patient experiences of taking antidepressants for depression: a secondary qualitative analysis. Res Social Adm Pharm, **9**(6): p. 884-902 (2013).

3. Anderson, H.D., et al.: Rates of 5 common antidepressant side effects among new adult and adolescent cases of depression: a retrospective US claims study. Clin Ther, **34**(1): p. 113-23 (2012).
4. de Choudhury, M., and De, S.: Mental Health Discourse on reddit: Self-Disclosure, Social Support, and Anonymity. in ICWSM. (2014).
5. Reddit Inc. r/depression. Available from: https://www.reddit.com/r/depression/.
6. Boe, B., PRAW: The Python Reddit API Wrapper. (2012).
7. Food and Drug Administration, Depression Medicines. (2019).
8. Peters, G.-J.Y.: Human and Machine-Readable Justifications and Justified Decisions. (2021); Available from: https://justifier.one.
9. Peters, G.-J.Y. and Zorgo, S.: Reproducible Open Coding Kit. Available from: https://r-packages.gitlab.io/rock/.
10. Saha, K., et al.: Understanding Side Effects of Antidepressants: Large-scale Longitudinal Study on Social Media Data. JMIR Ment Health, **8**(3), p. e26589 (2021).
11. Shaffer, D.W., et al.: The nCoder: A technique for improving the utility of inter-rater reliability statistics, in Epistemic Games Group Working Paper 2015-01. UW-Madison (2015).
12. Shaffer, D.W.: A tutorial on epistemic network analysis: analyzing the structure of connections in cognitive, social, and interaction data. Journal of Learning Analytics, **3** (2016).
13. Choi, J.: A Case Study of #MeToo Analysis with Epistemic Network Analysis. in First ICQE. Madison, WI USA (2019).

Directed Epistemic Network Analysis of Knowledge-creation Discourse

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Abstract. This study describes insights into learning as knowledge creation derived from directed epistemic network analysis (dENA). In knowledge creation, an advanced learning approach, there are two critical perspectives—idea improvement and epistemic agency—for analyzing how learners engage in knowledge creation. However, the epistemic agency analysis method has received less attention than the idea improvement analysis method. Moreover, no previous study analyzing epistemic agency using epistemic network analysis (ENA) has considered the directionality of learners' actions. Hence, this study examined the effectiveness of ENA with directionality; findings showed that the implementation of directionality to ENA illustrates not only which epistemic actions are activated but also how the epistemic actions affect each other in knowledge-creation discourse.

Keywords: Knowledge Creation, Knowledge Building, Learning Analytics, Directed Epistemic Network Analysis (dENA).

1 Introduction

This study examines what directed epistemic network analysis (dENA) [1] can bring to learning as knowledge creation. The knowledge-creation metaphor requires that learners create and improve their own ideas instead of memorizing existing knowledge [2]. Knowledge building, one theory of knowledge creation, aims to achieve collective knowledge advancement through learners' discourse and requires the understanding of how learners engage in idea improvement with their epistemic agency to design a learning environment [2, 3]. However, few studies have examined methods for analyzing epistemic agency. Recently, analytics for knowledge-creation discourse have been developed to analyze both perspectives of idea improvement and of epistemic agency using socio-semantic network analysis (SSNA) and epistemic network analysis (ENA) [4, 5]. After [4], Fogel et al. [1] demonstrated that dENA can reveal differences in connection directionality by accounting for the order of events, which was not shown by using ENA alone. Consequently, to advance the analysis of epistemic agency, this

study adopted dENA, which implements directionality to ENA, and examined the implications of the analysis results for the learning environment in terms of knowledge creation. The study aimed to determine the differences revealed between high and low groups by including directionality in the analysis.

2 Methods

This study used the same data used in [4] collected from a biology class in a Japanese high school. In the class, there were 39 tenth-grade students and 12 groups of three or four students each. Furthermore, the previous study evaluated students' outcomes by the structure-behavior-function (SBF) framework, which assesses the understanding of complex systems [6], and these groups were clustered into high- (n = 3) and low-SBF groups (n = 9). The lesson was designed based on jigsaw instruction [7] to engage students in collaborative idea improvement. The main challenge of the class was to explain how vaccination protects us from infections. Students solved this challenge by engaging in jigsaw group work for 75 minutes. The educational materials in the preparation group work for the jigsaw group work conveyed knowledge on "humoral immunity," "primary and secondary responses," and "cell-mediated immunity" to enable students to solve the main challenge.

In [4], students' discourse was coded by the framework of shared epistemic actions [8] to analyze shared epistemic agency. Table 1 shows the coding categories and example utterances. Students' discourse was recorded and transcribed, where each line was a turn of talk for a total of 4,302 lines. Furthermore, two researchers independently coded the data, and disagreements were resolved through social moderation [9].

This study created graphs with dENA and interpreted the visualized data. The units were 12 groups nested into three phases, nested into high- or low-SBF levels. The conversation setting of the models depended on phase and group, and the moving stanza window size was five. The statistical test function for dENA was not developed.

Table 6. Coding categories and example utterances.

Category of action [16]	Example
CREATING AWARENESS (CA)	What is it? What is being grown?
ALLEVIATING LACK OF KNOWLEDGE (ALoK)	You're talking about "eradication", but the right word is "annihilation."
CREATING SHARED UNDERSTANDING (CSU)	(Person a:) Do macrophages also present information about viruses? (Person b:) What? Are this and that the same thing?
GENERATIVE COLLABORATIVE ACTIONS (GCA)	Ah, yes, yes, yes. That means wait... That's why it has to be vaccinated first. Then, if the natural immunity can't cope with it, it becomes acquired immunity, like T cells or B cells, and the problem is that.... Oh, B cells grow fast, don't they?
PROJECTIVE	Well, we have to think about text explanation, but first, we have to think about vaccines.
REGULATIVE	Let's summarize the three stories for now…
RELATIONAL	What about B? (Ask a person who studied the educational material B)

3 Results and Discussion

The graphs in Fig. 1 show the differences between the high- and low-SBF groups in each phase. While subtracted networks are often useful to visualize the differences in mean networks there are situations where it is easier to make comparisons by directly examining individually each group. This is the case for phase 1 where we need to interpret each graph individually. Specifically, it is difficult to show the differences by comparing high- and low-SBF graphs in Phase 1 (Fig. 1), because the former were more active than the latter in Phase 1 resulting stronger connections for all edges in the networks.

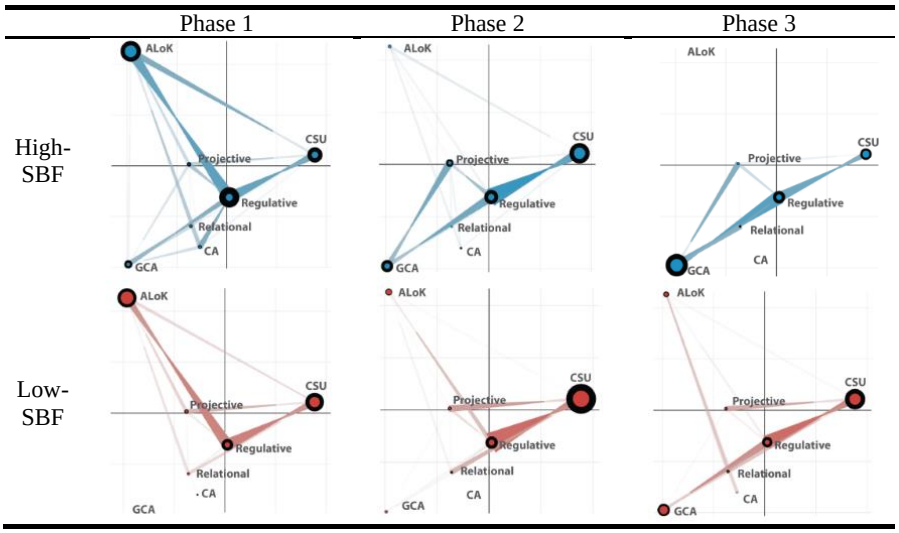

Fig. 1. Graphs of each phase by dENA.

In Phase 1, we observed three key characteristics. First, both SBF levels were actively working on ALoK, as indicated by the relatively larger node size of ALoK in both plots in Phase 1. Such behavior was also highly iterative in both SBF level groups, as indicated by the proportion of the self-connection colored circle in the ALoK node. In Phase 2, while both SBF levels were actively creating shared understanding through synthesis, as represented by the strong connections between CSU and REGULATIVE, the high-SBF groups more clearly moved away from ALoK and focused more on outcome-oriented actions, such as CSU and GCA, by summarizing progress (REGULATIVE) and setting goals (PROJECTIVE), as shown in the graph of high-SBF in Phase 2. In Phase 3, the most advanced knowledge-creation action, GCA, became the major focus of the high-SBF groups, as indicated by its large node size, while in the low-SBF groups, GCA finally started being connected with other nodes. Furthermore, while ALoK was only active in the high-SBF groups in Phase 1, it was present in the low-SBF groups' network throughout the three phases. This might indicate that the lack of knowledge was a struggle for the low-SBF groups' students throughout the activity.

In conclusion, this study confirmed the differences in GCA and ALoK between the high- and low-SBF groups, even though both SBF levels performed knowledge-related actions managed by REGULATIVE actions. This study's results indicate which action drove other actions and the importance of creating sufficient shared understanding to generate and revise common ideas for the final knowledge artifacts. Of course, considering two important modeling perspectives—dENA for epistemic agency and SSNA for idea improvement—for knowledge creation, future work should examine the combination of these two methods. However, this study suggests that directionality in analytics for knowledge-creation discourse contributes to supporting interpretations and designing learning environments.

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References

1. Fogel, A., Swiecki, Z., Marquart, C., Cai, Z., Wang, Y., Brohinsky, J., Siebert-Evenstone, A., Eagan, B., Ruis, A.R., Shaffer, D. W.: Directed Epistemic Network Analysis. In: Ruis A.R., Lee S.B. (eds.) Advances in Quantitative Ethnography. ICQE 2021. CCIS, vol 1312, pp. 122-136. Springer, Cham (2021).
2. Paavola, S., Hakkarainen, K.: The knowledge creation metaphor—An emergent epistemological approach to learning. Sci. Edu., 14, 535–557 (2005).
3. Scardamalia, M., Bereiter, C.: Knowledge building and knowledge creation: Theory, pedagogy, and technology. In: Sawyer, R. K. (ed.) The Cambridge Handbook of the Learning Sciences. 2nd edn. pp. 397–417. Cambridge University Press, New York (2014).
4. Oshima, J., Oshima, R., Saruwatari, S.: Analysis of students' ideas and conceptual artifacts in knowledge-building discourse. Br. J. Edu. Tech., 51(4), 1308-1321 (2020).
5. Shaffer, D. W.: Quantitative Ethnography. Cathcart, Madison (2017).
6. Hmelo-Silver, C. E., Pfeffer, M. G.: Comparing expert and novice understanding of a complex system from the perspective of structures, behaviors, and functions. Cogn. Sci., 28(1), 127-138 (2004).
7. Miyake, N., Kirschner, P. A.: The social and interactive dimensions of collaborative learning. In Sawyer, R. K. (ed.), The Cambridge Handbook of the Learning Sciences. 2nd edn. pp. 418–438. Cambridge University Press, New York (2014).
8. Damşa, C. I., Kirschner, P. A., Andriessen, J. E. B., Erkens, G., Sins. P. H. M.: Shared Epistemic Agency: An Empirical Study of an Emergent Construct. J. Learn. Sci., 19(2), 143-186 (2010). DOI: 10.1080/10508401003708381
9. Herrenkohl, L.R., Cornelius, L.: Investigating elementary students' scientific and historical argumentation. J. Learn. Sci., 22(3), 413–461 (2013).

Integrating Interdependence and Temporality in the Analysis of Team Cognition: Comparing ENA and dENA

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Abstract. Effective care teams are critical to ensuring patient safety and improving quality of care. Understanding team cognition and communication are crucial to team effectiveness, but these are not easily modeled using traditional Epistemic Network Analysis (ENA). Directed ENA (dENA) is a promising analytic tool. To explore the usefulness of dENA, we used dENA to monitor communication to allocate tasks in a primary care team and compared our visualizations with ENA models. dENA models were more intuitive and matched the reality of team communication better, but model fit was problematic. Future work should explore dENA model fit measures and expectations. Nonetheless, dENA represents an important advance to modeling team communication and team cognition.

Keywords: dENA, Team Communication, Primary Care Teams.

1 Introduction

Health care has many quality and safety issues [1]. The introduction of and focus on effective care teams is one can improve patient safety [2]; team cognition and communication, which is emergent, interdependent, temporal in nature, is crucial to team effectiveness. Wooldridge and colleagues [3] previously conducted a case study of team cognition, focusing on communication to allocated tasks in primary care teams, using logistic regression and Epistemic Network Analysis (ENA). The team consisted of a physician, nurse, medical assistant (MA) and unit clerk. The logistic regression showed that synchronicity of communication, role of the sender (i.e., who assigned the task) and role of the receiver (i.e., the person asked to do the task) were significant in determining if the task assignment was accepted. Tasks assigned synchronously were more likely to be accepted, as were tasks assigned by the physician and unit clerk. The ENA analysis showed the same and supported a deeper understanding of how and why the unit clerk was the most successful in assigning tasks to other team members.
The analysis by Wooldridge et al. [3] used ENA before an effective way to account for and visualize interdependence *and* order was developed. Recently, directed ENA (dENA) was developed to do exactly that – account for interdependence and order in complex collaborative thinking [4]. In HF/E terms, this situates dENA perfectly to

study team communication and team cognition, such as task allocation. Fogel et al. [4] found that while ENA was useful in describing team cognition of U. S. Navy air defense warfare teams, dENA produced more robust, detailed models that were intuitively aligned with the qualitative data underlying the quantified network models. dENA was able to model interdependent, temporal and ordered team communication.
The objective of this study is to compare results from Wooldridge and colleagues [3] with findings from dENA of the same data set to extend dENA [4].

2 Methods

The Institutional Review Board at the University of Wisconsin-Madison approved this study. This study is a secondary analysis of data reported by Wooldridge et al. [3].

2.1 Summary of Prior Methods

Wooldridge et al. [3] observed one primary care team that practices in the Midwestern United States for 15 hours. They collected detailed, written notes that focused on work system elements and team communication. The notes were segmented into lines – each line included the task allocation and response as a single line – and coded for role of sender and receiver, synchronicity and accepted or rejected tasks. They used logistic regression and ENA to model the impact of sender, receiver and synchronicity on task acceptance. For full methodology details, please see Wooldridge et al. [3].

2.2 dENA Methods

We analyzed the same data set using the dENA R package [4], maintaining the coding structure (i.e., roles, synchronicity and acceptance) but segmenting the lines so each line represented assignment or response. The dENA algorithm identified code co-occurrence between a current line and its preceding line (i.e., a moving stanza window of two). In dENA, the current line is the *response*, and its preceding lines within the window are the *common ground*. In this study, a response is as a reaction to the task assignment (i.e., the common ground). For example, if code MD appears in response line and code UC appears in common ground line, that line is the MD reacting to the task assignment placed by UC. To account for such directionality of connections between response and common ground, dENA records codes co-occurrence in an asymmetric adjacency matrix; the number of connections from any code A to code B may be different from code B to code A. With the asymmetric adjacency matrix, the dENA algorithm transforms the matrix into a ground vector and a response vector in a high dimensional space and then normalizes them into a lower dimensional space using a singular value decomposition. This normalization process results in a pair of ground score and response score, which are used to plot the network nodes using the same optimization routine as ENA. The dENA analysis results a graphical representation that captures the strength and directionality of connections between codes in a network space.

3 Results

Figure 1 shows the ENA plots developed by Wooldridge et al. [3] and the analogous plots developed using dENA. When interpreting dENA network visualization, the node size is proportional to the frequency of that code as a response in the data. The larger the node is, the more frequent it acted as a response. The directed connection is represented by a pair of triangles: for any two nodes, a triangle with its base at node A and its vertex points towards node B represents a directed connection from node A to node B. The more saturated and thicker the triangle is, the stronger the connection is. Such connection strength is also represented by the pinch point where two triangles meet. For example, if the pinch point of the two triangles between A and B is closer to node A, the directed connection from B to A is relatively stronger than the reverse. In this study, the nodes indicate role. Our model had co-registration correlations of 0.5062 (Pearson) and 0.4975 (Spearman) for the first dimension and co-registration correlations of 0.3727 (Pearson) and 0.2828 (Spearman) for the second.

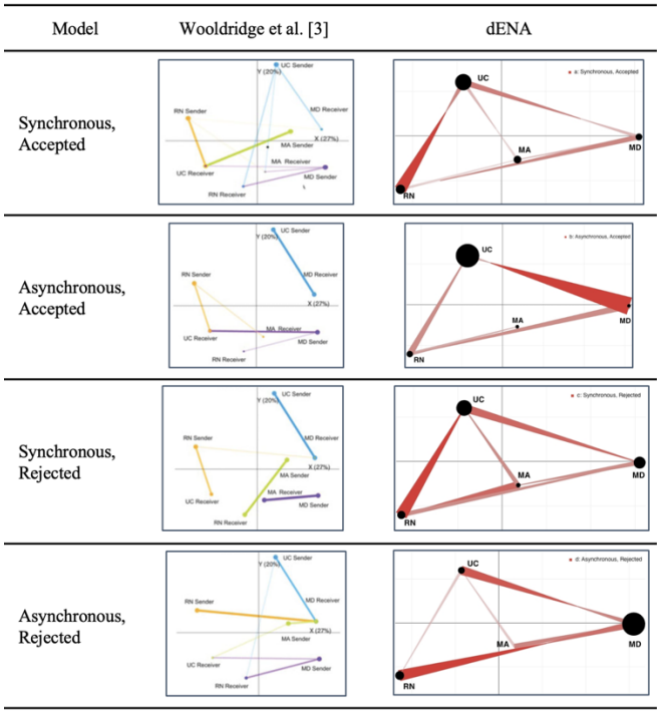

Fig. 1. Comparison of ENA models from Wooldridge et al. [3] with dENA models.

4 Discussion and Conclusion

In this case study, dENA was able to show what had previously been revealed using ENA. However, the dENA graphic visualization was more accessible and more intuitive to interpret then the ENA models. Both ENA and dENA models revealed that UC was the most successful in allocating tasks. Such phenomenon was clearer in the dENA visualizations given the node size contrast – in the top two dENA visualizations in Fig 1, the node size of UC is the largest. The visual affordances of dENA are more intuitive than ENA. The segmentation of data is more congruent with reality – the data for dENA were segmented by *turns of talk* (or the initial message and response for asynchronous communication). The ENA forced interdependence by including both in one line to represent temporality but complicated data analysis and interpretation.

This study does have limitations, in addition those noted by Wooldridge et al. [3]. The Pearson and Spearman co-registration correlations of our model are not high, which might indicate that there is inconsistency between the network visualization and the summary statistics, as explained in Bowman et al. [5]. Wooldridge et al. [3] did not report co-registration correlations, raising the question if our model had similar or worse fit. We encourage more detailed reporting of the development and fit of network models. Future work could investigate if goodness of fit measures should be amended for dENA (e.g., similar to Shaffer's rho in addition to Cohen's kappa [6]).

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References

1. Institute of Medicine Committee on Quality of Health Care in America: Crossing the Quality Chasm: A New Health System for the 21st Century. National Academy Press, Washington, DC (2001).
2. Baker, D., Salas, E., Battles, J., King, H.: The Relation between Teamwork and Patient Safety. In: Carayon, P. (ed.) Handbook of Human Factors and Ergonomics in Health Care and Patient Safety. Taylor and Francis group, Boca Raton, FL (2012).
3. Wooldridge, A.R., Carayon, P., Shaffer, D.W., Eagan, B.: Quantifying the qualitative with epistemic network analysis: A human factors case study of task-allocation communication in a primary care team. IISE Transactions on Healthcare Systems Engineering 8, 72-82 (2018).
4. Fogel, A., Swiecki, Z., Marquart, C., Cai, Z., Wang, Y., Brohinsky, J., Siebert-Evenstone, A., Eagan, B., Ruis, A.R., Shaffer, D.W.: Directed Epistemic Network Analysis. In: Ruis, A.R., Lee, S.B. (eds.) Advances in Quantitative Ethnography. ICQE 2021. Communications in Computer and Information Science, vol. 1312, pp. 122-136 (2021).
5. Bowman, D., Swiecki, Z., Cai, Z., Wang, Y., Eagan, B., Linderoth, J., Shaffer, D.W.: The Mathematical Foundations of Epistemic Network Analysis. International Conference on Quantitative Ethnography, pp. 91-105 (2021).

6. Eagan, B., Brohinsky, J., Wang, J., Shaffer, D.W.: Testing the reliability of inter-rater reliability. Proceedings of the Tenth International Conference on Learning Analytics & Knowledge, pp. 454-461 (2020).

Learning from SSDI Applicants in Their Own Words

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Abstract. This study uses Epistemic network analysis to model the discussions of individuals participating in online forums related to Social Security Disability Insurance; a particular focus is on the difference between conversations of initial applications and appealing one's denial. The results suggest that conversations of being denied and going through the appeals process have stronger connections with pain and medical conditions with providing sufficient medical evidence.

Keywords: Social Security Disability Insurance, Epistemic Network Analysis.

1 Introduction

The Social Security Disability Insurance (SSDI) program's application process can be complex and time-consuming. Approximately two-thirds of applicants have claims that are initially denied. These claims take an average of two years to be resolved, and nearly two-thirds are eventually awarded benefits [1, 2]. This high initial rate of denial and subsequent award on appeal suggests the existence of a knowledge gap between applicants and the Social Security Administration (SSA). The extended length of the process produces a strain on applicants by delaying access to benefits; additionally, this adds administrative burden and preventable costs on the SSA. We use a data set of conversations on online forums relating to SSDI to explore this potential knowledge gap.

2 Theory

SSDI is a social insurance program intended to cover long-term disruptions to employment due to disability. The two main requirements for being awarded benefits are having a sufficient work history and documentation of a qualifying medical condition.

Exploring conversations on online forums will provide insight into the challenges faced by SSDI applicants. Prior research of online discussions relating to disability found participants derived benefits such as gaining information, freedom to discuss diverse and taboo subjects, and help in problem solving [3]. Online forums help provide information to people having difficulty obtaining services due to disability, overcoming geographic barriers, or limited socialization opportunities.

Epistemic Network Analysis (ENA) is a quantitative ethnographic technique for modeling the structure of connections in data. ENA extracts the meaningful features in

the data operationalized as Codes by examining the connections within conversations [4]. ENA is well-suited to analyzing the data set of SSDI related conversations as it contains a rich array of experiences and the large nature precludes manual analysis. This research seeks to extend the application of ENA to provide insight and actionable information to decision makers regarding public policy.

3 Methods

The data used in the analysis was scraped from seven online forums spanning 2004 to 2020 where SSDI was a primary focus. The posts were segmented by sentence and coded using the automated classifier nCoder (see Table 7). All codes had Cohen's $\kappa > 0.90$ and Shaffer's $\rho\ (0.90) < 0.05$ between a human rater and nCoder. Conversations were defined at the thread level, and infinite stanzas were used due to the permanence of existing posts within a thread. A robustness check using a large moving stanza was qualitatively similar to using the infinite stanza. Conversations were classified as relating to INITIAL APPLICATION or DENIAL APPEALS based on which code is more frequent.

Table 1. Derived codes for SSDI online forums.

Name	Definition	Example
DENIAL APPEALS	Refers to SSDI application denial and traversing the appeals process	*It was her lawyer that placed the paperwork in for her for the Reconsideration*
INITIAL APPLICATION	Refers to a new application; Code is mutually exclusive with DENIAL APPEALS	*My father applied for Social Security disability benefits back in June of this year.*
MEDICAL EVIDENCE	Refers to documentation and records needed to justify the qualifying medical condition	*Have you looked at your medical records to see what kinds of things your doctors are documenting?*
MENTAL HEALTH	Refers to mental health conditions; this may refer to listings in the SSA Blue Book	*I suffer from Major Depression and anxiety now, since my accident that has changed my life.*
NEUROLOGICAL CONDITION	Refers to neurological conditions; this may refer to listings in the SSA Blue Book	*My husband [was] diagnosed with Monomelic Amyotrophy recently.*
PAIN	Refers to the feeling of pain and descriptions of related sensations	*I can sit for an hour or so before my hips, shoulder and elbows start to hurt from arthritis*

4 Results

Conversations classified under DENIAL APPEALS exhibit stronger connections between PAIN, MENTAL HEALTH, and MEDICAL EVIDENCE while INITIAL APPLICATION discussions have more connections between NEUROLOGICAL CONDITION and MEDICAL EVIDENCE.

Table 2. A qualitative example relating to DENIAL APPEALS.

User	Excerpt
User 1	Well in the denial letter **[DENIAL APPEALS]** this is what they wrote: "The medical evidence **[MEDICAL EVIDENCE]** shows that you have CFS, CTS, asthma, joint pain **[PAIN]**, memory loss, and visual loss" … I wrote in all of my conditions, symptoms and pains, aches **[PAIN]** and problems … down the side of the application **[INITIAL APPLICATION]** to get it all in.
User 2	The bluebook will give you some idea of what SSA considers to be disabling. Having looked at your recent post, what I would suggest is that you get your neurosurgeon and rheumatologist to write a letter, preferably in your medical records **[MEDICAL EVIDENCE]**, stating your Residual Functional Capacity.

We see these connections where User 1 talks about their denial and their documentation of medical conditions. Another theme of the data is the centrality of MEDICAL EVIDENCE to prove one's condition. For example, in the excerpt when User 1 talks about including every medical issue they have, and User 2 responding with advice to only include evidence relevant to the SSA's determination criteria.

The resulting ENA model (see Fig. 3) shows the subtraction plot highlighting the differences between INITIAL APPLICATION and DENIAL APPEALS conversations. There is a statistically significant difference between the mean plotted points between the conversation types. Along the Y axis, a two sample t test assuming unequal variance showed INITIAL APPLICATION (mean = 0.10, SD = 0.78, N = 296 was statistically significantly different at the alpha = 0.05 level from DENIAL APPEALS (mean = -0.06, SD = 0.75, N = 502; t(597.38) = 2.80, p = 0.01, Cohen's d = 0.21).

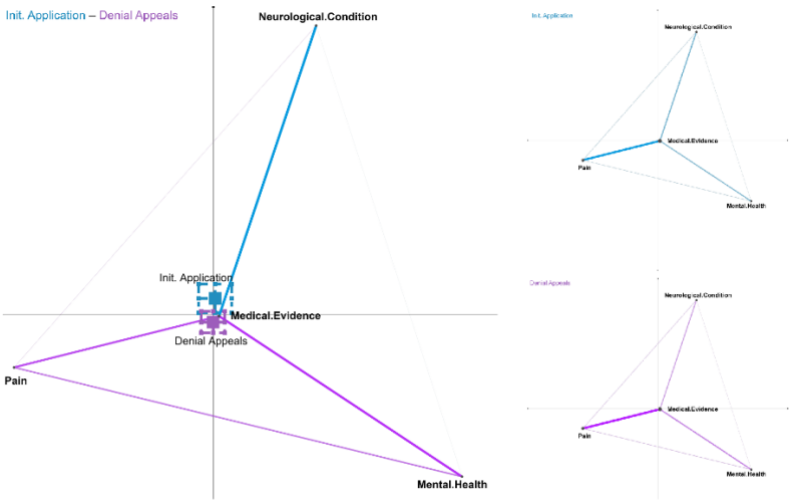

Fig. 1. Left: ENA subtraction graph comparing INITIAL APPLICATION (blue) and DENIAL APPEALS (purple) conversations showing difference in types of medical conditions discussed. Right: The ENA graphs for INITIAL APPLICATION (upper) and DENIAL APPEALS (lower).

5 Discussion

This study shows systematic differences in conversations between filing an INITIAL APPLICATION and discussing DENIAL APPEALS exist. Conversations containing INITIAL APPLICATION make stronger connections between NEUROLOGICAL CONDITION and MEDICAL EVIDENCE. In contrast, DENIAL APPEALS make stronger connections among PAIN, MENTAL HEALTH, and MEDICAL EVIDENCE. The stronger connections between INITIAL APPLICATION and NEUROLOGICAL CONDITION suggest it is relatively easier to document the impacts of a medical condition. Denied applicants struggle to document their underlying medical conditions adequately; these have higher relation to PAIN and MENTAL HEALTH, which may be more challenging to document and justify considering the general lack of a physical diagnosis. Additionally, the individual circumstances of such conditions may place a larger burden on an applicant to completely document their condition. Applicants may not be aware of how important documentation is and the difficulty of providing the necessary medical evidence for some conditions. The results highlight the importance for SSA to give more precise guidelines regarding what level of evidence and documentation is expected, especially for conditions that require a more significant extent of proof. This could have a potentially large impact on many applicants who are initially denied but subsequently awarded benefits upon appeal with the derived program efficiencies helping both the SSA and SSDI applicants.
A possible extension of this work would be exploring the MEDICAL EVIDENCE code to further understand its connections. Currently this code does not explain much variation along either axis due to its omnipresence; thus, useful information is likely to be observed from separating this code.

One limitation of this study is it most likely does not represent the entire population of SSDI applicants despite containing many observations spanning more than a decade. Additionally, this study only examines one aspect of a complex process and may not capture other relevant or interacting facets of the application and appeals process.

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References

1. Annual Statistical Report on the SSDI Program. https://www.ssa.gov/policy/docs/statcomps/supplement/2019/index.html, last accessed 2020/2/25.
2. Autor, D. H., Maestas, N., Mullen, K. J., & Strand, A.: Does Delay Cause Decay? The Effect of Administrative Decision Time on the Labor Force Participation and Earnings of Disability Applicants. National Bureau of Economic Research (2015).
3. Finn, J.: An exploration of helping processes in an online self-help group focusing on issues of disability. Health & Social Work 24(3): 220–31 (1999).
4. Shaffer, D. W.: Quantitative Ethnography. Cathcart Press, Madison, WI (2017).

Co-Designing Assessment Dashboards with Teachers for Educational Games: A Case of Persistence

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Abstract. The co-creation of educational technologies is dynamic in nature and poses challenges for analyzing data generated during rapid and time-constrained co-design sessions. Thus, it's challenging to closely investigate how the co-design process played out over time, and how it led to certain technological innovations. Applying Quantitative Ethnography methods, we aim to investigate how teachers and researchers collaboratively designed data visualizations for an educational math game to measure their students' "persistence." In this poster, we report preliminary findings based on the thematic analysis codebook that the research team iteratively established.

Keywords: Co-Design, Assessment Literacy, Data Visualization, Human-Centered Learning Analytics, Game-Based Learning.

1 Introduction

Learning Analytics (LA) can add value to teaching and learning practices in classrooms, for example, by providing teachers with greater insight into students' learning so they can provide timely feedback [1]. There are three challenges for integrating LA with educational technology in classrooms: (1) teachers must understand how data is processed, (2) teachers must place appropriate value in LA's suggestions, and (3) LA's data visualization tools must be usable by teachers in real contexts. We aim to understand the interactions between teachers' assessment literacy, data visualization, and LA, within the context of game-based assessment. Our team engaged teachers as co-designers of teacher-facing, interactive, LA data dashboards, designed for enabling decision-making based on data gathered from an educational game, Shadowspect. Shadowspect is a 3D puzzle game for assessing Common Core Geometry standards, student persistence, and spatial reasoning [2]. To increase teachers' rigorous use of game-based assessment data and support pedagogical decisions based on LA, the project investigates how to co-design LA and data visualizations that elicits teachers' active participation without imposing technical barriers. The end goal of this research

is to develop interactive data visualizations that embody generalizable, theoretically articulated, and empirically grounded design principles.

To those ends, among other questions, our project asks: RQ1: How do teachers and researchers come to understand each other's values and desires during the co-design process? RQ2: How do teachers' existing assessment literacy and practices influence the process identified in RQ1?

In this poster, we share preliminary findings of our thematic analysis of one case study from that project. This analysis was aimed at answering RQ1 and RQ2, and it centers on teacher/researcher discourse around the measurement and visualization of students' "persistence," a salient desire of the teachers that emerged early in the co-design process.

2 Methods

Context & Data Collection. We selected 8 math teachers as design fellows from 16 secondary school teachers who applied for an open call for participation. The teachers were selected on their interests in educational values of games, data use in classrooms, and co-designing processes. The team and teachers met monthly during development iteration cycles for 12 months. A typical co-design session lasted 2 hours. Due to COVID-19, all design sessions were conducted and recorded remotely via Zoom. The team collected several sources of data: design session discussions, teacher interviews, teachers' individual think-alouds, artifacts generated by the fellows, and the team's field notes. The focus of co-design activities varied, such as from generative ideation with prompts to identify indicators for a metric, to trying out a prototype and creating a user journey map to describe how they would use it in real classroom contexts [3].

Student "persistence" emerged early in the co-design process as a trait that participants wanted to measure, visualize, understand, and respond to. For example, the research team asked the fellows to create the kinds of stories that they wish to tell about students using analytics from the game, and the general consensus was that, because the game encourages students to try challenging problems, teachers wanted to see measurements related to growth, efforts, and progress. The fellows then defined, selected, and grouped a set of metrics that they wished to see in the teacher-facing game data dashboard, and their top three choices were persistence, math standards, and common errors and misconceptions. For this poster, we focus on the first of these: persistence.

There are varying definitions of persistence in the literature, so participants and the research team eventually operationalized persistence as the ability to maintain an action or complete a task, regardless of one's inclination towards the task, with the active choice to continue in a course of action, even in the face of obstacles, difficulties, or discouragement [4,5]. While game-based learning literature has previously defined and measured persistence [6,7], to date there has been no discussion on how teachers can use this information in classrooms. Therefore, for this case study, we analyzed all sessions and individual think-aloud activities that included explicit discussion of

persistence in order to learn how the teachers' assessment literacies, design requirements, and use of data visualizations arose within the context of that one concept.

Thematic Analysis. Transcripts of Zoom recordings where persistence was a topic of discussion were inductively coded, where common themes were identified by a close reading of the data and iterative comparing, sorting, and defining similar data [8,9]. Themes were agreed upon through social moderation within the research team and triangulated with artifacts generated by the fellows and the team's field notes [10]. The identified themes are defined and illustrated in Table 1.

Table 1. Codebook.

Label	Code	Example
MOTIVATION	Discourse invoking participants' motivations for use of the design, such as extrinsic pressures to incorporate more data in decision making and intrinsic motivations to see subjects succeed.	"if I'm talking to parents...this is really good data to have" or "We're teaching these kids not just math, but we're trying to teach them to survive in the real world."
CONCEPTION	Invoking or describing possible conceptual definitions for some bigger picture concern, such as defining a concept by its flavors or by what it requires.	"A prerequisite to some of our definitions of persistence is failure."
OPERATION-ALIZATION	Invoking or describing implementations of a metric for measuring some concept, such as tracking moves spent, tracking duration, developing composite scores, and aligning multiple metrics.	"I would want it to be...like, 'students who have made a real attempt'...defining time-wise or move-wise" or "I'm wondering if...just like the number of reattempts would be more interesting."
DESIGN	Invoking the design itself, such as proposals for features, discussion of (imagined or real) features, desires for affordances, the limits of those affordances, and evaluations of a design prototype.	"It'd be important to me that...the students along the X axis are the same, graph-by-graph" or "I'm wondering if...that visualization with the line and the bubbles seems confusing."
CONCERN	Invoking or implying concerns, critiques, or confusions of a metric, a design, or the design process as a whole, such as pointing out conflating factors and confusion over what a metric represents.	"There's like kids who sit and think, and there's kids who sit and do nothing, so it's kind of hard to tell what's going on, whether it's like active time or inactive time" or "I've been asking this question kind of all along. I'm not, I don't really understand."
DESIGN TEAM	References to the design team's power in relation to the participants, such as participants trusting a metric because it was created by this team.	"We have some folks from [institution] who are letting us test out a game"

DIGGING INTO	Invoking or processes of participants' seeking richer qualitative understandings of their subjects, design elements, or concepts through engagement (imagined or real) with a design, such as comparing two subjects qualitatively and trying to uncover subjects' thinking.	"It felt like this third person...like, they kept trying. Like, they eventually checked, like they changed the perspective again. And then they eventually got rid of that triangular prism, checked their perspective again. It feels like they were more invested, and just like, couldn't quite get there" or "In all honesty...I feel like I don't have time to sit and really dive deep into the types of data that I'm getting."
ABDUCTION	Invoking or describing ventured explanations prompted by information reported by a (imagined or real) design, such as subjects' traits, motivations, skills, histories, and behaviors.	" 'Time between failure and exit.' It looks like they're solving every puzzle" or "most obvious ones are like the students that are not persisting, probably like logging out right away, and those that are, like, getting in it, are really good problem-solvers and are really good with their spatial skills, which are the rapid solvers."
OBSERVATION	Invoking participants' (imagined or real) observations or assessments from outside of the design, put into relation with (imagined or real) information reported by a design, such as subjects' in-person behaviors or assessments of subjects made prior to the design.	"students that are very different types of students that you've learned from other views in class...to see that they've spent the same time, but to want to know how they did it differently."
SELECTION	Invoking or processes of participants' seeking to identify subjects, design elements, or concepts for the purpose of taking action, such as identifying those with the highest or lowest scores on some metric.	"I don't really care about the kids kind of in the middle, 'cause they're doing what they're supposed to be doing, they're making progress...it's those outlier kids that need the extra attention."
ACTION	Describing participants' strategies for actions to be taken with respect to one or more of their subjects, in relation to (imagined or real) information reported by the design, such as praising successes and intervening in struggles.	"I would wanna sit down with that student and help them to develop strategies" or "this will be easy for me just to grab this and...I know I'm gonna put one rapid solver with one non-persistent."
TRANSPOSITION	Invoking or processes of (real or imagined) transpositions of the data collected by the design in order to focus on one dimension, such as on students, on design elements, or on concepts.	"I think I'd want, like, an alert of like, 'This misconception was shown by, you know, 70% of your students in the past week.' Like, 'Here's a puzzle you should look at.'"

3 Preliminary Findings

We found that although teachers agreed on the reason for persistence's central importance—persistence is a life skill—, translating that value into a single conceptual definition was difficult [11]. Multiple competing definitions arose, metrics were proposed, and it was the design team, not the teachers, that ultimately selected which

to implement according to technical feasibility [12]. Throughout the co-design process, teachers demonstrated prior data literacy through critiques of these (proposed or implemented) metrics. And teachers interacted, or imagined interactions, with these metrics through the dashboard design. This design lent affordances and limitations to three major tasks for teachers' assessment and response practices: (1) digging deeper into the data on one data point in order to come away with a richer qualitative understanding; (2) “transposing” the data to focus on students, puzzles, or competencies; and (3) selecting stand-out data points for further action [13, 14]. Teachers advanced several ways to incorporate the design into those actions and remarked on a number of motivating factors behind their interest in data dashboards. And as teachers thought through how they might "dig" to gain rich understanding, we noticed three patterns: (1) the design prompted teachers to reason abductively by venturing student-level explanations for why they might see the data that they do; (2) iterating between abductive reasoning and rich understandings appeared to lend confidence to both, a richer understanding resulting in better-held guesses, and vice versa; and (3) those rich understandings were used to both explain and be explained by imagined observations of their students in the broader classroom context [15]. Finally, it would be remiss to ignore the design team's own power in the process: we interpreted teachers' conceptions and motivations, we implemented the design, we were sometimes looked in to "check" the teachers' understandings, and teachers' may have limited their critiques in conversations with us [16].

4 Conclusion & Next Steps

Our next steps are to share our general findings with the teacher community to elicit emic feedback, automate coding of all session transcripts, and employ quantitative methods to elucidate relationships between teacher’s assessment literacy, design requirements, use of visualization in classrooms, and the overall trajectory of that discourse [9, 17]. Our hope for this analysis is that the application of Quantitative Ethnography (QE) methods to this case study will (1) provide the QE community a rich demonstration of the temporal dynamics of the values that emerge in co-design processes with teachers, (2) allow us to theoretically relate those dynamics to teachers’ existing assessment literacy and practices, and (3) combine those results with our other research to develop interactive data visualizations that embody generalizable, theoretically-articulated, and empirically-grounded design principles.

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References

1. Macfadyen, L. P., Dawson, S., Pardo, A., & Gaševic, D.: Embracing big data in complex educational systems: The learning analytics imperative and the policy challenge. Research & Practice in Assessment 9, 17–28 (2014).

2. Ruipérez-Valiente, J. A., & Kim, Y. J.: Effects of solo vs. collaborative play in a digital learning game on geometry: Results from a K12 experiment. Computers & Education 159, 104008 (2020).
3. Kumar, V.: 101 design methods: A structured approach for driving innovation in your organization. John Wiley & Sons (2012).
4. Cloninger, C. R., Svrakic, D. M., & Przybeck, T. R.: A psychobiological model of temperament and character. Archives of general psychiatry 50(12), 975-990. (1993).
5. Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R.: Grit: perseverance and passion for long-term goals. Journal of personality and social psychology 92(6), 1087. (2007).
6. DiCerbo, K. E.: Game-based assessment of persistence. Journal of Educational Technology & Society 17(1), 17-28. (2014).
7. Ventura, M., & Shute, V.: The validity of a game-based assessment of persistence. Computers in Human Behavior, 29(6), 2568-2572 (2013).
8. Glesne, C.: Becoming Qualitative Researchers: An Introduction. Pearson, Boston (2015).
9. Shaffer, D. W., Ruis, A. R.: How We Code. ICQE, CCIS 1312, 62–77 (2021).
10. McDonald, N. et al: Reliability and Inter-rater Reliability in Qualitative Research: Norms and Guidelines for CSCW and HCI Practice. Proceedings of the ACM on Human-Computer Interaction (2019).
11. Xu, Y., & Brown, G. T.: Teacher assessment literacy in practice: A reconceptualization. Teaching and Teacher Education 58, 149-162 (2016).
12. Vezzoli, Y., Mavrikis, M., & Vasalou, A.: Inspiration cards workshops with primary teachers in the early co-design stages of learning analytics. In Proceedings of the Tenth international conference on learning analytics & knowledge 73–82 (2020).
13. Gibson, J. J.: The ecological approach to visual perception. Psychology Press (2014).
14. Schatzki, T. R.: The site of the social: A philosophical account of the constitution of social life and change. Penn State Press (2002).
15. Michos, K., et al: Involving teachers in learning analytics design: Lessons learned from two case studies. In Proceedings of the Tenth international conference on learning analytics & knowledge, 94–99 (2020).
16. Vasalou, A., et al: On power and participation: Reflections from design with developmentally diverse children. International Journal of Child-Computer Interaction 27, 100241 (2021).
17. Brohinsky, J., et al: Trajectories in Epistemic Network Analysis. ICQE, CCIS 1312, 62–77 (2021).

When Data Interleaves and Intersects: Threaded Epistemic Network Analysis

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Abstract. Researchers who are interested in modeling threaded data, such as logfiles of discussions on Internet forums, need to account for the *hierarchical* structure of threaded discourse. To address this issue, we propose a new extension of Epistemic Network Analysis (ENA) called Threaded ENA (tENA). We present this technique and demonstrate its efficacy using data from Reddit.

Keywords: Threaded Epistemic Network Analysis (tENA), Epistemic Network Analysis (ENA), Threaded Conversation, Hierarchical Data.

1 Introduction

Epistemic Network Analysis (ENA) is a quantitative ethnographic approach to modeling how epistemic concepts are connected in Discourse [1]. Modeling *threaded* discourse (also known as *nested* or *hierarchical* discourse), such as conversations on Reddit or 4chan, has become an increasingly important topic in discourse analysis. In this paper, we examine some of the technical challenges associated with analyzing threaded discourse data using ENA. Then, we propose a new technique, Threaded Epistemic Network Analysis (tENA), to address these challenges.

2 Theory

Conversations, whether synchronous or asynchronous, unfold *sequentially*: A says something, B replies to what A said, C says something in response to A and/or B, and so on. That is, each contribution *responds* to the contribution(s) that preceded it temporally. Therefore, to understand how people make meaning through discursive interaction, we have to associate each contribution to the discourse (e.g., each turn of talk) with the preceding contribution or contributions to which it is responding—that is, to its *relational context*. In QE studies, this is typically operationalized with a *moving stanza window* that consists of a referent line plus the n preceding lines that define the relational context [2]. However, this creates a problem when discussions from multiple, independent groups are recorded in the same log files. Because those

files are often recorded in time order rather than sorted into groups, the datasets are *interleaved* in the sense that adjacent lines may be from different conversations.

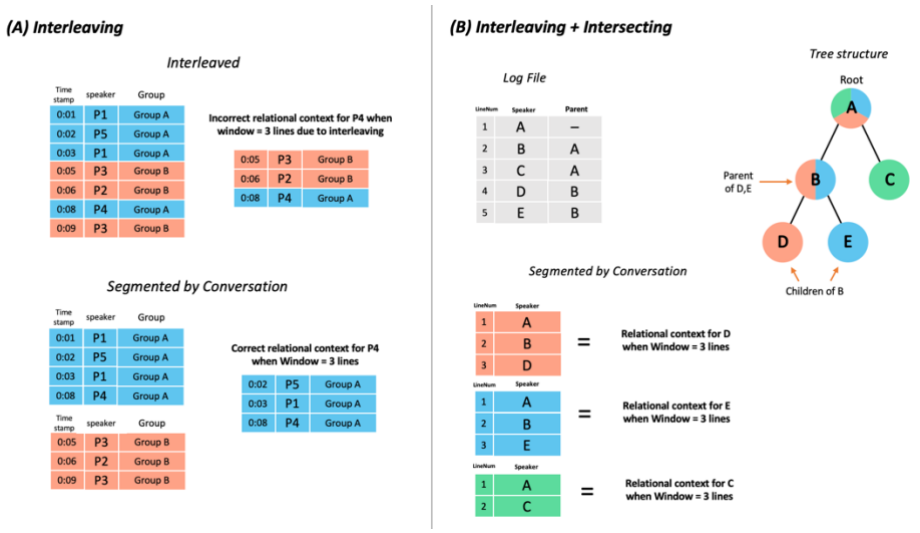

Fig. 4. (A) Temporally ordered data with *interleaving*; (B) Hierarchically ordered data with *interleaving* and *intersecting.*

For example, if we define relational context for each contribution as a referent line plus the n preceding lines in Fig. 1 (A), the relational context for the contribution of P4 (Group A) includes the contributions of P2 and P3 (Group B). However, those contributions should not be included in the relational context for P4 because Group A and Group B are independent groups—that is, P4 is not interacting with P2 or P3.

ENA solves this problem by identifying each *conversation* as the set of lines defined by a single variable (in the case of Fig. 1, group), *removing any intervening lines from other conversations*. Thus, the relational context for contribution x is defined as a referent line plus the n preceding lines *within* the conversation where x occurs. In Fig. 1 (A), the relational context for P4 includes the 2 preceding lines only from Group A (in the case of a window length of 3).

However, this solution is not effective for threaded discussion data because threaded discussions are organized *hierarchically*. Each contribution has a parent. That parent has its own parent, but also may have other children. In other words, two contributions that share the same parent are both responding to that parent, but may not be responding to each other. That is, the lines in the dataset *intersect*, in the sense that a single contribution can be part of multiple conversations. The relational context in threaded data—where each contribution is a direct response to one preceding contribution—is thus defined as the chain of responses that extends back to the original contribution in the thread (or some fraction thereof). While ENA can account for interleaving in data, it cannot account for intersecting.

To address this issue, we developed tENA, or Threaded ENA. In tENA, *each contribution is assigned to a unique conversation* which includes the contribution, its parent, its parent's parent, and so on, thereby removing any intervening lines that are not part of that contribution's direct lineage.

3 Methods

The data used for this analysis consist of one Reddit thread—"*I'm terrified that we are going to reopen our economy too quickly at the expense of human lives*"—from the subreddit *CoronavirusUS*. PRAW (Python Reddit API Wrapper) was used to scrape the posts (N = 776 posts, posted from 04/29/2020 to 05/01/2020 by 304 unique users).

We conducted grounded analysis to identify key elements of the discourse (see Table 1). Then we used the *nCoder* webtool to develop automated classifiers and test for inter-rater reliability between the human rater and each automated classifier. Kappa was greater than 0.90 and Shaffer's rho was less than 0.05 for each code.

Table 1. Codebook.

Name	Definition	Examples
ECONOMY	References to the economy or economic indicators such as unemployment.	*"It's estimated that 130 million people will die due to the global economy being shut down."*
POLITICS	References to politics or government.	*"We really need to stay cautious and look for ways to save more lives that the government has failed to do"*
COVID-19	References to or explanations of COVID-19 prevalence or incidence.	*"We've flattened the curve, hospitals weren't overloaded …"*
LETSOPEN	Assertion that lockdowns, stay-at-home orders, or other measures to restrict human contact should end, or that businesses and services should open or reopen.	*"You can continue to stay home until there is a vaccine but it's time for the country to start slowly reopening."*
TOOSOON	Assertion that reopening the country (e.g., lifting lockdown or stay-at-home orders) is risky, harmful, or otherwise undesirable.	*"But just reopening without a plan will cause suffering and death. That's the bottom line."*

Data was segmented by post, and Conversation was defined as each unique thread based on parental lineage. A moving stanza window of 2 lines was used because most of the posts were in conversation only with the immediate parent post.

First, we measured the accuracy of standard ENA applied to threaded data by identifying the number of moving stanza windows that included utterances other than the parent of a post (which is all that should be included in a window of 2 lines). Second, we randomly reordered the lines of our original dataset to generate a dataset with the same code frequencies but different code distributions. Third, we constructed three network models: (1) an ENA model of the original dataset; (2) an ENA model of the random dataset; and (3) a tENA model of the original dataset. Finally, we compared the three plots to determine whether node placements and connection strengths were different.

4 Results

In the ENA model of the original data, only one of the 774 moving stanza windows (0.13%) contained the correct parent for the referent line. In fact, the ENA model of the

original data (Fig. 2, Center) is virtually identical to the ENA model of the random dataset (Fig 2, Left), which contained the same coded lines but randomly reordered. The tENA model (Fig. 2, Right) of the original data is markedly different from both other models.

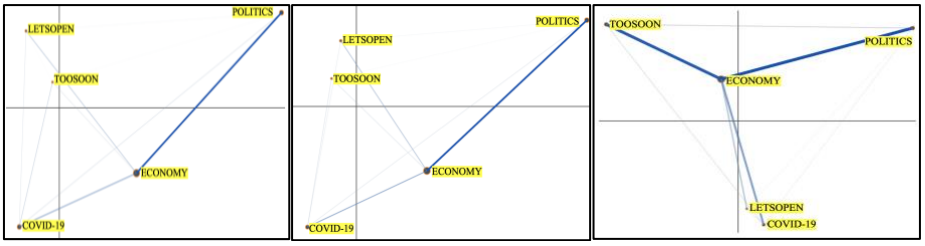

Fig. 2. *Left:* ENA model of the random dataset. *Center:* ENA model of the original dataset. *Right:* tENA model of the original dataset.

The primary difference between the ENA models and the tENA model is the connection between ECONOMY and TOOSOON, which is markedly stronger in the tENA model and better fits the qualitative interpretation of the discussion. This connection is an important part of the discourse, as the post that initiated the thread argued that the United States should not reopen its economy at the expense of people's lives, and many subsequent posts made connections between ECONOMY and TOOSOON.

5 Discussion

Our results suggest that while standard ENA does not model threaded discourse appropriately—it is, in fact, equivalent to modeling randomly reordered data—tENA accurately models the relationship between each post and its parent post. Future work will explore whether sibling posts, rather than just parents, should be included in the relational context when modeling threaded data.

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References

1. Shaffer, D.W.: Quantitative Ethnography. 1st edn. Cathcart Press, Madison, WI (2017).
2. Siebert-Evenstone, A. L., Arastoopour Irgens, G., Collier, W., Swiecki, Z., Ruis, A. R., & Shaffer, D. W.: In search of conversational grain size: Modelling semantic structure using moving stanza windows. Journal of Learning Analytics, 4(3), 123–139 (2017).
3. Weninger, T. "An Exploration of Submissions and Discussions in Social News: Mining Collective Intelligence of Reddit." *Social Network Analysis and Mining* 4, no. 1: 173 (2014).

Does Online Services Improve Social Security Disability Insurance Application Experience?: Analyzing Online Forum Data with Epistemic Network Analysis

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Abstract. The Social Security Disability Insurance (SSDI) application process is known to be exceedingly complex and time-consuming. Therefore, in December 2008, the Social Security Administration (SSA) launched iClaim, an improved online application system to make the process easier. This study examines seven different online discussion forums on SSDI to analyze and compare how the users in those forums communicated challenges they faced in the Pre and Post-iClaim eras.

Keywords: Epistemic Network Analysis (ENA), iClaim, Social Security Disability Insurance (SSDI)

1 Introduction

The Social Security Disability Insurance (SSDI) program provides benefits to workers who become disabled. At the end of November 2020, 9.7 million Americans were receiving SSDI benefits. Unfortunately, two-thirds of the roughly 2 million SSDI applications received every year are denied. About 95% of the applicants denied benefits appeal the decision, and approximately two-thirds of those are awarded benefits. The average time between appeal and benefit award is 22 months. The extended length of the process causes unnecessary strain on applicants by delaying access to benefits and drives preventable costs to the Social Security Administration (SSA).

In December 2008, the Social Security Administration (SSA) launched iClaim, an improved version of the online application system, intending to reduce application completion time, allowing third parties to access and submit applications, and facilitating access to application status. It is estimated that iClaim accounted for 7.5 percent of the increase 24% increase in SSDI applications nationwide from 2008 to 2011 [1]. However, it is unclear whether iClaim has indeed streamlined the complex processes and alleviated the difficulties that the applicants often encounter.

Existing SSDI-related research overwhelmingly rests on surveys and interviews based on self-reported data, which might not reveal unique personal situations or reach financially vulnerable populations. Moreover, the gap in the information about the

nature and quality of applicants' first-hand experiences navigating SSDI applications makes it hard for SSA to glean insights into those struggles. This study contributes to the literature by investigating discourse in online discussion forums on SSDI, a novel source of information for SSDI-related research.

Previous research has shown that online forums give access to individuals with more diverse backgrounds and can improve the well-being of stigmatized group members [2, 3]. Online forums also facilitate communication in a friendly context, enabling users to share their experiences, feelings, and advice in a non-threatening environment [4]. Therefore, these forums offer authentic insights into how applicants think and act regarding SSDI applications. To understand the challenges that SSDI applicants face regarding the iClaim program and how they communicate about them, we analyze and compare the patterns of discourse in online discussion forums on SSDI during the Pre- and Post-iClaim periods.

2 Method

We scrapped user-generated content spanning from 2004 to 2020 from seven online discussion forums on SSDI (Federal Soup, FreeAdvice, Hadit, MSWorld, NeuroTalk, Physical Evaluation Board, and SSDFacts). Next, we segmented the data by each post, resulting in a total of 141,728 posts contained in 19,987 unique threads written by 9,015 unique authors. Because these forums are open to applicants who are seeking help, generally, each thread starts with a question from one user, and other users leave replies by sharing advice or personal experiences and providing explanations or references to alternative resources or even emotional support.

To code the dataset, we first conducted a grounded analysis of the posts to find meaningful elements of the forum discourse, resulting in six codes (See **Table 1**). Then we developed an automated coding scheme with regular expression matching.

Table 1. Codes from SSDI forums.

Name	Definition	Example
SUGGESTION	Suggesting the next possible steps or solutions.	*".... go to a disability lawyer first before going to your doctor and gathering any further medical documentation."*
RESOURCE	Referring to the external resources such as policy documents and helpful websites.	*"The website of the OPM is http://www.opm.gov/"*
QUESTION	Asking questions or seeking information from other users.	*"Do you have performance deficiencies because of your condition? .... "*
FRUSTRATION	Expressing negative emotions, mainly frustration.	*"After being injured for three years, I am exhausted by all this."*
POSITIVE EMOTION	Expressing positive emotions.	*"So glad that I listened and filed for reconsideration and took on a proactive role in making sure that I had everything I needed and then some."*
COMMUNICATION	Referring to communication with SSA, from contacting a local office to submitting an application online.	*"I called local SSA last week & set up an appt via phone to make an application for them."*

We use Epistemic Network Analysis (ENA) [5]; to analyze the users' discourse in collaborative discussion forums. Because we are interested in analyzing how individuals expressed their thoughts, we model the co-occurrences only within each post.

We define Pre-iClaim posts as those written between May 2004 and November 2008 and Post-iClaim posts as those written between December 2008 to September 2014, the end of the Fiscal Year (FY) 2014. We excluded the period October 2014 onward because the number of applications filed through the internet remained virtually unchanged until April 2020, the start of the COVID-19 pandemic. As a result, there were 5999 Pre-iClaim posts and 82929 Post-iClaim posts.

3 Results

Table 2 illustrates a representative pattern of discourse in the Pre-iClaim and Post-iClaim periods. During the Pre-iClaim period, user *BL* first asked some questions to understand the post initiator's situation more clearly. Then, *BL* suggested some possible solutions ("follow the reconsideration") to solve the post initiator's problems. On the other hand, during the Post-iClaim period, user *bluerinse103* had an issue with their SSA online account, which led them to call the SSA and learn that they may need to drive a long distance to visit their field office, which cause them a lot of stress. The later illustrates a situation in which the online application system, which was intended to ease the applicants' burden instead, caused the applicant feelings of frustration.

Table 2. Excerpts of posts written during the Pre-iClaim and Post-iClaim periods

Period	User	Post
Pre-iClaim	*BL*	*I think while your concerns are valid, you are overreacting at this point. Did you file the reconsideration? …. Have you called your Local Office to speak to someone there? Is it possible for you [QUESTION] to visit your Local Office to speak with someone in person? …. Just make sure you follow the reconsideration [SUGGESTION].*
Post-iClaim	*bluerinse103*	*…. following their instructions to try again on Monday to give their system a chance to update the new information, I got the same message. So I called them [COMMUNICATION] again and explained everything …. So they verified all of my information and told me that …. I should try again [SUGGESTION], and then if it didn't work then, I would probably need to visit [SUGGESTION] my local office. I was so hopeful and relieved [POSITIVEEMOTION] over the weekend, and now I have to deal with the prospect of driving a long distance … but this is just so frustrating [FRUSTRATION]*

The mean positions of the posts written during Pre-iClaim and Post-iClaim in **Fig. 1** (center) suggest that the two groups are different in terms of their positions on the X-axis. A two sample t-test assuming unequal variance showed that Pre-iClaim group (mean= -0.21, SD= 2.91, N=5999) was statistically significantly different at the alpha 0.05 level from Post-iClaim group (mean= 0.04, SD=2.55, N=82929; t(6683.3)= -6.6802, p=2.579e-11, Cohen's d= 0.09).

The Pre-iClaim network plot (**Fig. 1**, left) shows a strong connection between QUESTION and SUGGESTION. In contrast, the Post-iClaim network plot (**Fig. 1**, right) shows a strong connection between SUGGESTION and FRUSTRATION.

Furthermore, according to the mean subtraction plot (**Fig. 1,** center), Pre-iClaim

posts tend to mention COMMUNICATIONS and RESOURCES in the context of interactional aspects. In contrast, Post-iClaim posts are more likely to mention COMMUNICATIONS and RESOURCES in the context of emotions.

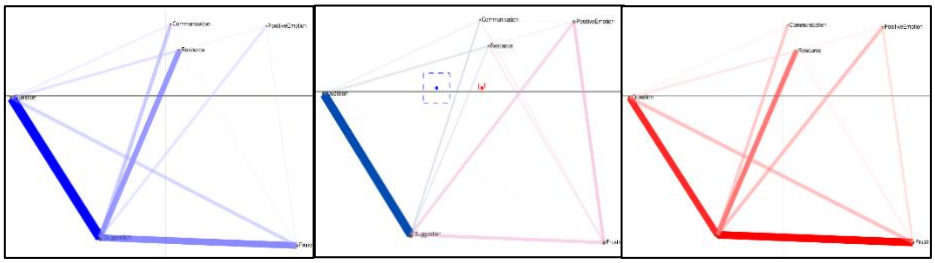

Fig. 1. Mean ENA network plots for Pre-iClaim posts (left) and Post-iClaim posts (right), and subtracted mean network plot (center). Squares are group means; the dashed boxes are 95% confidence intervals (t-distribution).

4 Discussion

This study shows how Pre-iClaim posts and Post-iClaim posts show different discourse patterns in online discussion forums on SSDI. When referring to communication with the SSA, the Pre-iClaim posts focused more on the interactional aspects, whereas Post-iClaim posts concentrated more on the emotional aspects. The results suggest that applicants face particular challenges when using iClaim that put an emotional strain. For example, applicants who expect that using iClaim would eliminate the effort of visiting the field office but end up having to visit their field office anyway after encountering some difficulties with the online application system may experience feelings of frustration. Future studies could further examine why and how iClaim can be putting pressure on SSDI applicants.

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Madison. The opinions, findings, and conclusions do not reflect the views of the funding agencies, cooperating institutions, or other individuals.

5 References

1. Foote, A., Grosz, M., Rennane, S.: The Effect of Lower Transaction Costs on SSDI Application Rates and Participation. J. Policy Anal. Manage. 38, 99–123 (2019).
2. Pendry, L.F., Salvatore, J.: Individual and social benefits of online discussion forums. Comput. Hum. Behav. 50, 211–220 (2015).
3. Wright, K.B.: Communication in health-related online social support groups/communities: A review of research on predictors of participation, applications of social support theory, and health outcomes. Rev. Commun. Res. 4, 65–87 (2016).
4. Barak, A., Boniel-Nissim, M., Suler, J.: Fostering empowerment in online support groups. Comput. Hum. Behav. 24, 1867–1883 (2008).
5. Shaffer, D.W., Collier, W., Ruis, A.R.: A tutorial on ENA: Analyzing the structure of connections in cognitive, social, and interaction data. J. Learn. Anal. 3, 9–45 (2016).

Using Tweets to Understand Physicians' Experiences of Discrimination in the Workplace

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Abstract. Biased and discriminatory behaviors have historically been, and continue to be, a serious problem in the field of medicine. These behaviors have major impacts on the career satisfaction of medical providers, including trainees such as medical students and residents, and have been associated with burnout, negative effects on wellness, and attrition from practice. The Twitter platform can offer a unique perspective on discrimination in medicine from the perspectives of both resident physicians in training and attending physicians currently working in medicine. Given that ENA is a useful method for understanding differences in qualitative descriptions of experiences, this approach will be utilized to detect and represent differences among the publicly shared experiences of attendings and residents. Tweets from both residents and attendings will be coded for experiences of and reactions to discrimination in the clinical workplace, and the network models between residents and attendings will be compared. This work will allow for a better understanding of the nuances of reactions to discrimination based on position and power in the medical system hierarchy.

Keywords: Discrimination, Medicine, Twitter.

1 Background

Diversity in the medical workforce has been linked to better patient care [1]. However, biased and discriminatory behaviors, or differential treatment of an individual or group based on actual or perceived characteristics, have historically been, and continue to be, a serious problem in the field of medicine. These behaviors have major impacts on the career satisfaction of medical providers, including trainees such as medical students and residents, and have been associated with burnout, negative effects on wellness, and attrition from practice [2]. Replacing medical providers contributes not only to medical system costs, but also has negative impacts on patient care. The medical system has not yet been successful in addressing the current climate to ensure that physicians from underrepresent groups are just as likely to be successful in their medical training and to persist in their medical careers. Overall, academic medical environments are often rated as less supportive by those from underrepresented groups in terms of navigating the academic space and transitioning to professional practice [3]. Additionally, medical

providers may not report all issues of bias and discrimination through official channels for fear of career retaliation or a lack of confidence that any action will result, [4], making investigating these issues through multiple means imperative. In some medical fields, such as surgery, attempts to address issues of diversity have remained stagnant. A recent study found that surgeons from underrepresented groups make up just 7% of academic surgery faculty in the US, and [5] diversity in the surgical pipeline has not increased significantly in the last 15 years [3]. Knowing the experiences and reactions of those resident physicians in training to work in surgery and other medical fields as well as of those attending physicians currently working in medical practice is essential for taking concrete steps to improve the medical environment. Understanding variations in the experiences of these groups is important given the hierarchal nature of the medical field, which may lead to differences in how these groups speak about, take action against, and receive supported for these experiences.

1.1 Understanding the Problem

Twitter is a social media application on which people express personal opinions on topics and content related to a variety of issues. Recently, Twitter has become increasingly popular in academic surgery as a place for promotion of scholarly work as well as discussion of workplace issues [6]. Thus, the Twitter platform can offer a unique perspective on discrimination in medicine from the perspectives of both resident physicians in training and attending physicians currently working in medicine.

2 Methods

2.1 Data Collection

Tweet Binder, a twitter scraping service, will be used to scrape data from November 1, 2007 to August 4, 2021. Keywords, such as *discrimination, bias, medical education, and medicine,* were used to do an initial search and identify the time period in which tweets related to these issues in medicine began to appear on Twitter. Tweets on these topics have continued to increase since that time, with a peak during the early part of the COVID-19 pandemic, which further exposed issues of discrimination related to medical care. We will use the username and the text content of the tweet for analysis. Additionally, we will look at user profiles to determine whether the users are resident trainees or attending physicians.

The technique of Epistemic Network Analysis (ENA) will be used to attempt to understand similarities and differences in the discrimination experienced by residents and attendings [7]. While we anticipate that there will most likely be similarities in the types of discrimination experienced by residents and attendings, given the hierarchal structure of the field of medicine, we hypothesize that the ways in which they respond to these instances will be different. Since ENA is a useful method for understanding differences in qualitative descriptions of experiences, we believe this approach allows for the detection and representation of differences among the publicly shared experiences of residents and attendings. This work will address the question of whether there is a significant difference between resident physician trainees and attending physicians in how discrimination in the medical environment is publicly discussed on Twitter?

2.3 Qualitative Analysis and ENA

After reviewing the data, members of the research team will develop codes using an inductive process of conventional content analysis [8]. Two researchers will code the tweets, and Cohen's kappa and Shaffer's rho will be calculated. ENA will then be used to compare the networks of codes between residents and attendings.

3 Anticipated Results

Tweets from both residents and attendings will be coded for experiences of and reactions to discrimination in the medical workplace, and the ENA network models of residents and attendings will be compared. Table 1 presents examples of tweets from both a resident trainee and an attending surgeon discussing issues of discrimination in the medical environment.

Table 8. Example tweets from a resident trainee and attending surgeon.

Clinician	Example Tweet
Resident	*GOOD JOB SISTER. I Was Recently asked to take of hijab and i would be guaranteed an interview for residency. I politely declined. I have good qualifications but my hijab was something that wasn't going to settle with the residency committee. Thank you for sharing*
Attending	*This is what happens in #medicine everyday. Rampant #discrimination. We stopped bordering on illegal territory. Now we live there. @acgme, is it acceptable for residencies to ask applicants to remove religious attire?*

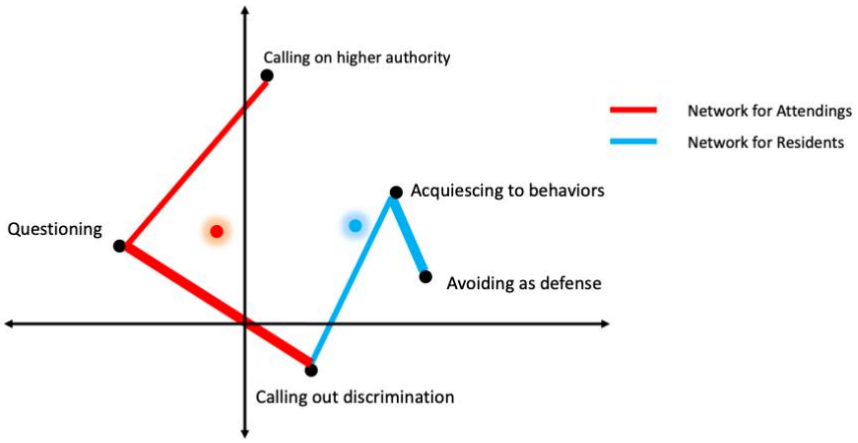

Fig. 1. An example of hypothesized differences in networks between residents and attendings.

As can be seen from the tweets, the resident physician publicly called out the discrimination but also talked about how they had to avoid the environment altogether, potentially negatively impacting their training opportunities. In contrast, the attending surgeon was able to call out the discrimination as illegal, publicly question the system, and tag a governing body responsible for resident training programs to address the situation. As such, one hypothesis is that, while both residents and attendings may call out discriminatory behaviors, given their relative lack of power in the training environment, residents may be forced to acquiesce to these behaviors and avoid these environments, whereas attendings have more power to question these behaviors and systems and call on higher institutional authorities to do the same, as represented in Figure 1.

4 Implications and Areas for Discussion

This works seeks to better understand publicly reported experiences of and reactions to bias and discrimination in the medical workplace. Investigating differences in perspectives of resident trainees and attending physicians will allow us to better understand the nuances of reactions to discrimination based on position and power in the medical system hierarchy. This knowledge will help to facilitate the better design of support systems and interventions targeting discrimination based on the issues identified by multiple stakeholders at different levels within the system. Given that this is certainly a complex issue, knowing what to focus on for intervention based on our findings may be challenging and will benefit from discussion. Finally, while specific to the field of medical training, the methods and results from this study can facilitate discussion of issues of discrimination in other workplace-based learning settings and might prove useful to those who are taking on this work in other learning environments.

References

1. Silver, J.K., Bean, A.C., Slocum, C., Poorman, J.A., Tenforde, A., Blauwet, C.A., Kirch, R.A., Parekh, R., Amonoo, H.L., Zafonte, R., Osterbur, D.: Physician workforce disparities and patient care: a narrative review. Health Equity. Jul 1;3(1):360-77 (2019).
2. Osseo-Asare, A., Balasuriya, L., Huot, S., Keene, D., Berg, D., Nunez-Smith, M., Genao, I., Latimore, D., Boatright, D.: Minority resident physicians' views on the role of race/ethnicity in their training experiences in the workplace. JAMA network open. Sep 7;1(5):e182723 (2018).
3. Bingmer, K., Ofshteyn, A., Bliggenstorfer, J.T., Steinhagen, E., Stein, S.L.: Where is the leak in the surgeon pipeline?. The American Journal of Surgery. Nov 1;220(5):1174-8 (2020).
4. Snyder, C.R., Schwartz, M.R.: Experiences of workplace racial discrimination among people of color in healthcare professions. Journal of Cultural Diversity. Sep 1;26(3) (2019).
5. Valenzuela, F., Arenas, M.A.: Underrepresented in surgery:(lack of) diversity in academic surgery faculty. Journal of Surgical Research. Oct 1;254:170-4 (2020).
6. Logghe, H.J., Selby, L.V., Boeck, M.A., Stamp, N., Chuen, J., Jones, C.: The academic tweet: Twitter as a tool to advance academic surgery. Journal of surgical research. Jun 1;226:8-12 (2018).
7. Shaffer, D.W.: Quantitative Ethnography. Cathcart Press, Madison, WI. (2017).
8. Hsieh, H.F., Shannon, S.E.: Three approaches to qualitative content analysis. Qualitative health research. Nov; 15(9):1277-88 (2005).

Using Epistemic Network Analysis to Make Meaningful Connections Between First-Year Medical School Courses

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Abstract. Medical schools regularly evaluate their curricula for alignment, relevancy, and to make recommended modifications. Using narrative student course evaluations are an untapped mechanism to determine possible course and curricular changes. In this study, Epistemic Network Analysis (ENA) was used to illustrate relationships between two courses in a first-year medical school curriculum. Findings from this study indicate curricular alignment and slight qualitative differences between the courses, and suggest ENA can offer valuable insights in the curriculum evaluation process.

Keywords: Medical Education, Curricular Change, Course Evaluations, Narrative Student Evaluations, Epistemic Network Analysis.

1 Introduction

Faculty, department chairs, and administrators regularly use student course evaluations for feedback on the course experience within higher education [1]. However, the focus of analysis for these evaluations is usually on the quantitative or numerical survey results, with limited attention to narrative comments. More broadly, courses are periodically reviewed to determine continued relevancy and curricular fit, usually as part of a wider curriculum review and evaluation. The selected medical school for this study is currently in the beginning stages of just such a curriculum evaluation. Epistemic Network Analysis (ENA) was used to discern the relationships between two courses in the first-year medical school curriculum, with the goal of determining alignment and if potential curricular and/or instructional changes are supported.

2 Theory

Curriculum theory comprises four dimensions: the aims or objectives, content or subject matter, methods or procedures, and evaluation and assessment [2]. The current analysis fits within the evaluation and assessment dimension of curriculum theory. This fourth dimension refers to the determination of whether the curriculum has been implemented successfully. How institutions utilize student-provided information for curriculum evaluation is largely uncharted territory in medical education, with few exceptions [3]. Given the intense need for carefully considered change in medical

school curriculum [4], the ability to utilize student feedback on course evaluations as one curriculum evaluation mechanism would offer unique insights into the student experience.

Epistemic Network Analysis (ENA) is a quantitative ethnographic technique for modeling the structure of connections in data [5]. ENA models the connections between Codes by quantifying the co-occurrence of Codes within narrative information and was developed to model theories of cognition, discourse, and culture. In the context of the current study, ENA was used to model meaningful connections between Codes across two courses. Given the challenges associated with medical education curriculum change [6], having the ability to understand meaningful connections from students' perspectives could offer useful information regarding curricular change.

3 Methods

3.1 Data Collection

The current study focused on narrative student course evaluations for first-year courses from the 2019-2020 academic year. Two courses were selected because of their known curricular similarities; both courses focus on integrating practical and clinical skills needed for practicing medicine. Emergency Medical Technician (EMT) training is the first course medical students take, immediately followed by Integrated Practice of Medicine 1 (IPM1). Both courses are team-taught by multiple faculty.

A total of 94 evaluations from EMT and 211 evaluations from IPM1 were included in the analysis. Each set of evaluations contained responses to the same six questions or topics: general module organization and content; module assessment; the overall modules and suggested module improvements; module weaknesses; and feedback on module resources. The term 'module' is used interchangeably with 'course'.

3.2 Data Coding and Analysis with ENA

Codes from the narrative responses were determined during three thematic coding processes using nCoder [7], an automated coding tool, and two human coders. Afterwards, repeated spot-checking of Codes and refining keywords was handled by the same human coders. Table 1 indicates Codes, their corresponding definitions, sample keywords, and sample student responses. The ENA tool [8] was used to create individual networks depicting question responses by Codes for each course using course as the units, and course and question as the conversation.

Table 1. Codes, Definitions, Sample Keywords, and Sample Responses.

Code	Definition	Sample Keywords	Sample Responses
Learning Supports	Student-indicated objects, materials, experiences, etc. that support learning in and across courses.	were helpful, tied everything together, were beneficial	lecture outlines were helpful, and so were the clinical videos.

Course Clarity	Student perception that materials used to teach or learn are clear, organized, logical, and easy to understand.	well-organized, good flow, clear outlines, clearly presented	the module was very well organized and informational
Positive Faculty Impact	Student perception that faculty genuinely cared about their teaching, about students and their learning, and made a positive impact.	genuinely cared, willing to help	…faculty were very supportive in making sure we understood concepts.
Clinical Relevancy	Student perception that topics they learn in class apply in the clinical environment in which they are/will be working.	clinically relevant, clinical correlates, clinical skills	Every assessment had clinically relevant situations and content…
Fair Assessments	Student perception that an assessment is representative of what they were taught in a course and is objective in nature.	assessments were fair, fairly tested, fair representation	Assessments are a fair representation of the material.
Materials Errors	Student-identified errors in course materials, assessments, quizzes, outlines, etc., such as grammatical errors, typos, and/or incorrect information.	wrong answers, misspellings, simple errors, mistakes	There were several questions on quizzes and tests that had typos, missing information, or grammatical errors.
Inclusivity Concerns	Student-raised concerns related to diversity, equity, and inclusion in the course material, discussions, assessments, etc.	inequalities, diversity, bias, disparities, minority, race	I think some of the patient cases could be reviewed for more diversity and inclusion topics.
Technology Issues	Student-reported technical difficulties and/or errors with technology or software used for the course, such as with Panopto, Canvas, imbedded audio, etc.	audio problems, speed adjustments, technical issues	Clinical skills videos often have audio issues.
Assessment Problems	Student-indicated problems with quizzes, formative or summative assessments, clinical skills exams, etc., such as confusing questions, mismatches between content taught and tested, etc.	misaligned questions, confusing test questions, clearer scenarios	Assessments were often disconnected from class content covered in lecture.
Obstacles to Learning	Student-identified obstacles within the course that create confusion, hinder or interfere with learning. Includes poor course and/or lecture organization, unclear or confusing materials, lack of resources, etc.	was confusing, difficult to understand, prevented learning	The module felt a little disjointed in the order in which material was presented.

Poor Coordination Among Faculty	Student perception of how content coverage and course material is managed across different faculty that teach in the module.	better coordination, more consistency, between faculty	Consistency in information presented to us by adjuncts is an area for improvement.

4 Results

4.1 Qualitative Findings

Emergency Medical Technician (EMT) training introduces core clinical skills and ends in students passing required exams to receive EMT certification. Through this training, students begin their career in medical education as a member of an interprofessional healthcare team and reflect on their experience within the framework of the objectives of the Integrated Practice of Medicine 1 (IPM1) modules. IPM1 then expands students' clinical reasoning and skills, moving students towards competency as physicians. As such, these two courses are intentionally designed to be connected and aligned.

In this study, the qualitative results show similar themes across the selected first-year courses, in that students similarly discuss course clarity, clinical relevancy, learning supports, fair assessments, positive faculty impact, materials errors, assessment problems, and obstacles to learning (see Table 1 above). The results also show a few differences, such as EMT students discussing concerns about poor coordination among faculty and IPM1 students discussing inclusivity concerns and technology issues. This section focuses on these qualitative differences.

EMT students stated concerns about coordination among faculty and offered suggestions about how to address that, such as in the following quote. "*Many of the adjuncts contradicted each other as far as what was expected of us, what the NREMT would be like, and on other areas, so having a better line of communication with the adjunct faculty would improve organization of the course overall*." Further suggestions around improving coordination can be seen in another quote: "*I also recommend that all adjuncts are trained the same way on how to preform assessments and lab skills*." These concerns were not expressed by students in the IPM1 course.

IPM1 students stated a few concerns about having technology issues, such as "*Clinical skills videos often have audio issues*."

Highlighting the inclusivity concerns expressed by several IPM1 students is the following quote: "*I think faculty together are working towards a more inclusive way of teaching and presenting learning topics where all will benefit from. There is much room to grow and improve… I would like to see in the future more IPM faculty of color. I believe this will benefit both student and peer faculty growth, learning, and development. As we seek to make learning topics more inclusive, touching on topics that involve race, gender, sexual orientation, etc. I believe we can go a little deeper. Many of these topics just scratched the surface this year and I think for true learning to take place we need to be open to having time and a safe space for these deeper discussions*."

4.2 Quantitative Findings

The current ENA analysis showed similarities and possible differences between student responses for each course (see Fig. 1). The main similarities exist in how each course connects clinical relevancy, course clarity, fair assessments, learning supports, positive faculty support, and obstacles to learning (see center of the difference network in Fig. 1). A close review of the ENA networks suggests possible differences between the courses. The first possible area where IPM1 and EMT might differ is that inclusivity concerns is connected more strongly to several codes in IPM1 than in EMT (see difference network in Fig. 1).

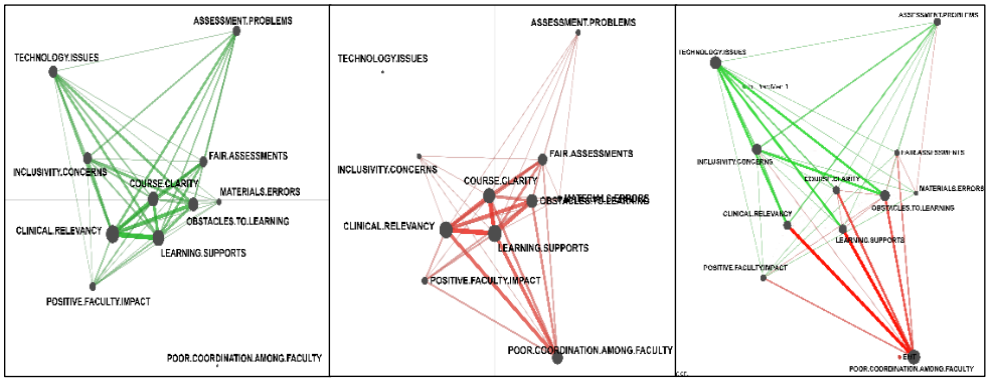

Fig. 1. From left to right, ENA models for IPM1, EMT, and the difference model between the two courses.

The second area where the ENA networks show a possible difference is how IPM1 responses connect technology issues and assessment problems with other codes, which is not seen in EMT. For IPM1, student comments such as "*would love to be able to have proper audio with the examination examples in the future*." and " I *really wish I could have used the videos made by the professors showing us how to do physical exams that were posted on youtube, but many had serious audio issues and I couldnt understand the audio, I wish they could be rerecorded*." demonstrate how students made connections between technology issues and assessment problems.

The last area of possible difference is that EMT has more connections to poor coordination among faculty, whereas this code does not show up in IPM1. In EMT, student comments such as "*the way skills or assessments were being taught varied from adjunct to adjunct, therefore, leading to confusion amongst the students*" and "*Better communication when it comes to having a standard for how a student should learn a critical skill*" show students' perception of poor coordination among faculty, and also how that connects to clinical relevancy.

Of critical note, Mann-Whitney tests on both axes showed no statistically significantly differences between courses. Along the X axis, EMT (Mdn=-0.24, N=6) was not statistically significantly different at the alpha=0.05 level from IPM1 (Mdn=0.22, N=6, U=13, p=0.48, r=0.28). Along the Y axis, EMT (Mdn=-

0.02, N=6) was not statistically significantly different at the alpha=0.05 level from Int.Prac.Med.1 (Mdn=-0.15, N=6, U=19, p=0.94, r=-0.06). This is actually a positive result, as will be explained in the next section.

5 Discussion and Conclusion

Generally, the qualitative and quantitative findings support one another, showing similarities across courses. Since the courses are intentionally designed to be aligned in the curriculum, the fact they are not statistically significantly different supports that alignment generally exists between the two courses. Beyond this alignment, however, the ENA networks offer a closer view of slight differences between the courses, which was supported by the qualitative findings. For inclusivity concerns, these topics are built into the curriculum for IPM1, so it is unsurprising to see connections there and not in EMT. Arguably though, inclusivity topics should also be incorporated into the EMT curriculum. While EMT responses show assessment problems, they were not connected to technology issues, which was seen in IPM1. This difference could be due to the nature of exams requiring and incorporating more software in IPM1 than in EMT. Lastly, given that both IPM1 and EMT are co-taught by a team of faculty, it is surprising to see concerns for poor coordination among faculty for one course (EMT) and not the other (IPM1). It should be noted, however, that a different group of faculty teach each course. This difference in faculty groups could offer an explanation for the observed difference perceived by students.

Overall, these difference findings between courses indicate the IPM1 course needs to address some technology issues and assessment problems, and perhaps inclusivity concerns, while the EMT course needs to address poor coordination among faculty. Some of these challenges appear to be instructor or technology related, rather than curricular in nature. Still, the ENA networks and qualitative results offer insights into curricular alignment (lack of statistically significant differences) and could aid evaluators in identifying curricular problems versus instructor or technology challenges.

The current analysis expands the use of ENA to students' narrative comments and provides a glimpse into themes and patterns that emerge within and across courses in a first-year medical school curriculum. A better understanding of emergent themes and patterns can offer a data driven method for more accurate decision-making as medical schools consider course and curriculum changes. Working in that fourth domain of the curriculum theory [2], this practical contribution provides more robust information for curriculum coordinators and senior leadership to consider when evaluating the curriculum.

References

1. Boyson, G. A., Kelly, T. J., Raesly, H. N., Casner, R. W.: The (mis)interpretation of Teaching Evaluations by College Faculty and Administrators, *Assessment & Evaluation in Higher Education*, 39:6, 641-656. (2014).

2. Scott, D.: (Ed.) Curriculum and Assessment (Vol. 1). Greenwood Publishing Group. (2001).
3. Yeng-Kahn, A. M., Baker, C. E., Lomis, K. D.: Medical Students' Perspectives on Implementing Curriculum Change at One Institution. *Academic Medicine*. 92(4), 455-461 (2017). doi: 10.1097/ACM.0000000000001569
4. Sklar, D. P.: Implementing Curriculum Change: Choosing Strategies, Overcoming Resistance, and Embracing Values. *Academic Medicine*. 93(10), 1417-141 (2018). doi: 10.1097/ACM.0000000000002350
5. Shaffer, D. W., Collier, W., & Ruis, A. R.: A tutorial on epistemic network analysis: Analyzing the structure of connections in cognitive, social, and interaction data. *Journal of Learning Analytics*, 3(3), 9–45 (2016).
6. Buja, L.M.: Medical education today: all that glitters is not gold. *BMC Med Educ.* 19(110), 1-11 (2019). https://doi.org/10.1186/s12909-019-1535-9
7. nCoder Online Tool. https://www.n-coder.org/ , last accessed 04/26/2021.
8. ENA Online Tool. https://app.epistemicnetwork.org/ , last accessed 04/26/2021.

How Does Physician Payment Reform Affect Health Care Quality?

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Abstract. Epistemic Network Analysis was used to model health systems/insurers' strategies of improving health care quality in response to the physician payment reform under the Affordable Care Act. Non-integrated health systems/insurers were compared to integrated ones. Although no significant difference between these two groups was found so far, the results suggested physician payment reform might have a larger impact on non-integrated organizations, and integrated organizations might be devoted to care coordination on a broader scale.

Keywords: Epistemic Network Analysis, Physician Payment, Care Coordination

1 Introduction

The physician payment reform under the Affordable Care Act (ACA) intended to shift the payment model away from fee-for-services to improve health care quality and constrain health care costs [1]. Understanding strategies that health systems/insurers took in response to this reform is crucial for future payment model initiatives and policy-making decisions.

2 Theory

Multiple alternative models, such as pay-for-performance, bundled payment, and accountable care organizations, were promoted by the physician payment reform under ACA. These models link health systems' revenue to the health care quality and/or let health systems share financial risks with insurers, which help align interests of health systems and insurers to improve health care quality and constrain health care costs.

This study focused on two useful tools--health information technology and care coordination--for health systems/insurers [2, 3]. As some health systems and insurers are integrated--health systems owned health plans, or affiliated with insurers--and integrated organizations might have a stronger link to care coordination [4], comparison between the non-integrated health systems/insurers and integrated ones were made.

The transcribed interviews published in the *Conversation* section of the journal *New England Journal of Medicine Catalyst* from 2016-2017 were modeled by Epistemic Network Analysis (ENA). These interviews are with leaders of health systems/ insurers.

ENA, which is a quantitative ethnographic technique for modeling the structure of connections in the data, would show the linkages among physician payment reform, health care quality, health information technology, and care coordination [5].

3 Method

The ENA was modeled based on codes in Table 1. Each interview is a conversation; each sentence is a line. In total, 32 interviews, of which including 3060 lines, were analyzed. A moving window stanza with a window size of 8 lines was applied. The unit of analysis is each individual in an interview. The entire interview was classified into the integrated group if its main interviewee is an integrated organization leader. An automated coder, nCoder, was applied for coding. All codes had Cohen's $\kappa > 0.65$ and Shaffer's $\rho\ (0.65) < 0.05$ between a human rater and the automated classifier.

Table 1. Codebook and IRR scores.

Code	Definition	Example	Kappa (rho)
Physician Payment Reform	moving away from fee-for-service	off fee-for-service, bundled payment	1.00 (0.02)
Health Care Quality	quality of health care services	high-value care, better care, patient satisfaction	1.00 (0.02)
Health Information Technology	information technology applied to health/health care	electronic medical record, Epic, information flow	1.00 (0.00)
Care Coordination	bridge gaps between patient care activities	team of experts, care coordinator	0.94 (0.04)

4 Results

4.1 Qualitative analysis.

The qualitative data show that the connection between physician payment reform and health care quality exists in both non-integrated and integrated groups. However, this connection might be stronger among non-integrated organizations, as integrated organizations might rely less on physician payment models to improve care quality. As in Table 2, a non-integrated provider provided feedbacks to Medicare (an insurer) to help upgrade the payment models, so that the model could better align with the goal of care improvement. However, for integrated organizations, the provider and the insurer are in one organization, they could interact internally through methods other than payment models to improve health care quality.

Table 2. Health Care Quality and Physician Payment Reform example.

Group	Interview except	Code
Non-integrated	*...we gave significant feedback back to Medicare, and now Medicare has revised both the **Bundled Payments** for **Care Improvement** program as well as the **Comprehensive Joint Replacement program,** their mandatory program, to differentiate between those two.*	Health Care Quality, Physician Payment Reform
Integrated	*I think the fundamental relationship that enables health care to be delivered with **higher quality** and lower cost is a payer/provider interaction that goes beyond simply **changing the incentives** that go from the payer to the provider.*	Health Care Quality, Physician Payment Reform

It is worth mentioning that, although health information technology and care coordination were applied by both non-integrated and integrated organizations to improve health care quality, integrated organizations might be more devoted to integrating social/community resources (e.g. housing, employment) with care delivery, which allows them to coordinate care activities on a broader scale. Table 3 shows that care coordination of a non-integrated organization is only from patients' pre-care to post-care. A leader of an integrated organization brought up that they were trying to partner with those who have mastered things like housing and employment.

Table 3. Care Coordination example.

Group	Interview excerpt	Code
Non-integrated	*...taking out that **journey** through, of course, their **pre-care, their surgery, their inpatient care, and then their post-acute care**, which can go out 30, 60, 90 days.*	Care Coordination
Integrated	*It is time we look beyond the four walls of our institutions and see how we can **partner with those who have already mastered things like housing and employment**.*	Care Coordination

4.2 ENA model

Fig. 1 shows the comparison and individual ENA networks of the non-integrated (blue) and integrated (red) groups. The non-integrated group (Mdn=(0.27,0), N=16) was not significantly different from integrated group (Mdn=(0,0), N=29) at the alpha=0.05 level (x-axis, p=0.39, r=-0.16; y-axis, p=0.97, r=-0.01).

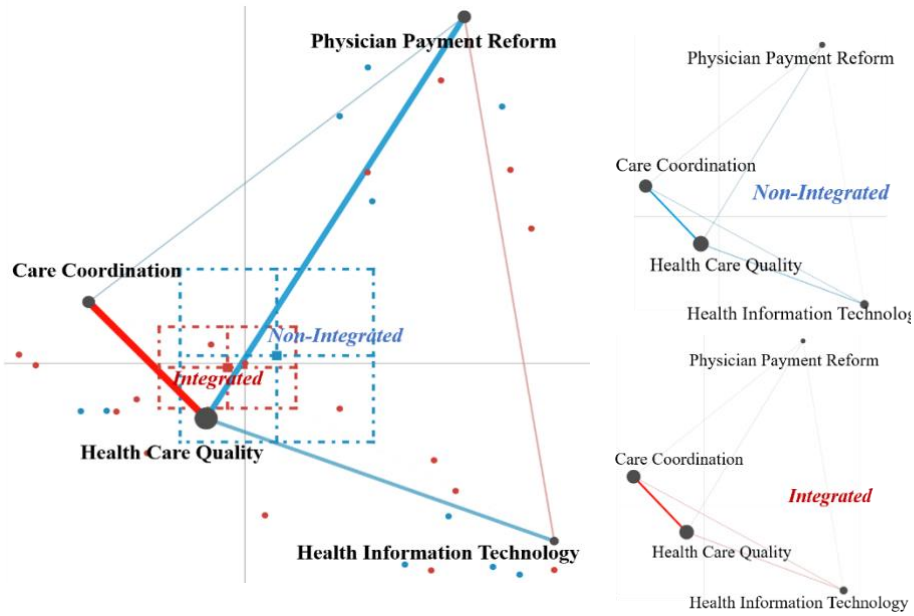

Fig. 1. Left: comparison ENA network for non-integrated (blue) versus integrated (red) groups. Right: ENA network for non-Integrated (top) and Integrated (bottom) groups.

The individual ENA networks of non-integrated and integrated groups are similar. Physician payment reform is connected with health care quality, which has linkages to health information technology and care coordination. This is consistent with the theory and qualitative data—health information technology and care coordination were applied to improve health care quality in response to physician payment reform. Individual networks also show that health information technology is linked to care coordination, which reflects that care coordination might be supported by health information technology.

The comparison ENA network shows that physician payment reform has a stronger linkage to health care quality in the non-integrated group. This could be because integrated groups improve health care quality through internal provider/insurer interactions other than payment models. Moreover, care coordination has a stronger connection with health care quality in the integrated group. This corresponds to the qualitative data—integrated organizations might be devoted to care coordination on a broader scale.

5 Discussion

This study didn't find significant difference between non-integrated and non-integrated groups in strategies of improving health care quality. However, the qualitative analysis

and the ENA model suggested that physician payment reform might have a larger impact on non-integrated organizations. This might be due to that integrated organizations have internal provider/insurer interactions. Care coordination seems to play a more important role in integrated organizations, as integrated organizations might devote to care coordination on broader scale. This corresponds to the theory that integrated organizations has stronger motivation to coordinate care.

Including additional data and adding codes that could reflect more nuanced information might provide a better understanding of health system/insurers' response to payment reform under ACA. Further research would be needed.

References

1. Baumgarten, A.: Analysis of Integrated Delivery Systems and New Provider- Sponsored Health Plans (2017). https://www.rwjf.org/en/library/research/2017/06/analysis-of-integrated-delivery-systems-and-new-provider-sponsor.html, last accessed 2021/5/6.
2. Buntin, M.B., Burke, M.F., Hoaglin, M.C., Blumenthal, D.: The Benefits Of Health Information Technology: A Review Of The Recent Literature Shows Predominantly Positive Results. Health Affairs 30(3):464–471 (2011).
3. AHRQ\Care Coordination. https://www.ahrq.gov/ncepcr/care/coordination.html, last accessed 2021/5/6.
4. Orszag, P., Rekhi, R.: The Economic Case for Vertical Integration in Health Care. NEJM Catalyst 1(3):CAT.20.0119 (2020).
5. Shaffer, D.W.: Quantitative Ethnography, Carthcart, Madison WI (2017).

Epistemic Network Analysis of Reddit Comments Relating to COVID-19 Vaccine News on the r/Coronavirus Subreddit

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Abstract. This study examines how discourse changed in response to global COVID-19 vaccine news articles, posted on the Reddit subreddit, r/Coronavirus, between November 2020 to January 2021. This analysis was conducted in April 2021, as part of the 2nd Annual COVID-19 Data Challenge, hosted by the International Society for Quantitative Ethnography (ISQE). Comments were coded using nCoder and modeled using Epistemic Network Analysis (ENA), to examine changes in discourse before and after December 17th, 2020. Overall, a positive attitude for COVID-19 vaccines was expressed across time and conversation. This excitement for the vaccine shifted from a connection with safety to a strong connection with rollout, signifying a widespread sense of preparedness to receive a vaccine and its benefit to resolving the COVID-19 pandemic.

Keywords: nCoder, Reddit, COVID-19, Vaccine, Epistemic Network Analysis (ENA)

1 Introduction

Following a heavy year with millions dead across the world, the possibility of a COVID-19 vaccine finally became a reality over the past year [3]. The World Health Organization (WHO) has proposed that global vaccination will be the quickest way to subside COVID-19 outbursts and be a key in the global effort to return to normalcy [2]. Yet, among citizens, globally and domestically, increased concern about vaccines have been voiced in the media [5].

Reddit is a social news site, aggregated by niche topics, including the largest community engaging in COVID-19 related discussions online, r/Coronavirus [4]. This abundance of vaccine-related conversation produces a large volume of textual data well situated to examine users' opinions about recent events and news articles.

Our team from the COVID-19 Data Challenge set forth to utilize this data and understand how r/Coronavirus users' perceptions of COVID-19 vaccines shifted over time. Comments attached to a sample of vaccine-related posts in the r/Coronavirus subreddit were used as lines of data in the following analysis. Quantitative Ethnography

methodologies, unique for their capacities to handle big data and tell rich stories with qualitative data, were utilized to better understand the discussion in relation to vaccine information.

2 Methods and Design

The data in this study included 31,000 user comments in response to 290 vaccine-related articles posted on r/Coronavirus. This dataset, uploaded by Xing Han Lu, was extracted from Kaggle and included only r/Coronavirus posts containing links to credible sources or news articles [4]. Additionally, r/Coronavirus is moderated to ensure content is objective and political discussion is absent [4].

Topic modeling aided the process of selecting common sentiments and concepts expressed in user comments. Inductive coding generated potential topics of interest, which our team iteratively reduced to a consensus subset for analysis. The chosen topics of interest for analysis are in the codebook (Table 1.) and are in small caps throughout this paper.

In order to analyze the data using Epistemic Network Analysis (ENA), each line of data needed to be binarily classified as containing zero or more of the codes in the codebook. Each line corresponded to a single utterance, which was defined as one user comment. Given the impracticality of manually coding 31,000 lines of data, nCoder was leveraged to automate the coding process [1].

Table 1. Codebook.

Code Name	Definition
Vaccine	Mentioning of a specific vaccine or manufacturers associated to its creation or distribution
Excitement	Expressed excitement or enthusiasm about getting a vaccine, vaccine news or details
Rollout	Any discussion surrounding the rollout of vaccine(s) or their distribution and availability
Government	Discussion centered around governmental decisions or regulations
Distrust	Concerns with a vaccine's positive effect in curbing the spread of COVID-19
Safety	Discussion on broader vaccine safety and their efficacies

Lines were classified as Pre, or Post, depending on if its comment date was before or after December 17th, 2020 (midpoint). Each article in the dataset was studied as a unit of analysis. For example, one unit consisted of all the lines (string of comments) associated with post title "Six in 10 Americans are willing to receive COVID-19 vaccinations – Gallup." A conversation was defined as all comments before or after the midpoint, each having the same comment date. Aggregate networks were produced in ENA to compare differences in discourse connections before and after the midpoint. Connections between two codes were defined by their cooccurrences within a post, using a moving stanza window of three lines.

3 Results

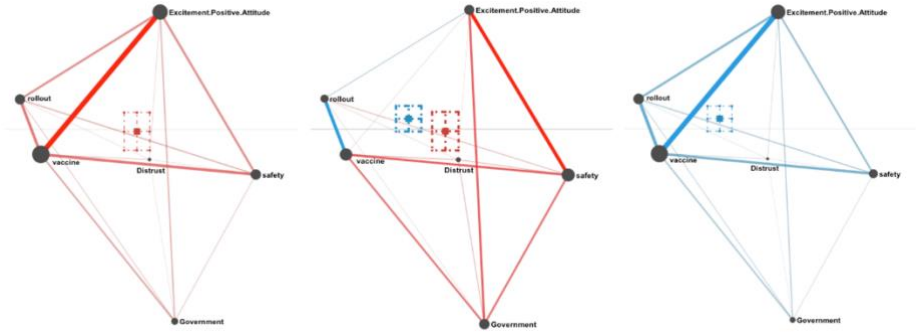

Fig. 1. Mean discourse networks for Pre (left, red), Post (right, blue), and a difference network graph PrePost (center). X-axis MR1 (18.1%), Y-axis SVD2 (24.8%).

The Pre graph (left), highlights that the strongest connection was between VACCINE and EXCITEMENT. Ex. "I'm in the Moderna trial and I'm fairly sure I received the real thing and not the placebo. I'm pretty excited as well." Likewise, the Post graph (right) reveals that the strongest connection was also between VACCINE and EXCITEMENT. Ex. "I'm on the J&J trial! Excited to see how it does." The difference in their strength of connection across time was 0.01 (0.61 Pre/ 0.60 Post). The code DISTRUST had weak connections between all co-occurring codes, but the strongest of these was between DISTRUST and VACCINE (0.08 Pre).

The resulting difference network, shown in the Pre/Post graph (middle), reveals statistically significant differences between the patterns of discourse connections made pre and post, along the X-axis at a 0.01 level of significance ($P < 0.01$). The primary driver of this statistically significant difference is that in the Pre mean network, there were stronger connections between EXCITEMENT and SAFETY, whereas in the Post mean network, there were stronger connections between VACCINE and ROLLOUT. Furthermore, from pre to post, the node size for ROLLOUT increased, while the node size for SAFETY decreased, indicating more frequent code occurrences of ROLLOUT in user comments and less frequent code occurrences of SAFETY across time.

4 Discussion

The most prominent connection in user comments, both before and after the midpoint, was between EXCITEMENT and VACCINE. Excitement and trust in the safety and authorization of these vaccines remained constant. This was unsurprising considering Reddit users' liberal political leanings and the fact-based, non-speculative or conspiratorial posting rule r/Coronavirus enforces to limit unreliable information [6].

This study contradicts research supporting the notion that globally and domestically, the citizenry held increasingly higher concerns regarding COVID-19 vaccines [5]. Instead, this study showed DISTRUST was not prominent in user comments, which again is rooted in r/Coronavirus users' continual trust in the scientific process of vaccine development and their authorizations for use. The efficacy of the vaccine trials appears to be fully supported in the comments of r/Coronavirus users.

The change in connection between VACCINE and ROLLOUT aligns with the transition from trials and development of the vaccines to their dissemination. In this time, the FDA gave emergency use authorization of both the Pfizer and Moderna vaccines, shifting comments about vaccine efficacy towards additional excitement about vaccine availability [3]. As additional vaccines were authorized, the focus centered on the equity of distribution across populations, ranging from frontline professionals to individual citizens and the logistics of when individuals could receive their vaccine.

The limitations include the importance of including Reddit responses to date (June, 2021) due to updated vaccine developments. Since millions have now been vaccinated, different patterns of connections may be revealed. Additionally, new topics of interest for analysis may emerge. Future analysis would require consideration of the fact that each comment was in response to a distinct article and its bias. Furthermore, as the bulk of this research was conducted during the COVID-19 Data Challenge, fully validating the codebook remains a work in progress. As a result, inter-rater reliability (IRR) remains uncalculated.

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References

1. Cai, Z., Siebert-Evenstone, A., Eagan, B., Shaffer, D.W., Hu, X., Graesser, A.C.: nCoder+: A Semantic Tool for Improving Recall of nCoder Coding. In: Eagan B., Misfeldt M., Siebert-Evenstone A. (eds) Advances in Quantitative Ethnography. ICQE 2019. Communications in Computer and Information Science, vol 1112. Springer, Cham. (2019).
2. COVID-19 vaccines, https://www.who.int/emergencies/diseases/novel-coronavirus-2019/covid-19-vaccines, last accessed 2021/06/05.
3. COVID-19 Vaccine Distribution: The Process, https://www.hhs.gov/coronavirus/covid-19-vaccines/distribution/index.html, last accessed 2021/06/06.
4. How Reddit's coronavirus community became a destination,
5. https://www.nbcnews.com/tech/tech-news/how-reddit-s-coronavirus-community-became-destination-n1162661, last accessed 2021/06/09.
6. Marco-Franco, J. E., Pita-Barros, P., Vivas-Orts, D., Gonzalez-df-Julian, S., Vivas-Consuelo, D.: COVID-19, Fake News, and Vaccines: Should Regulation Be Implemented? International Journal of Environmental Research and Public Health 18(2), 744 (2021).
7. Pew Research Center, https://www.journalism.org/2016/02/25/reddit-news-users-more-likely-to-be-male-young-and-digital-in-their-news-preferences/, last accessed 2021/06/05.

Marx and ENA? Analyzing Alienation with Epistemic Network Analysis

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Abstract. Marx's *Estranged Labour* posited Capitalism alienates humans from their true nature as a consequence of being part of the working class. This alienation is considered a central detrimental effect of the Capitalist system. How alienated workers feel has been shown to vary considerably demographically however. In this project, we use Epistemic Network Analysis to analyze how subjects talk about work. We find younger workers have very different thoughts on work and meaningfulness compared to older workers. Implying they question the alienation of their labor, younger workers more strongly characterize work through connections between meaningfulness, passion and helping others. Older workers however make more connections between meaningfulness, family and income, tending to characterize work as meaningful in providing them with an income through which to support their family.

Keywords: ENA, Labor, Alienation.

1 Introduction

Ever since Marx's seminal (1844) work, *Estranged Labour*, one of capitalism's central detrimental effects has been viewed as the alienation Capitalism's coerced labor causes workers to feel from their own innate labor. Less specific research has been able to investigate how this alienation manifests between groups or is subjectively perceived. In this project we analyze essays workers wrote about their job and if it is meaningful. For the purposes of this analysis, we operationally define alienation as a lack of meaningful interest in work. Using automated classifiers, we code the data for a variety of topics. We subsequently use ENA to build a model that distinguishes between how young and old subjects connect topics differently. Throughout findings we conclude that young workers question the alienation of their labor more so, while old workers are more likely to embrace it.

2 Methodology

Data for this project comes from the Work Stories Corpus (Morrison 2019), a dataset containing subject's qualitative essays on if their job is meaningful or not. Using

nCoder, we applied and validated automated classifiers to sentences in subject's essays. We created our final selection of codes based on reading of texts and subsequent identification, discussion and selection of notable topics and themes. We use Epistemic Network Analysis to model how subjects connect the topics.

We compare age groups of subjects. We operationalize young subjects as subjects age 35 or under, and old subjects as subjects 36 or older. We choose to divide subjects into age categories based on past research which has shown alienation varies between age groups. (Martin et al 1974). We choose 35 to be our specific cutoff because it's approximately the median age of our sample.

3 Results

Our main ENA model is presented in Figure One. Results indicate a significant difference between young and old subjects across the x-axis. Color and thickness of lines indicate which group connected which concepts more. As is visually clear, young subjects connected meaningfulness with both passion and helping people more. Qualitative examples made it clear that while not all subjects considered their jobs meaningful, most were in broad agreement in considering being passionate about something or helping people to characterize a meaningful job. Many subjects articulated that they did not have a meaningful job because they were not passionate about what they do and/or did not feel what they did was helping people.

Helping appears to be the primary concern for meaning, and one participant stated that their work would only feel extremely meaningful if they were "curing cancer or helping sick dogs". Another young worker stated that "in some respects my job is not meaningful, because I do not really have a passion for the mindless tasks that sometimes consume my day-to-day schedule". They did not find their work meaningful, because they were lacking passion or care in their everyday activities. Those young adults who did find their work to be meaningful tended to be helping people directly in their role, for example, ""I enjoy helping people, and making them really smile".

On the other hand, old subjects made disproportionally more connections between concepts on the left side of the figure. Specifically, old subjects connected Meaningfulness much more to Family and Income. Qualitative examples suggest that old subjects simply think about work far differently from young subjects. Old subjects believe work is meaningful because it provides them with income with which they can support their family.

In contrast to younger workers, older adult workers tended to find meaning from other areas of their lives and used the income from their jobs to support the meaningful activities outside of work. This ability to provide financially made their work meaningful. One older adult participant mentioned, "It allows me to provide for my family which is the most meaningful thing in the world to me" This person finds meaning in their role as a familial caretaker, and their job allows them to do this. Their specific line of work is not central to the feeling of meaningfulness. Another participant stated, "Of course my work is also meaningful as it provides me income". Money provides this individual access to needs and wants, and this gives them a sense of meaning, independent of what they do for their line of work.

4 Discussion

Young subjects in our project have arguably more directly human perceptions of what makes work meaningful. In *Estranged Labour*, Marx describes a critical human quality to have the freedom of applying mental and physical energy how one desires. Old subjects on the other hand placed more indirect emphasis on human interests defining meaningfulness in work. Old subjects seemed content in their work so long as it helped them to support their family. Ultimately, we believe these age group differences reflect life course differences which consequentially manifest alienation differently. Young people have less experience with work, and are less likely to have a family. Older people have more experience with work and are more likely to have a family. Subsequently, young people's opinion of work is less likely to be shaped by their experience of what work is, but rather by their preconceived notion of what work *should* be, which is bound to be more shaped by innate human qualities and less likely to be shaped by the economic system which they inevitably must partake in. Older subjects have been part of the capitalist system longer and their views of work are primarily shaped by their long experience with the capitalist system, a system which of course teaches one to be alienated from the work they do. Subsequently, we see many examples of older subjects constructing meaning from work not directly from the work they do, but from the indirect byproduct in that their work provides them with money, which subsequently provides them with a means to be support their family, which of course is meaningful on a human level.

5 Conclusion

In this project, we have found evidence to suggest that younger workers question the alienation of their labor more than older workers do. This conclusion is supported by the clear finding that younger workers define what meaningful work should be as work that one is passionate about or helps others, while older workers define meaningful worker as simply providing the financial ability to support their family. Ultimately, this project has demonstrated a novel application of Epistemic Network Analysis in analyzing the psycho-social implications of a sociological phenomenon. Future research should continue in this vein of methodology and further unravel how alienation psychologically manifests.

References

1. Martin, W. C., Bengtson, V. L., and Acock, A. C.: "Alienation and age: A context-specific approach." *Social Forces* 53.2, 266-274 (1974).
2. Marx, K.: Estranged labour. (1844).
3. Morrison, M., Kale, S.: "The Work Stories Corpus: Full-Time Workers Talk about Their Jobs, With Accompanying Psychological Data", (2019). https://doi.org/10.7910/DVN/QTL28S, Harvard Dataverse, V1, UNF:6:cKhtda0y3Y9/rZqi/EItyw== [fileUNF]

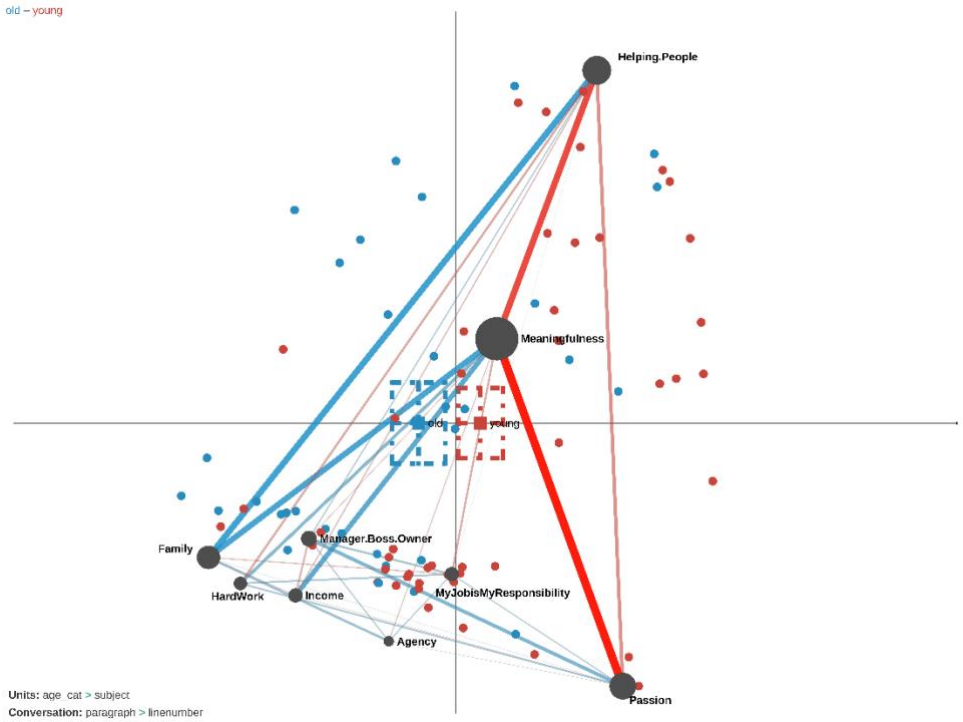
old – young
Helping.People
Meaningfulness
old
young
Family
Manager.Boss.Owner
HardWork
Income
MyJobisMyResponsibility
Agency
Passion
Units: age_cat > subject
Conversation: paragraph > linenumber

Fig. 1

Change the Museum: Initial Analysis of Social Media Posts Reflecting on Museum Workplace Experiences

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Abstract. This study examines posts to the Change The Museum Instagram account about the observed and personal experiences in the museum workplace from June – July 2020. Overall, the strongest connections were between Positional Influence, Microaggressions, and Race. Results found in posts of observed behavior additionally indicated connections with Ignorance, while personal experience posts indicated more connections with Gender, Employment, and Retaliation. These complimentary results indicate the importance of calling out observed behavior, while also empowering employees to report their own firsthand experiences to get a fuller picture of the issues facing the museum workplace.

Keywords: Museum Workplace, Diversity, Racism Microaggressions, Policy Change.

1 Introduction

Change the Museum (@ChangeTheMuseum) is an Instagram account that invites stories for "pressuring US museums to move beyond lip service proclamations of anti-racist missions by amplifying anonymously-shared, crowdsourced tales of unchecked racism" [4,6]. Since June 2020, the administrators have shared over 800 posts as of September 2021, with over 50k followers and countless more through reposts and shares on other social media platforms. The site receives posts through a Google Form and asks users to confirm that those facing discrimination have granted permission to share the occurrences, which are either personal or observational in nature. The account follows and shares content from other arts accountability campaigns, including @artandmuseumtransparency, @changetheboard, @changethemuseum_aunz (for content specific to Australia and New Zealand), @museumworkersspeak, @salarytransparency, @show_the_boardroom, and several museum unionizing-effort accounts. This range points to shared concerns for accountability in museums [3,6].

The phenomenon of creating a space for arts and culture workers to share experiences about their respective institutions with the collective museum sector coincided with statements made by museums—internally to staff and online through

press releases, blogs, and social media posts—about the COVID-19 pandemic, the deaths of George Floyd and many people of color, and conversations or plans for efforts related to inclusion, diversity, equity, and accessibility (IDEA, also abbreviated in other combinations).

This study seeks to examine how racism is personally experienced or observed by staff in museums as expressed through posts on Change The Museum. It considers the effects of microaggressions, employment, and institutional culture, including positional influence of or retaliation by management and leadership. Such an analysis necessarily addresses intersectional identities, which may include a combination of race and ethnicity, gender and gender identity, and sexual orientation [2]. Fears of retaliation, feeling invisible and unsupported, or experiences of inaction when claims were raised to management emerged as factors that inhibit sharing or seeking change through internal channels within the museum.

2 Methods

This study looks at 199 posts from June – July 2020 on the Change The Museum Instagram that were written as first person accounts. Posts were designated into two categories: Personal or Observed. Personal posts directly involved the person who submitted while Observed posts described witnessed situations. Sample posts are in Table 1.

Table 1. Examples of Observed and Personal Posts.

Type	Example Post
Personal	…I came into work with my hair braided, this same supervisor told me I looked different that day and said "you look... DARKER. Must be the braids." I was completely shocked. I never reported him, since I wanted to be promoted and I knew I wouldn't be if I complained.
Observed	…the senior curator on the call referred to herself as Hitler…I guess as a way to be self-critical of her own behavior, but she had Jewish assistants, and it was uncomfortable for everyone.

A codebook was developed from a grounded analysis of the data, seen in Table 2. Coding of each post was carried out by two raters, followed by a process of social moderation to reach agreement on its final coding. Epistemic network analysis (ENA) was used to examine the pattern of connections between observed and personal experiences described in the posts. For this analysis, a post was defined as both the unit of analysis and conversation. Co-occurrences of factors across the entire conversation were included in the model. A minimum edge weight threshold of 0.3 was applied to highlight the most salient connections in the network.

Table 2. Codebook of constructs used in analysis.

Type	Definition
Race	Referring to a person or people on the basis of their membership in a particular racial or ethnic group

Gender	Referring to a person or people on the basis of their gender
Employment	Involving aspects of hiring, advancement, recruitment
Ignorance	Example of explicit or intentional ignorance on an issue; explicit lack care/empathy of issue; explicit lack of experience with an issue
Microaggressions	Common verbal, behavioral or environmental slights, whether intentional or not, that communicate hostile, derogatory, or negative attitudes toward culturally marginalized groups; includes instances of unconscious bias
Positional Influence	Relating to position of power, privilege roles (e.g. supervisor, senior leadership, board member; not donor, volunteer)
Retaliation	Punishing someone for engaging in legally protected activity
Tokenism	Referring to instances when an individual is the symbolic representation of diversity; can include instances of fetishization

3 Results and Discussion

ENA models of Observed and Personal posts are in Figure 1. The nodes represent each coded construct and lines (or edges) between the nodes represent the strength of the connection between each construct, with thicker lines indicating stronger connections. The results indicate a distinct difference between Observed posts and posts of personal experiences (Personal). Along the X axis (MR1), a Mann-Whitney test showed that Observed (Mdn=-0.24, N=57) was statistically significantly different at the alpha=0.05 level from Personal (Mdn=0.12, N=142 U=6012.50, p=0.00, r=-0.49).

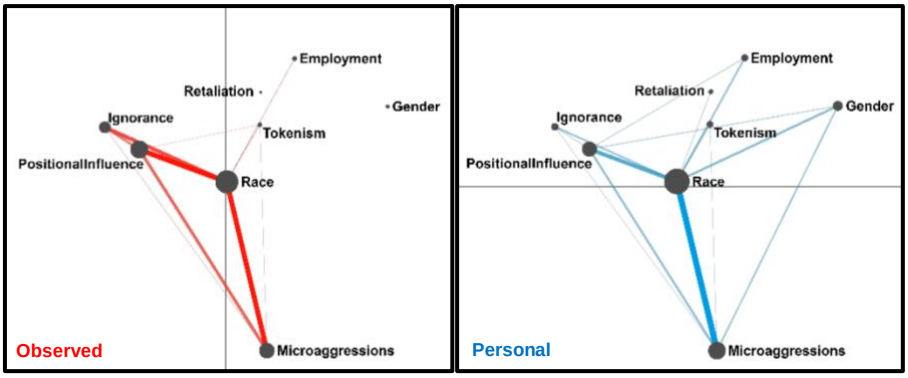

Fig. 5. ENA models of observed experiences (left) and personal experiences (right).

In both Observed and Personal network models, the most prominent links are between Race, Microaggressions, and Positional Influence. In Observed posts, there are stronger connections for Ignorance with both Positional Influence and Race. The connection of Positional Influence and Microaggressions is also strong. In Personal posts, distinct connections with Race emerge, including Employment and Retaliation. Gender is called out with Race and Microaggressions. These occurrences indicate that posts sharing observations are more related to positions of influence, while personal posts include less visible, more intimate issues (such as Retaliation and Employment).

This study captures the first month and a half of posts on Change The Museum about instances of unchecked racism in museums. While there was some overlap in the strongest construct connections, the two different types of posts distinguished what issues are more visible (Observed, "I saw this") and more private (Personal, "I experienced this"), with issues concerning the latter would otherwise go unnoticed unless such firsthand accounts were shared. These initial findings help show that it is both important to call out behavior as it is observed, while also empowering people to report their own experiences in order to capture a fuller picture of the issues concerning the workplace. The corresponding relationship between racism, microaggressions, and positional influence both from observed behavior and first person testimonials validate calls by staff for meaningful institutional change in the museum sector. A follow-up study that looks at more posts (one full year) would provide comparative insights into the issues, challenges, and concerns shared anonymously over time. An assessment of whether or not those topics are being addressed in specific and measurable ways in the goals, trainings, and action steps of museum IDEA plans would prove useful to leaders, to staff who have felt unseen or unheard, and to those who study the history of museums. This examination could occur at institutional, local, regional, and national levels.

Additional studies can consider how the posts and stories—especially those that are pinned to the profile—respond or relate to real-time occurrences, trends, or situations in museums, society, and the world (e.g. Philadelphia Museum of Art unionization, violence toward people of color, salary transparency requests). Focusing on specific groups, such as Latino/a/x or women of color (WOC) or Black staff, can deepen an understanding of the needs of staff and visitors at museums and ways these institutions can remain relevant and connected to their many audiences [1]. Expanding the constructs to include religion, limited-term staff, docents/volunteers, and donors, as well as ideas such as #MuseumsAreNotNeutral (a global advocacy initiative started in August 2017) or museums as political spaces can aid in better understanding the depth of issues and realizing potential for change necessary in the museum workplace.

References

1. Cohen, A.: *Emerging from crisis*. American Alliance of Museums. (2020). https://www.aam-us.org/2020/11/01/emerging-from-crisis/
2. Crenshaw, C.: Demarginalizing the intersection of race and gender: A black feminist critique of antidiscrimination doctrine, feminist theory and antiracist politics. *University of Chicago Legal Forum*, 1(8), 139-167 (1989).
3. Pogrebin, R.: *Upheaval over race reaches museum after curator's Instagram post*. The New York Times. (2020). https://www.nytimes.com/2020/06/24/arts/design/met-museum-staff-letter-racism.html
4. Rami, T.: *The Instagram account 'Change the Museum' is doing just that*. The Vulture. (2020). https://www.vulture.com/2020/07/change-the-museum-instagram.html
5. Vyas, D.: Social media in museum story-telling, and towards facilitating greater representation. *The ESACH Quarterly, (1),* 85-90 (2021).
6. Whiting, S.: *Top SFMOMA curator resigns as upheaval continues.* Datebook from the San Francisco Chronicle. (2020). https://datebook.sfchronicle.com/art-exhibits/top-sfmoma-curator-resigns-as-upheaval-continues

Top Tier Talk: How Leaders Conceptualize STEM Diversity Programs in Higher Education

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Abstract. As higher education institutions design and implement opportunities to support minority participation and persistence in STEM majors and careers, it benefits college and university organizers to critically reflect on the perceived impacts of their programming on student outcomes so that targeted and iterative improvements may be enacted over time. This work is the first step in a larger study funded to explore how programs and resources offered by a regional alliance of schools may have shaped minority student participants' exploration of science, technology, engineering, and mathematics (STEM) majors and careers over time. The poster will illustrate how faculty alliance representatives from three schools (a state-assisted, privately governed university, a private university, and a community college) describe the programs and resources they offer to students at their respective schools in semi-structured virtual interviews. Epistemic network analysis will be used to connect themes that emerge from their discourse: (a) themes related to what opportunities they offer at each school (i.e., financial resources, workshops, etc.), and (b) themes related to perceived student impact (i.e., major completion, job acquisition, etc.). Completed models will be shared with each institution leader to further their intentional reflective processes, as well as a form of member checking. This work is positioned to extend existing work that has used quantitative ethnographic techniques to interrogate the complexity of teacher practices to school-wide programming enacted by administrative-level faculty.

Keywords: STEM Minority Participation, Administrator Reflections, Epistemic Network Analysis (ENA).

1 Background and Research Goals

Despite recent increases in the number of accessible careers in science, technology, engineering and mathematics (STEM) in the United States, minoritized groups remain underrepresented in these fields [1]. This troubling trend has persisted even as research on regional university alliances and related academic supports have shown promise for encouraging STEM minority participation over time [2, 3]. In response to these findings, the National Science Foundation released a 2020 STEM Education visioning re- port [4] which advocated for higher education institutions to intentionally implement structural changes that can support equitable STEM participation, stressing the need for

higher education leaders such as administrators, faculty and staff to consider their roles in the "education ecosystem" and to reflect intentionally on how their beliefs, statements and actions (including the resources and programming they offer as a result of this positionality) may affect student outcomes.

The perspectives of higher education leaders who organize and enact STEM minority programming have been highlighted as valuable for assessing the efficacy of such interventions [5]. Examples of research that has explored administrator and faculty perspectives often focus on their own student mentorship practices [6, 7], or on the negative effects of faculty-level microaggressions and stereotyping [8]. What may better serve the students and institutions in which these leaders work are opportunities for organizing faculty to reflect more wholistically on how they see the entire educational ecosystem – the variety of practices, beliefs, structures, resources and interventions in which they engage – as impacting student experiences and outcomes. The aim of this work was to encourage these kinds of intentional reflections in faculty representatives from three higher education institutions that are part of the Louis Stokes Alliance for Minority Participation (LSAMP), a coalition funded by the National Science Foundation to encourage STEM minority participation and retention. The research questions ask: (1) How do LSAMP leaders characterize the educational ecosystem that shapes STEM minority programming at their schools? and (2) What are their perceived out- comes in terms of student participation, retention and success?

2 Methods

This work is situated in a larger study aimed at examining how participation in LSAMP programming may have influence students' exploration of career identities in STEM [9]. Epistemic network analysis will be used to visualize patterns of associations that institution leaders draw between their characterization of the educational ecosystem at their school and their perception of student impacts.

2.1 Participants and Settings

Participants of this study are institutional leaders of the LSAMP program at three different institutions in the Greater Philadelphia Region: a private R1 institution; a state- assisted, privately governed R1 institution; and a community college. All of these three institutions have been alliance partners from the inception of the Great Philadelphia LSAMP in 1993, and they represent rich and unique institution types, student populations, and traditions.

This study adopted a purposive sampling technique; institutional leaders that were invited to participate hold crucial positions within the LSAMP programming at their respective institutions and are regular attendees to the monthly LSAMP Executive Committee meetings of the region. Each interviewee held one or more leadership titles at their institution of employment. In some cases, one or more of the leaders' official position titles related to diversity and inclusion, while others held titles as department heads for STEM departments at their school and were expected to lead diversity and inclusion efforts as a result. Two leaders from the state funded institution were inter-

viewed in tandem, and one representative from the private institution and community college were interviewed individually.

2.2 Data Collection

Leader reflection data was obtained from semi-structured virtual interviews conducted by the authors [10]. Semi-structured interview protocols were developed collectively by the research team based on prior research related to STEM identity exploration [9] and were intended to prompt leaders to both characterize the educational ecosystem at their school and describe their perception of student impacts. Given the semi-structured format of interviews, some questions were tailored to specific contextual features of the school or referenced specific programming where ap- propriate. Follow-up questions were also asked to extend themes and topics that emerged ad hoc during the interviews. Some of the examples of main interview questions included:

(1) What kinds of programming and events you have enacted to support STEM minority participation for the past five years?
(2) How do you communicate with students and recruit them for participation in these programming?
(3) How do you think your institution has been successful at encouraging students' exploration of STEM career identities? What needs to improve?

2.3 Data Analysis

The research team is in the process of transcribing the interview data and segmenting statements by sentence. Once completed, a priori codes will be identified using an inductive thematic analysis [11], involving the iterative development of topics that emerged based on open-ended review of the transcripts. Researchers will then deductively code lines of discourse for the presence or absence of each theme, with inter-rater agreement reached through social moderation [12].

Epistemic networks will be generated using the ENA Web Tool. Units of analysis will be each interview, possibly subset by an incremental variable that groups lines (i.e., every ten lines) of interview data together. We may also use the Knowledge Building Discourse Explorer (KBDeX) to identify meaningful units of analysis in the discourse [13]. Conversations in the data will be segmented between each interview, and the re- searchers may also segment between speakers based on what is learned from interpretive review of the data. The codes visualized in the network will be those identified thematically and applied deductively to the dataset. Once the models are generated, the researcher will refer back to interactions and activities coded in the data to close the interpretive loop and lend qualitative support to the development of case studies [14]. Networks will ultimately be shared with leaders to encourage further discussion and reflection on their own conceptualizations and processes.

3 Conclusion

This work will extend existing literature by using quantitative ethnographic techniques to interrogate the complexity of school-wide STEM diversity programming from the perspective of the organizers. Models and reports will also be shared across leaders in the alliance, as some have requested tools that can help them understand what other schools are doing to support their students.

Acknowledgements
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References

1. National Science Board, National Science Foundation: Science and engineering indicators 2020: The state of U.S. science and engineering. NSB-2020-1. Alexandria, VA (2020).
2. Arciero-Pino, A., Flores, B., Knaust, H., Gonzales, L., Quintana-Baker, M.: Qualitative assessment of the University of Texas system Louis Stokes Alliance for Minority Participation Summer Research Academy Abroad: An international experience in research and culture. In: 2015 IEEE Frontiers in Education Conference (FIE), pp. 1-5. IEEE (2015).
3. Foltz, L. G., Gannon, S, Kirschmann, S. L.: Factors that contribute to the persistence of minority students in STEM Fields. Planning for Higher Education 42(4), 1-13 (2014).
4. National Science Foundation: STEM education for the future: A visioning report. A Sub-committee of the Advisory Committee of the Education & Human Resources Directorate. Alexandria, VA (2020).
5. Washington Lockett, A., Gasman, M., Nguyen, T. H.: Senior level administrators and HBCUs: The role of support for Black women's success in STEM. Education Sciences 8(2), 48 (2018).
6. Womack, V. Y., Wood, C. V., House, S. C., Quinn, S. C., Thomas, S. B., McGee, R., Byars-Winston, A.: Culturally aware mentorship: Lasting impacts of a novel intervention on academic administrators and faculty. PloS one, 15(8), e0236983 (2020).
7. Mondisa, J. L., Packard, B. W. L., Montgomery, B. L.: Understanding what STEM mentoring ecosystems need to thrive: A STEM-ME framework. Mentoring & Tutoring: Partnership in Learning, 29(1), 110-135 (2021).
8. McGee, E. O.: Devalued black and latino racial identities: A by-product of STEM college culture? American Educational Research Journal, 53(6), 1626-1662 (2016).
9. Foster, A.: CAREER: Projective reflection: Learning as identity exploration within games for science. National Science Foundation, Drexel University, Philadelphia, PA (2014).
10. Seidman, I.: Interviewing as qualitative research: A guide for researchers in education and the social sciences. Teachers College Press (2006).
11. Creswell, J. W.: Educational research: Planning, conducting, and evaluating quantitative and qualitative research, 4th edn. Pearson, Boston, MA (2015).
12. Oshima, J., Oshima, R. Matsuzawa, Y.: Knowledge Building Discourse Explorer: A social network analysis application for knowledge building discourse. Educational Technology Research and Development, 60(5), 903–921 (2012).
13. Stake, R. E.: The art of case study research. Sage Publications, Thousand Oaks CA (2020).

Doctoral Consortium

Quantitative Ethnography of Cooking to Inform the Design of Smart FMCG Technologies

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Abstract. This research examines the interactions of fast-moving consumer goods in cooking as part of a project exploring the value of ethnographic findings for designing technologically enhanced versions of these products. To develop a method for the formation of such insights, a field study of cooking was conducted in which participants were observed as they prepared a meal in their households. A quantitative ethnographic approach was applied to build an understanding of different aspects of these interactions - including their frequential, sequential, and correlational features; aiming to elucidate the often *'seen but unnoticed'* in our everyday life. Through participatory design workshops with consumers and professionals, we are now seeking to reflect on the opportunities that quantitative ethnographic findings pose for designing technologies that fit well their practices and contexts.

Keywords: Design Ethnography, UbiComp, Domestic Environment.

1 Personal Statement

Current Status of Research I am in my last year of an interdisciplinary program conducting my fourth and final study before finishing my degree. My three prior studies consisted of an auto-ethnographic and ethnographic study of cooking, along with a participatory design workshop. The ethnographic studies were analysed through a quantitative ethnography (QE) approach. The insights gathered from this analysis have since then been visualised and presented as a resource for design in our workshops.

In this closing study, we are working together with product development professionals to explore what value our QE findings might have for the ideation of smart products. In the coming months, I will integrate these findings together to convey their relevance coherently in my thesis.

Expected Benefits of Participation I expect first and foremost to engage with the QE community and receive feedback on the research I have conducted so as to improve my thesis and future publications. Though I have made extensive use of many methods derived from QE, my training in the field has been essentially autodidactic, as it is largely unknown in my department despite their long-standing tradition in design ethnography. I strongly desire to hone my skills and knowledge in QE, and I feel my work would greatly benefit from the more formal and professional approach to this subject which is sure to be found at the conference. Beyond all of this, I also aim to build long-lasting relationships that could continue well into my research career.

Finally, I plan on sharing my experience and the value in applying findings from QE analyses to the design process while following the principles of design ethnography and participatory design. In short, I believe that my participation in the consortium has the potential to initiate collaboration and foster future joint projects between researchers at the Mixed Reality Lab at the University of Nottingham and members of the QE community.

Issues and Challenges to Explore I am exploring the potential of QE findings to provide an understanding - not only of the practice of cooking, but of the design of technologically enhanced versions of consumer goods as well. This has brought to the forefront the challenge of how to make QE findings accessible to a wider and non-academic audience. We must also work towards articulating how to conduct a QE analysis - not only on people's interactions, but also on the interactions of objects in order to attain a better understanding of their practical use. This highlights the difficulty of ascribing meaning to interactions between objects in such a way as to incorporate context rather than just from purely quantitative data. Given the conceptual nature of QE methods and their relationship with more general mixed methods approaches, we are also confronted with the challenge of striking the right balance in how they are integrated; a balance which we are tasked with finding if we are to make the most of our endeavours.

2 Summary of Research

Abstract. This research examines the interactions of fast-moving consumer goods in cooking as part of a project exploring the value of ethnographic findings for designing technologically enhanced versions of these products. To develop a method for the formation of such insights, a field study of cooking was conducted in which participants were observed as they prepared a meal in their households.

A quantitative ethnographic approach was applied to build an understanding of different aspects of these interactions - including their frequential, sequential, and correlational features; aiming to elucidate the often *'seen but unnoticed'* in our everyday life. Through participatory design workshops with consumers and professionals, we are now seeking to reflect on the opportunities that quantitative ethnographic findings pose for designing technologies that fit well their practices and contexts.

Keywords: Design Ethnography, UbiComp, Domestic Environment.

Goals of Research The purpose of this project is to provide a thorough understanding of the interactions with fast-moving consumer goods (FMCG) in the practice of cooking, then to explore the value of these findings for designing technologically enhanced products.

Background From packaged foods to personal care products, FMCGs have a pervasive presence in our lives [3]. Given the relevance that these products have for us and the increasing availability of ubiquitous computing technologies, there has been a recent focus on creating versions which use these technologies to provide additional functionalities tailored to fit their specific context of use [4]. Technologically enhanced FMCGs have the potential to positively impact our lives by supporting us in issues of great importance, such as reducing our carbon footprint [7].

To design effective technologies that fit the actual practice of use, it is necessary to first understand what is accomplished in order to then envision what might be accomplished [2]. The use of ethnographic research has been largely successful in informing the design of a variety of systems, with its recommendations grounded in empirical observations that may not normally be captured by other methods [5]. However, there still appears to be a complete absence of studies that clearly focus on FMCG interactions as they relate to any of their practices. Cooking is an exemplary case of a practice necessitating FMCGs, and it represents a setting that allows us to highlight how its complex interactions can influence design [1]. At the same time, QE [6] lends itself perfectly to revealing cooking's complexities, granting meaningful interpretations to the vast quantities of interactional data.

Methods To analyse interactional data from our cooking studies, a QE analysis was selected, thereby allowing the incorporation of contextual interpretations into the results of quantitative methodology. This analysis focused on different features of FMCG interactions; for instance, analysing *'collaboration'* allowed for identifying which sets of FMCGs and utensils were commonly used in combination. To explore the value of these QE findings for design, a participatory design approach was chosen, and these findings were presented in workshops. In these ongoing workshops, participants have been encouraged to use the insights regarding the practical use of FMCGs to sketch design concepts. Finally, to evaluate the ideas expressed by

participants through their comments and sketches, thematic analysis has been employed.

Preliminary Findings We have built a deeper understanding of different aspects of practical FMCG interactions in cooking, such as their frequential, sequential, and correlational features. We are also exploring the many possible ways that this understanding may serve as a valuable design resource for both consumers and professionals. To provide a simplistic example, we are exploring how the finding that different categories of FMCGs are used at different sections of the cooking process (see Figure 1) could influence designs of time-sensitive functionalities.

Contributions This project seeks to contribute to the exploration of how insights from QE analyses may be employed in the early stages of design. Specifically, it seeks to provide contributions in two different areas. First, it provides a

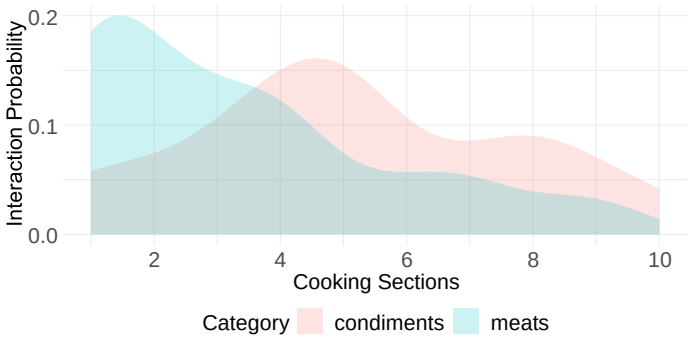

Fig.1. Probability of interactions for selected FMCG categories across time.

method to investigate and understand the interactions of FMCGs in the practice of cooking; and second, it yields insights for designing enhanced versions of FMCGs based on findings from QE. Together these contributions can prove fruitful for creating technologies well-suited for cooking in the household environment.

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References

1. Comber, R., Choi, J., Jettie, H., O'hara, K.: Designing for human-food interaction: An introduction to the special issue on food and interaction design. International Journal of Human-Computer Studies, 72, 181-184, (2014).
2. Crabtree, A., Rouncefield, M., Tolmie, P.: Doing design ethnography. Springer Science Business Media (2012).

3. Crabtree, A., Peter T.: A Day in the Life of Things in the Home. In Proceedings ofthe 19th ACM Conference on CSCW, 1738-1750 (2016).
4. Lydekaityte, J.: Smart interactive packaging as a cyber-physical agent in the interaction design theory: a novel user interface. In IFIP Conference on HCI, 687-695. Springer (2019).
5. Randall, D., Rouncefield, M., Ethnographic approach to design. The Wiley handbook of human computer interaction set (2018).
6. Shaffer, D.W.: Quantitative Ethnography. First Edition. Madison, Wisconsin: Cathcart Press (2017).
7. Shahmohammadi, S., Steinmann, Z. J., Tambjerg, L., van Loon, P., King, J. H.,and Huijbregts, M. A.: Comparative greenhouse gas footprinting of online versus traditional shopping for fast-moving consumer goods: A stochastic approach. Environmental science technology, 54, 3499-3509 (2020).
8. Wolfson, J.A., Bleich S., Clegg-Smith, S., Frattaroli, S.: What does cooking meanto you?: Perceptions of cooking and factors related to cooking behavior. Appetite, 97, 146-154 (2016).

Exploring Schooling and Networking on Social Media in COVID-19 Using Twitter Data

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Personal Statement

My name is Yiyun Fan, and I am a Ph.D. candidate of Drexel University's STEM Education doctoral program in the School of Education. I am also a research assistant in the Games and Learning in Interactive Digital Environments (GLIDE) Lab (PI. Dr. Foster) and the Methods Lab (PI. Dr. Toni Sondergeld) at Drexel University. My research interests center around learning sciences, educational technology, learning analytics, and quantitative methods in higher education. I am especially passionate about applying interdisciplinary perspectives and bringing state-of-art analytical approaches to address educational issues. For that reason, I am also pursuing a graduate minor in Data Science from Drexel University's College of Computing and Informatics. Born and raised in southern China, I finished my B. A in English at Fudan University, Shanghai. My interest in educational research started from my study about language and language teaching. I believe that quantitative ethnography (QE) bridges well with my research interests in quantitative design as well as in uncovering the meaning of language and discourse more broadly in educational research.

I am currently at the stage of developing my dissertation proposal. The general direction is to draw from large-scale, longitudinal social media data to understand the features and evolution of educational networks and internet discourse regarding schooling during the COVID-19 pandemic on social media. This will most likely be an exploratory, mixed-methods study that seeks to reveal insights from the most salient topics from educational stakeholders expressed online and how these topics evolve over time as the pandemic progresses. This direction is motivated by a paucity of educational research that takes advantage of rich social media as a primary data source to both quantitatively and qualitatively understand the social networks, topics of interest, and overall sentiment in the education community during a prolonged education in emergencies event such as COVID-19. Twitter is an ideal choice of the social media platform for such a study because of its relatively open data sharing policy and focus on text-based posts.

One of the major challenges with this dissertation design is analyzing and reporting such high-volume qualitative text-based data from Twitter effectively. I have conducted a pilot study for my dissertation at a much smaller scale that adopts social network

analysis (SNA) to investigate educational networks on Twitter from the beginning of the coronavirus pandemic (March-April 2020), which was presented as a roundtable at AERA 2021. While having hands-on research experiences with SNA, I am less familiar with quantitative ethnography (QE) and Epistemic Network Analysis (ENA). However, I believe ENA could be a powerful addition to my dissertation design as it has the advantages of quantifying and visualizing qualitative text-based data at a large scale. This can help with my analysis and presentation of longitudinal Twitter data tremendously. Meanwhile I hope to share SNA perspectives, preliminary findings, and exchange research ideas with other participants of the consortium.

I look forward to participating in the ICQE21 Doctoral Consortium and deepen my understanding of ENA and develop relevant research skills through collaborative interaction with QE scholars. Thank you for your consideration!

Exploring Schooling and Networking on Social Media in COVID-19 Using Twitter Data

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Abstract. The COVID-19 pandemic has disrupted schools worldwide and posed unprecedented challenges to education. This proposed study seeks to collect education in COVID-related Twitter data and then use Social Network Analysis (SNA) and Epistemic Network Analysis (ENA) to explore the features and evolvement of the networks and discourse among educational stakeholders on Twitter during the pandemic. This research summary presents preliminary findings from data analysis from the peak of school closures in May and at the start of the new academic year in September 2020, which sheds light on how the educational community has utilized social network as a way to connect in the time of crisis.

Keywords: Twitter, Social Network Analysis, Epistemic Network Analysis.

1 Goals of the Research

The purpose of this study is to explore the features of the educational networks and discourse on social media, specifically Twitter, during the COVID-19 pandemic and how these networks and discourses have evolved over time. The educational network here is defined as the network of educational stakeholders, namely any individuals or entities that have posted education-related tweets during a specified timeframe.

2 Background of the Project

The COVID-19 pandemic has created a new normal for education and has brought challenges to everyone involved: teachers, students, staff, parents, and policymakers. Teachers particularly need support and professional development to successfully transition from face-to-face to online teaching environments [1]. Social media provides a low-cost, accessible platform for its users to share resources and support. Informal online communities and networks, many of which form on social media, have served as an alternative to traditional, face-to-face teacher professional development (PD) [2]. Twitter, as a popular social media application, encourages text-based discourse and hosts rich longitudinal data that can provide useful insights about social phenomena [3].

There is a dearth of educational research that takes advantage of social media to understand communities and narratives among education stakeholders against an educational crisis.

3 Methodology

This research is a work-in-progress and will evolve to be a part of a mixed-methods study involving SNA, ENA, and qualitative analysis to understand salient themes within Twitter networks. This summary presents preliminary findings that compare educational networks on Twitter in May and September 2020. This study builds upon the open-access COVID-19 dataset by Banda et al. [4], who used API to capture tweets with keywords concerning “COVID19”. The researcher filtered this dataset with education-related keywords such as "school" and "student". The final dataset consists of 11464 tweets: 3045 in May and 7917 in September. The Twitter network is defined here as a directed network with nodes (Twitter users) and edges (“reply”). Analytical approaches include network density, diameter, centrality, and modularity measures.

4 Preliminary Findings

The educational network was overall sparse (density=0), with most interactions happening one-on-one (diameter=1). Few influential features exist in the network, as indicated by low centrality measures. Educational stakeholders seemed to interact with a limited number of users and rarely branching out to others (modularity being close to 1). Twitter had not yet shown its full potential in forming well-connected communities among educational stakeholders by September 2020. However, the drastically increasing tweets (nodes) about education and the growing interactions (edges) in September compared to May does indicate that social media attention had shifted to schooling against the COVID-19 context in the latter half of 2020 compared to earlier months.

5 Expected Contributions

The potential contribution of this research is twofold: Theoretically, it will deepen scholarly understanding of the implications of the pandemic on schooling, the nature of online communities for education, and the role of social media in crisis; Methodologically, the use of social media scraping and non-traditional methods such as SNA and ENA make this study an example for future educational research on similar topics.

References

1. Kebritchi, M., Lipschuetz, A., Santiague, L.: Issues and challenges for teaching successful online courses in higher education: A literature review. Journal of Educational Technology Systems, 46(1), 4-29 (2017).
2. Marcià, M., García, I.: Informal online communities and networks as a source of teacher professional development: A review. Teaching and Teacher Education, 55, 291-307 (2016).
3. Beigi, G., Hu, X., Maciejewski, R., Liu, H.: An overview of sentiment analysis in social media and its applications in disaster relief. Sentiment Analysis and Ontology Engineering, 313-340 (2016).
4. Banda, J. M., Tekumalla, R., Wang, G., Yu, J., Liu, T., Ding, Y., Chowell, G.: A large-scale COVID-19 Twitter chatter dataset for open scientific research: An international collaboration. arXiv preprint arXiv:2004.03688. (2020).

ReshapeT1D: Utilizing the Strengths of Quantitative Ethnography in Patient and Clinician Led Research to Understand Type 1 Diabetes Lived Experiences in Alberta

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Abstract. Type 1 diabetes (T1D) requires intensive education, constant monitoring, and adjustment of blood glucose which can lead to burnout and distress. Our research seeks to answer two main questions: (1) what is T1D healthcare like in Alberta? and (2) how can T1D lived experiences in Alberta support diabetes care quality improvement? Objective: To understand the opportunities and challenges in providing T1D care, identify factors associated with reduced quality of care, and provide recommendations for T1D health care. Methods: We will use narrative-based inquiry with non-proportional quota sampling based on strata for sex, geographic region, and education. Participants must be at least 18 years old, attended specialty care for 3 or more years. Recruitment will take place through social media and the connect1d.ca online patient recruitment platform. Data will be generated using a patient and clinician co-designed questionnaire and semi-structured interview guide. Each interview will be transcribed verbatim, and codes will be developed inductively using Interpretive Phenomenological Analysis by two raters working autonomously. Raters will draft a tentative code structure followed by triangulation repeated three times before final code tree development. Coding and segmentation will be performed with the Reproducible Open Coding Kit (ROCK). We will use Epistemic Network Analysis (ENA) to model networks of code co-occurrences in discourse to explore sample and subsample characteristics and describe statistical differences in narratives under scrutiny. Expected Findings: New insights into diabetes related care that will help the development of quality improvement tools in practice.

Keywords: Type 1 Diabetes, Mixed-Methods, Quantitative Ethnography.

1 Goals of Research

The goal of this research is to illuminate the lived experiences of people with type 1 diabetes (T1D) and build capacity across diabetes specialty care in Alberta.

2 Background

Type 1 diabetes (T1D) is an autoimmune disease that results in the destruction of pancreatic beta cells, leading to constant dependency on insulin and if ignored, can lead to significant short and long-term complications [1]. In Alberta, clinicians are now recognizing that solely focusing on biological surrogates is no longer an appropriate way to provide person centered care and that new methods of quality improvement are needed.

3 Methodology

We will employ a narrative based inquiry with a sample of 30-40 people through non-proportional quota sampling based on the following strata: sex (male/female), geographic region (urban/rural), education (high school / college / university / professional). Participants must be an Alberta resident of >18 years of age and living with T1D for 3+ years. Recruitment will take place through social media and the T1D patient recruitment platform, *ConnecT1D.ca*. Data will be generated through a co-designed questionnaire and semi-structured interview. Questionnaire demographics include sex, age (DOB), gender, ethnicity, urban vs rural setting, education, employment status, and health insurance status, as well as diabetes related questions.
The semi-structured interview will ask questions around themes on appointments, barriers, adaptability and resilience, and accessibility and will be transcribed verbatim and coded in two phases. First, the codes will be developed inductively using Interpretive Phenomenological Analysis by two raters working autonomously in creating codes and then collaboratively in code structure, triangulation, and code tree development. Coding and segmentation will be performed with the Reproducible Open Coding Kit (ROCK) [2].Following coding and segmentation, we will use Epistemic Network Analysis (ENA) [3] to model networks of code co-occurrences in discourse and explore sample-level characteristics to address our research questions.

4 Expected Findings & Contributions

This study will provide new innovative insights for T1D quality improvement development and contribute new evidence to the diabetes research community.

References

1. DiMeglio LA, Evans-Molina C, Oram RA.: Type 1 Diabetes. Lancet. 2018;391[10138]:2449-62.
2. Shaffer DW.: Epistemic network analysis: Understanding learning by using big data for thick description. Int Handb Learn Sci. 2018;520–31.
3. Peters, G., Zorgo, S.: Introduction to the Reproducible Open Coding Kit (ROCK). 2021; 1-8. Available from: https://r-packages.gitlab.io/rock/

Supporting Creativity in Black Girls as They Learn to Code Virtual Environments in an After-School Program

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Abstract. This dissertation is the fourth iteration of an on-going Design-Based Research study. It will examine the pedagogical processes that may support Black girls' creativity as they learn to code virtual environments. Philly Tech Camp/Black Girls in Computing will be designed to support the students' creativity while they learn to code a virtual chatbot. The data collection will focus on the students' discourses – journal reflections, interviews, and even the discourse between the user and chatbot. Through using Epistemic Network Analysis, this study seeks to disrupt the traditional norms of data collect, methods, and presentation to address contribute to creativity literature by focusing on the experiences of Black girls. Existing creativity research and literature is dominated by white voices, therefore this study seeks to address this gap and develop a method of analysis to understand and characterize Black girls' creativity processes as they code.

Keywords: Black Girls, Coding, Virtual Environments, Creativity, Identity, Epistemic Network Analysis.

1 Goals of the Research

The purpose of this study is to examine pedagogical processes that may support Black girls' creativity while they learn to code virtual environments in an after-school program. The pedagogical processes that this dissertation focus on include utilizing the culturally responsive computing and collect, analyze, synthesize, evaluate, and employ frameworks [1] to design a curriculum that offers opportunities for Black girls to engage in their creativity as they learn to code.

2 Background of the Project

Despite the Obama administration's "Computer Science for All" initiative and the numerous interventions seeking to increase computing participation in minoritized communities, there still exists a lack of diversity in computing careers [2]. One way to support Black women in CS, is to create opportunities to encourage Black girls to practice these skills. Such opportunities have been proven valuable for minoritized individuals who have encountered barriers while trying to acquire professional growth [3]. Creativity will be characterized through a after-school program that emphasizes the strengths of Black creativity for Black girls as a group to show these skills.

3 Methodology

During this program, students will learn basic coding in Python as they develop a virtual chatbot. Students will engage in activities that support their creativity, such as generating ideas, testing their programs, and evaluating feedback. Through open and focused coding, meaning will be drawn from the language and text that the students generate – chatbots, journal reflections, and interviews. I will apply ENA to document and characterize their unique experiences and develop networks across their ideas.

4 Expected Findings

The expected outcomes of this after-school program includes increased interest and self-efficacy in coding, as the participants will have a space to engage in computing related activities. The network visualizations from ENA will show specific aspects of creativity that Black girls are contributing. Lastly, this dissertation aims to produce new methods to broaden participation in computing careers by cultivating supportive environments for students to engage in a positive STEM experience.

5 Expected Contributions

One of the constructs of Black Feminist Theory is to disrupt the norms of methods, data collection, analysis, and methods [4]. ENA will serve as one of the ways to cause the disruption while documenting the creativity in Black girls. Educators can leverage the findings from this research to develop culturally responsive computing curricula that supports students' creativity.

References

1. Woodard, M., Foster, A.: Facilitating Creative Processes through Learning how to Develop Virtual Reality Environments in a Summer Camp. In Society for Information Technology & Teacher Education International Conference pp. 1900-1908. Association for the Advancement of Computing in Education (AACE) (2020).
2. Ross, M., Hazari, Z., Sonnert, G., Sadler, P.: The intersection of being black and being a woman: Examining the effect of social computing relationships on computer science career choice. In: ACM Transactions on Computing Education (TOCE), 20(2), 1-15 (2020).
3. Johnson, C. C., Sondergeld, T. A.: Outcomes of an integrated STEM high school: Enabling access and achievement for all students. Urban Education, 0042085920914368 (2020).
4. Acuff, J. B.: Black feminist theory in 21st-century art education research. Studies in Art Education, 59(3), 201-214 (2018).

Analysis of Learning Trajectories in Programming Activities Focused on Data Visualization

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Abstract. Our study aims to better understand students' trajectories in programming activities focused on data visualization. We ran a pilot study with four students to identify the key elements to characterize learning trajectories while creating data visualizations with the Dataviewer Scratch Extension and developed a tool for automated data extraction and analysis of these elements. As a next step, we intend to analyze audio recordings to combine information about verbal interactions with data from their programming processes using epistemic network analysis. We expect that our results can help us better understand how learning takes place in the context of data visualization programming activities to support students in their diverse learning trajectories.

Keywords: Data Science Education, Computational Thinking, Data Visualization.

1 Goals of the research

The purpose of our study is to characterize middle school students' programming trajectories while using the Dataviewer Scratch Extension (DSE) for data visualization purposes. By better understanding their trajectories, our goal is to improve the design of the DSE tool and to refine pedagogical strategies aimed at integrating data visualization programming activities into science classrooms.

2 Background of the project

In science teaching, the use of computational tools can deepen science practices related to data literacy and open new pathways for diverse representational forms. Drawing on this idea, we developed a Scratch extension for data visualization, the DSE [3] designed to allow kids to create visualizations for data through programming in easy and meaningful ways. With the goal of improving both the tool and the pedagogical strategies to integrate it into classrooms, we seek to learn more about students' programming trajectories while using it. Several researchers have been looking at how learning in the context of programming happens, using multiple types of analysis and tools. While some studies look at the learning outcomes by analyzing the final version of programming projects to assign scores, another approach is to use learning analytics

techniques to focus on their process rather than in their final products (e.g. [1, 4]). Such process-oriented measures, although more compatible with constructionist learning approaches, usually do not consider the role that the type of activity (e.g., creating a model, a visualization for data, or a game) plays in the programming process. In our research, we intend to focus our analysis on the specificities of learning trajectories in the context of data visualization activities.

3 Methodology and Preliminary Findings

Our initial data was collected in a pilot study conducted with four students in 90-minute online sessions, in which they created visualizations about earthquakes using the DSE. The data collected included video and audio recordings of the sessions, logs from their programming process and written reports. In our analysis, which was refined over several iterations, we defined a preliminary set of codes to characterize students' activities during the programming task and used these codes to implement a script to automatically capture and represent them as a timeline chart. As previous studies have shown [1, 2], different students followed diverse pathways while programming, but some patterns were also observed. As a next step, we intend to use epistemic network analysis with data from audio recordings and blocks used through the programming activity to better characterize their learning trajectories and look for new patterns.

4 Expected Contributions

Our study is an attempt to characterize students' programming trajectories while creating data visualizations in a comprehensive way. We expect that it can help researchers and designers to look at learning in the context of data visualization activities in new ways and, thus, better support students in their diverse learning trajectories.

References

1. Berland, M., Martin, T., Benton, T., Smith, C. P., and Davis, D.: Using Learning Analytics to Understand the Learning Pathways of Novice Programmers. *Journal of the Learning Sciences* 22(4), 564–599 (2013).
2. Blikstein, P., Worsley, M., Piech, C., Sahami, M., Cooper, S., and Koller, D.: Programming Pluralism: Using Learning Analytics to Detect Patterns in the Learning of Computer Programming. *Journal of the Learning Sciences*, 37–41 (2014).
3. Fernandez, C.: Combining computational and science practices in K-12 education. *Extended Abstracts - Proceedings of the 2020 ACM Interaction Design and Children Conference, IDC 2020*, 25–29 (2020).
4. Fields, D., Quirke, L., Amely, J., and Maughan, J.: Combining big data and thick data analyses for understanding youth learning trajectories in a summer coding camp. *SIGCSE 2016 - Proceedings of the 47th ACM Technical Symposium on Computing Science*

Education, 150–155 (2016).

Model Eliciting Activities to Learn Computational Thinking

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I am a Doctoral Candidate in The University of Texas at San Antonio. I passed my qualifying examination in May and I am working on my Dissertation Proposal. My research areas are Computational Thinking and Model Eliciting Activities. The methodology I have been using to analyze the data I have collected is Discourse Analysis and I have been using the Epistemic Network Analysis tool.

As I have advanced in my research trajectory I have incorporated different theories and methodologies that result in an innovative and forward-thinking strategy to include computational thinking in K-12 education that will benefit women and historically marginalized populations in STEM. With a tool as powerful as ENA I will be able to study aspects of the dialoge within an MEA that keep emerging after every iteration of the analysis.

Computational Thinking has been identified as key concepts that need to be mastered before students finish high-school. Computational thinking builds on power and limits of computing processes. It is a skill that will help the students solve problems, design systems and understand human behavior by thinking recursively, parallel processing and recognizing virtues and dangers of any activity. The purpose of computational thinking is to design for simplicity and elegance of the system.

My participation in the doctoral consortium would help me improve the knowledge and allow me to become proficient in ENA and quantitative ethnography. It is an opportunity to discuss results and compare methodology with fellow Ph.D. students using Epistemic Network Analysis and to learn from professors in the field. I expect to learn about coding with N-Coder and would like to learn about the advances in Machine Learning to achieve coding reliability. I expect fellow participants to learn from the studies I have analyzed with ENA and I expect to learn from their processes.

If I am honored to participate in the Doctoral Consortium I am sure other students will also benefit from my expertise in the content and from my knowledge of the methodology. During my research I have seen the challenge of doing discourse analysis in teams of high school students, I would like to explore further analysis on how to help them communicate with peers and teachers. How can they scaffold their knowledge to other students in the same and lower grades? Regarding the methodology, I would like to further analyze the window stanzas and difference in the discourse between teenagers

and adults. As I have further analyzed conversations I have found that in order for me to get better results in the plot, I need to increase the window stanza to whole conversations or at least 16 lines.

Model Eliciting Activities to Learn Computational Thinking

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Abstract. Students need tools that will help them succeed in areas such as computer science, engineering, mathematics, and education for the long run. Computational thinking is defined as the processes in formulating problems and their solutions so that they can be effectively carried out by anyone. With the use of Model Eliciting Activities, we help students understand Computational Thinking. Epistemic Network Analysis gives us the opportunity to analyze great amounts of data that was collected during the process of developing the MEAs and understand the role of the participants during the activities.

Keywords: Computational Thinking, Model Eliciting Activities, Discourse Analysis, Epistemic Network Analysis.

1 Goals of Research

How does the participation in a Model Eliciting Activity influence in the development and conceptualization of concepts such as Computational Thinking?

2 Background of the Project

Before enrolling into higher technical and programming classes, students can benefit from learning Computational Thinking. The purpose is to give them tools that will help them succeed in areas such as computer science, engineering, mathematics, and education for the long run [1]. Model eliciting activities work with problems that simulate real-life situations, the students produce artifacts as a result of the activity. Model- eliciting activities (MEA) are problem-solving activities in which students go beyond short answers and produce shareable, manipulative and reusable conceptual tools. Teachers using MEAs focus on the process students go through to come up with solutions that elicit their understanding of a specific subject [2]. Research has shifted towards a sociocultural view of teaching STEM, it has shifted from focusing on the individual as meaning making, towards individuals as part of a social context and how they function in this context [3].

3 Methods

We used a descriptive approach of discourse Analysis; Gee [4] describes discourse analysis as the study of language in use. During the study we looked at the content of the language being used in Model Eliciting Activities. Discourse analysis is a method that provided us with evidence for our theory and help us understand how students elicit conceptions of computational thinking. ENA [5, 6] analyzes data segmented, based on the principles of discourse analysis. Relationships are calculated and depicted graphically and we can look at the co-occurrence of concepts in the conversations that students have while learning a concept.

4 Preliminary Findings

The conversations between students were coded, these were the codes included in our ENA model, the conversations analyzed were all the lines associated with the MEA:

(1) Decomposition (2) Pattern Recognition (3) Abstraction (4) Algorithms

The descriptive plots result of ENA gave three very different results for each one of the groups as a result of the group dynamics. When a Model Eliciting Activity is well designed. Ideas will be generated. Each team elicited the concepts in Computational Thinking in a different way.

5 Expected Contributions

Different contributions and participation of team members is developed during a Model Eliciting Activity, with a tool such as ENA we will be able to understand how High School students elicit information and what is the contribution of each member of a team. Learning about team dynamics and power positions in the team will help future teachers when they develop STEM curriculum focused on including every student in the process of learning.

References

1. Wing, J. M.: Computational Thinking. Communications of the ACM (2006).
2. Lesh, R.A., Doerr, H.M.: Beyond constructivism: Models and modeling perspectives on mathematics problem solving, learning, and teaching. Lawrence Erlbaum Associates, Mahwah, N.J (2003).
3. Zawojewski J, Carmona G.: A developmental and social perspective on problem solving strategies. In: Proceedings of the Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education. International Group for the Psychology of Mathematics Education, Snowbird, Utah, pp 538–560 (2001).
4. Gee J.P.: Introduction to Discourse Analysis: Theory and Method. Routledge, London (1999).
5. Shaffer, D. W.: Quantitative Ethnography. Cathcart, Madison WI (2017).
6. Shaffer, D.W., Collier, W., Ruis, A.R.: A Tutorial on Epistemic Network Analysis: Analyzing the Structure of Connections in Cognitive, Social, and Interaction Data. Journal of Learning Analytics 3, 9–45 (2016).

Early Career Workshop

Stories of Intellectual Health

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Abstract. My current research explores the connections between learning and well-being. Building upon long-standing work in northern Thailand, I am interested in the relation of Indigenous storytelling and quantitative ethnography as method in the contexts of developing community-based school assessments. Specifically, I explore the possibilities of school assessments through leveraging the ethical foundations and learning theories of Indigenous families in Thailand. Data comes from a series of storytelling workshops with families and I use a mix of qualitative inquiry, video interaction, and epistemic network analysis to highlight families' complex theories of intellectual health to inform school re-designs.

Keywords: Indigenous Storytelling, Intellectual Health, Indigenous Quantitative Ethnography, Community-Based School Assessment.

1 Goals of the Research

The goal of this research is to develop a community-based school assessment tool drawing from Indigenous families' stories of intellectual health in Thailand. I ask, what are Indigenous families' intergenerational stories and theories of healthy learning and living? How can schools re-conceptualize their roles because of it?

2 Background of the Project

In Indigenous communities, stories are the theories for being [1]. In addition, recent Indigenous scholarship have suggested that "stories, discourse, numbers, and positivism are not oppositional forces but are in fact relational conspirators" [2]. The research presented here emerges from a twenty-year commitment to the teachers, young people, and families from an urban Indigenous school in Thailand called Sahasatsuksa. I document 12 Indigenous families' theories of *intellectual health* [3] and how across generations, they narrate and navigate the complex constellations of family goals. *Intellectual health* refers to how well a community engages in daily embodied processes of learning, living, and creation, including how they robustly navigate across and re-craft knowledge systems towards the regeneration of intergenerational ethics, relations, and responsibilities in life-generating ways.

3 Methods

I look to design a series of *Stories of Health* workshops in four villages to gather intergenerational stories of how families advance what they believe to be right and true, how they decide what their future generations need to know, and the role of school within these struggles. I collect video data of families' talk-in-interaction [4] and engage in interaction analysis and epistemic network analysis of family stories.

4 Preliminary Findings

This research contains innovations across in Indigenous understandings of how we code, how we segment dialogue, how we understand language through story and metaphor as they interface with quantitative ethnography so that more just and reciprocal kinds of ways of seeing and analyses are possible.

5 Expected Contributions

This study contributes important grounding frameworks for community-based school assessments. It highlights the relevance of quantitative ethnography from within Indigenous methodologies in the context of Indigenous Thailand. It offers broadened understanding of Indigenous storytelling within quantitative ethnography and methodological frameworks for understanding dimensions of learning and wellbeing. I believe that deeply engaging with these questions can help QE be a methodology and analysis tools that centers wellbeing and equity for our Indigenous families and communities.

References

1. Brayboy, B. J. M.: Toward a tribal critical race theory in education. *The Urban Review, 37*(5), 425–446 (2005).
2. Mataira, P.: Making Sense of Anecdata: Pushing the Edges of Science in Decolonizing Research. In E. Sumida Huaman & N. D. Martin (Eds.), *Indigenous Knowledge Systems and Research Methodologies: Local Solutions and Global Opportunities* (pp. 69–83). Canadian Scholars, p. 71 (2020).
3. Bang (in progress); Elliott-Groves, E., Hardison-Stevens, D., & Ullrich, J.: Indigenous Relationality is the Heartbeat of Indigenous Existence during COVID-19. *Journal of Indigenous Social Development, 9*(3), 158–169 (2020).
4. Erickson, F.: Talk and Social Theory: Ecologies of Speaking and Listening in Everyday Life (1 edition). Polity. (2004).

Personal Statement

I am writing this to express my personal statement to participate in the Early Career Workshop of the 2021 annual conference of International Community of Quantitative Ethnography (ICQE). My research focuses on investigating the impact of dialogical argumentation on grade eight students' scientific reasoning in general and epistemic knowledge of science in particular in a physics instruction. In December 2020, I had received my Ph. D. degree in *Physics Education* from Addis Ababa University.

After graduation, I am serving as an Assistant Professor in Physics at Gondar College of Teachers Education in the Department of Natural Sciences. My career objectives is to teach physics and continue to do research in science education. Epistemology is intertwined with metacognition and self-regulated learning. Metacognition and self-regulation play a paramount role in shaping students' scientific literacy, conceptual understanding, and views of the nature of science. Thus, the connections of epistemic knowledge to meta-cognitive supports and self-regulated learning strategies while doing laboratory activities and solving physics problems could be one direction of my future studies.

I am excited about this early career workshop due to many reasons. One, I will get guidance in my effort to be an independent physics education researcher. Two, the workshop will provide me a support system to produce research outputs which in turn paves a venue to contribute something to the global and local improvement efforts of science education. Third, working with scholar in quantitative ethnography further shapes my understanding of the methodology and its platforms. Fourth, the workshop will enable me to introduce with the QE community and in consequence to establish a network. In brief, working with the QE community will add a great experience and learning opportunity to my career.

I want to explore the following in the workshop.

a) I am now working on a manuscript that investigate teachers' epistemic discourse during dialogic argumentation using ENA. I want to further polish and make ready to submit to top-ranked international STEM education journals.

b) I want to further improve my understanding of ENA and my skills of using the ENA platforms.

Epistemic Practices during Dialogic Argumentation Instruction in Grade 8 Physics Lesson

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Abstract. This study aims to identify the practices and challenges faced by grade 8 physics teachers to promote epistemic knowledge through dialogic argumentation. A collective case study design was employed. Six classrooms were randomly selected after the transformative pedagogy intervention. The physics teachers had trained for three days about dialogic argumentation and its implementation. In addition, Talking Physics Students Activities manual, that contains fifty-two argumentative physics activities were distributed and used in a yearlong dialogic argumentation intervention. Post-intervention data were obtained from whole-class teaching and audio records of teacher interviews. Video data of whole class teaching were quantitated using quantitative ethnography and analyzed using epistemic network analysis. The epistemic network analysis showed weak and less frequent connections between epistemic aims, epistemic processes of construction, justification, and evaluation of knowledge. To make a better use of dialogic argumentation, therefore, well-thought-out and research-supported training needs to be given to science teachers.

Keywords: Dialogic, Argumentation, Epistemic, Scientific, Reasoning.

1 Goals of the Research

The goal of this research is to identify challenges and prospects physics teachers had faced to promote epistemic knowledge in dialogic argumentation instructional settings.

2 Background of the Project

Epistemic knowledge of science is the knowledge of how we know what we know [1]. Epistemic knowledge is essential to reconstruct and justify the knowledge produced by science. Such knowledge empowers one's functional understandings of the nature of science [2]. Its development also introduces students to core scientific practices [3].

Epistemic knowledge ranges from knowing and recognizing different scientific constructs such as hypothesis and theory to being able to justify ideas from evidence and understanding the justification for various forms of scientific inquiry [4].

Recently, dialogic argumentation has been advanced as a productive teaching strategy to develop scientific knowledge of students. Dialogic argumentation is a classroom discourse between two or more arguers that holds competing views about a particular issue. It is argued that such discourse contributes to enhancing students' scientific literacy and the competencies to "explain phenomena scientifically, to evaluate and design scientific enquiry; and interpret data and evidence scientifically" [5]. These competencies, in turn, require a synthesis of three forms of scientific knowledge: content, procedural, and epistemic knowledge. Many studies have attested the success of dialogic argumentation in improving conceptual knowledge in Africa and elsewhere [68]. However, science education studies that focuses on the epistemic practices of teachers during dialogic argumentation instruction that aims to promote epistemic knowledge of science are sparse.

3 Methodology

Using a collective case study and cross-case analysis, the challenges and prospects to promote epistemic knowledge in upper primary schools were studied by interviewing and observing the classes of six physics teachers. Videotaped whole class teachings were collected from six upper primary schools, using two video cameras place at the back and in front of the class. The interview provided information about teachers' experience in a dialogic classroom that informed the qualitative analysis of teacher epistemic practice of science. The translated and transcribed audio-video records of teacher interviews and classroom observations were qualitatively analyzed using thematic analysis and epistemic network analysis (ENA) respectively.

4 Preliminary or Expected Findings

The epistemic network analysis (ENA) of the video transcripts of six whole-class teachings, which included teachers' argumentative instructions, generated a mean network of each teacher's epistemic practices of science. The qualitative evidence was used to better understand the challenges teachers face when they promote the knowledge building process in Grade-8 science classrooms, which also supported the ENA results. Both ENA and qualitative excerpts provide the complete picture, as well as a fully comprehensive description of the epistemic practice of teachers who used argumentative instruction. Examining and understanding their challenges is a natural extension of these analyses.

As depicted Fig. 1, most of the physics teachers made weak and less frequent connections between Epistemic Aims and Constructing, Justification and Evaluation in their argumentative instructions. The strength and frequency of connections between Epistemic Aims and Constructing, Justification and Evaluation illustrate the nature of teachers' epistemic practices of science during argumentation lessons.

Fig. 1. Mean networks for six grade 8 physics teachers showing connections made between epistemic aims, constructing, justifying, and evaluating scientific knowledge claims.

5 Expected contributions

This study was among the few studies that investigated the impact of dialogic argumentation on epistemic knowledge, and as such it makes a unique contribution to the field of argumentation research in general and physics education research in particular. The study will also make a unique contribution to the field of science education research in Ethiopia in that it is the first rigorous empirical study that has investigated the impact of dialogic argumentation on Grade-8 students' knowledge in a natural classroom setting.

References

1. Kind, P. and J. Osborne, *Styles of Scientific Reasoning: A Cultural Rationale for Science Education?* Science Education, 2017. **101**(1): p. 8–31.
2. Manz, E., *Representing student argumentation as functionally emergent from scientific activity.* Review of Educational Research, 2015. **85**(4): p. 553-590.
3. Kuhn, D., *Teaching and learning science as argument.* Science Education, 2010. **94**(5): p. 810 - 824.
4. Öberg, G. and A. Campbell, *Navigating the divide between scientific practice and science studies to support undergraduate teaching of epistemic knowledge.* International Journal of Science Education, 2019. **41**(2): p. 230 - 247.
5. OECD, *Draft PISA 2015 Science Framework*. 2013, OECD Publishing: Paris, France.
6. Iwuanyanwu, P. and M. Ogunniyi, *Effects of Dialogical Argumentation Instructional*
7. *Model on Pre-service Teachers' Ability to Solve Conceptual Mathematical Problems in Physics.* African Journal of Research in Mathematics, Science and Technology Education, 2020. **24**(1): p. 129-141.
8. Murphy, P., et al., *Fostering high school students' conceptual understanding and argumentation performance in science through Quality Talk discussions.* Science Education, 2018. **102**(6): p. 1239 – 1264.
9. Von Aufschnaiter, C., et al., *Arguing to learn and learning to argue: Case studies of how students' argumentation relates to their scientific knowledge.* Journal of Research in Science Teaching, 2008. **45**(1): p. 101-131.

Symposia

Participatory Quantitative Ethnography

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Abstract. This symposium proposes that *Participatory Quantitative Ethnography (PQE)* is an important new strand of research for the QE community to develop. This paper introduces the participatory research values motivating PQE, outlines contributions from symposium speakers explaining the importance of PQE from different perspectives, before closing with a set of research questions that motivate a research agenda. It is hoped that this symposium may spark fruitful conversations and collaborations that advance PQE concepts, methodologies and tools.

Keywords: Participatory Research, Co-design, Visualization.

1 Introduction

In all fields, research must give form to data and insights. Visualizations serve as cognitive extensions that assist researchers not only in exploring their data, but in communicating findings to colleagues and broader audiences. Especially in data-intensive fields, widely used software tools define, and are defined by, research communities; you cannot fully participate in a community until you can wield its tools responsibly. In an emerging field like Quantitative Ethnography (QE), which is in part re-using current analysis and visualization tools, but also inventing new ones like Epistemic Network Analysis (ENA), how we model and map the world, and how we engage with stakeholders, are defining characteristics that merit critical reflection.

It is fair to say that QE's principles currently find fullest expression in ENA. In our view, the interest in QE is attributable not only to the power of ENA's data modelling and analysis, but also to the engaging, interactive visualizations it generates. Such diagrams are potentially more accessible to wider audiences, when introduced in

empowering ways, which opens new possibilities for bringing voices into the research process which might otherwise not be heard.

In this symposium, we will argue that the participatory research tradition raises important questions and opportunities for QE as a field. Simply put, participatory research involves participants during the stages of research. The intent is to co-create knowledge with people who are affected by the phenomena being investigated. In many participatory design traditions, researchers confront traditional colonial approaches to research and engage in collective ways of knowing and doing with historically and currently oppressed populations [1, 2, 3]. In this sense, such approaches challenge existing power dynamics and roles among the "researcher" and "the researched" and articulate the "how," "for what," "for whom," and "with whom" during the research process [4]. This humanizing and democratic research paradigm reimages ethnography as the co-construction of knowledge between ethnographers and participants [5] with the goal of interpreting cultures and developing thick descriptions [6]. This co-construction process may result in uncertain goals and tensions between collaborators, but through commitment and transparency, such tensions can be acknowledged and potentially worked through [7].

In the remainder of the paper, the symposium's participants present brief summaries of aspects of PQE that motivates their work, before we draw together some of the key questions to help define a research agenda to advance this way of working.

2 Symposium Position Statements

2.1 Simon Buckingham Shum, PQE as a Participatory Representational Practice

In my ICQE keynote talk last year [8], drawing on my background in human-computer interaction, hypermedia, visualization and educational technology, I proposed strategies that could help create more participatory, engaging representational artifacts in QE. Of those, I would like to reiterate here the challenge of cultivating researchers' skills to provide participants with a more participatory experience of QE's analytical representations. This is intended as a material practice aimed at giving participants a more active role in shaping QE research as it unfolds, rather than being informed of the results, as a *fait accompli.*

Our studies into what we termed "participatory representational practice" [9] were provoked in part by work in participatory design (PD). In our analysis of the literature, the specific skillset that the PD practitioner brings to design sessions, and the nature of their experience, had remained surprisingly under-examined. Thus, although PD efforts nearly always involve some level of facilitation, accounts of practice and research reports often left the concerns, dilemmas, and experiential aspects of the practice in the background. Very little work examined PD facilitation at the move-by-move level or provided close analysis of the interactions of participants and practitioners with visual representations.

We developed a language for *participatory representational practices* in meetings, which we termed Knowledge Art [10]. "Knowledge Artistry" is the ability to *foster,*

sustain, or restore participant engagement with visualisations, in the service of assisting collective sensemaking. Our analysis of this practice, from hours of video, was distilled into five interacting capabilities:

- *Aesthetics*. The choices we make for shaping a visualisation, e.g., what's included, what's foregrounded, what's excluded, how polished or unfinished the representation is, how editable we make it.
- *Ethics*. How our moves affect the other stakeholders, e.g., we can recognise or ignore a verbal contribution in a visual, change the meaning of what someone said in representing it, shift the topic of conversation by drawing attention to an aspect of the visual yet to be discussed.
- *Narrative*. The context for a session, e.g., the spoken/unspoken expectations of why we're here, how we should proceed, who sees representations we create.
- *Sensemaking*. How we interpret breakdowns, that is, unexpected events or anomalies that, e.g., disrupt the agenda, divert from the envisaged course of the conversation, question the validity of a representation.
- *Improvisation*. How well we make spontaneous, unplanned moves with the visualisation when such breakdowns occur, e.g., by inventing another on the fly, bringing up another view, handing the pen over to the participants and inviting them to lead.

As briefly illustrated in my ICQE20 talk, I propose that all of the above are relevant to what may happen when we sit down with participants and invite them to engage with an analytical representation in QE, such as an ENA diagram (but there will hopefully be many others in the future). It is therefore exciting to see examples in my colleagues' position statements in this paper, where they are closing the feedback loop to participants by inviting their engagement with ENA diagrams as works-in-progress and starting to think through the expressive implications for future software tools.

2.2 Mike Phillips, Using 'P' to Amplify the 'E' in QE

The QE community has undergone notable growth in recent years resulting in increasing numbers of researchers using this new methodology to represent complex and often large data sets. The growth of the QE community has not only developed new tools but has also amplified consideration of associated methodological, philosophical and ethical issues such tools bring with them.

QE tools like ENA have been used by some researchers for a number of years; however, the growing use of this powerful visualisation instrument by an increasingly diverse range of researchers has resulted in new ways in which ENA visualisations can be used. Drawing on Pike's foundational work in linguistics which made the distinction between etic and emic understandings of a phenomena, researchers using QE tools such as ENA develop *etic* visualisations of connections between tacit or ethereal concepts that have meaning in research parlance but are not commonplace in *emic* practitioner discourse; however, an increasing number of researchers have begun using ENA to amplify the 'E' in QE by using these etic visualisations as a tool to concretise and externalise these tacit, research oriented ideas with the participants - an approach we are proposing to call Participatory Quantitative Ethnography (PQE).

One such example from my own work [11] is taking various forms of theorised teacher knowledge and examining how different teachers use combinations of knowledge forms to make pedagogical decisions. In earlier work, I used these etic visualisations of teacher practice as the basis for conversations with the teachers who provided me with insights into their professional practice. Using the concretised visualisations helped the teachers put labels on elements of their practice that they would have otherwise described in less refined ways. This enabled them to not only discuss the visualisations with one another but importantly provide alternate perspectives on their practice that were not evident in the visualisations themselves. These emic ideas provided me with entirely new insights into the work of these teachers that were not contained in the data that I had originally collected.

This example of the translation of etic to emic provided me with incredible insights and now forms an important consideration when designing future QE studies. One of the potential challenges we have is that the powerful ENA representations that we are able to analyse are not always simple things for many participants to be able to understand. To avoid potential misunderstandings or misinterpretations, we need to consider new, simpler, yet equally powerful visualisations that are still grounded in the same empirical data but provide more opportunities for participants to make comments.

This use of *member checking* is an important ethnographic process [12] and in a QE context, the visual and interaction design principles, and researcher skill set, required to engage stakeholders with representations of their activity in ways that empower them requires new considerations. At the outset, I would argue these include as a minimum:

- *Develop a shared language:* Providing opportunities for participants to engage in the development of a shared repertoire [13] associated with the theoretical concepts or themes that interest us as researchers (for example, engaging in clarifying discussions associated with a video that is sent to / by participants to explain a definition of an idea or term prior to data collection);
- *Develop a data visualisation repertoire:* Considering different ways to represent data that enable participants to be generate their own network visualisations without the need for them to have any specialist skills (for example, being able to provide participants with a network map which has nodes but no weighted connections, or potentially to add labels to blank codes with the aim of providing alternate perspectives to a-priori codes provided by the researcher);
- *Provide opportunities for active participation:* Developing ways in which participants can interact with researchers and visualisations of their own data to engage them in the meaning-making process (for example, allowing participants to draw directly over visualisations to modify the connections that we have generated from data, or to co-construct connections as Hazel Vega Quesada and colleagues have suggested [14]).

These considerations provide opportunities for our participants to research with us rather than be researched by us, but they come with methodological, philosophical and ethical issues that require careful consideration and debate by a range of contributors. I encourage you to join us in these important investigations and conversations in the hope of using ‘P’ to amplify the ‘E’ in QE.

2.3 Hollie Moots and Mamta Shah, Elevating Clinical Nursing Education with PQE

Growing evidence from researchers in diverse disciplines and contexts affirms the affordances of QE for studying human behavior and modeling its complexities [15]. However, the strengths of this rapidly expanding community go beyond the tools and methods. The participatory culture of QE Society has democratized dialogue about engaging in QE and expanding access [16]. For instance, (a) the events designed to demonstrate worked examples, reflect on lessons learned, and foster new inquiries (e.g., webinar, data challenge), and (b) the resources designed for QE researchers to strengthen their understanding and application of methods and tools (e.g., tutorials, conference workshops) have enabled shared sense-making and acquiring a common language for doing QE research in our respective areas of work. It is time we expand the boundaries of this participatory community and transition our participants from being beneficiaries of our scholarship to stakeholders and co-contributors.

At Elsevier, we have adopted QE in the context of prelicensure clinical nursing education involving virtual reality simulations. To give you some context, recent advancements in virtual reality technology have positioned them as a promising simulation modality in nursing education, prompting researchers to assess its effectiveness [17, 18]. However, empirical investigations uncovering how nursing educators scaffold and sequence instruction using VR simulations, and tracing how learners progress before-during-after participating in VR simulations are hard to locate. We have used Epistemic Network Analysis (ENA) to examine audio discourse available from undergraduate nursing faculty and students using the Simulation Learning System with Virtual Reality (SLS with VR) [19]. ENA visualizations have enabled us to model how a nursing educator used her expertise in conjunction with SLS with VR to scaffold 'thickly authentic' experience for her students [20, 21]. We also modeled how students practiced key cognitive and social skills, visualizing connections and indicators of clinical competency development [22, 23].

By using ENA we have demonstrated that it is possible to capture and portray how VR simulations afford experiences that mimic what nursing students can expect in clinical settings. However, Simon's keynote address from the 2nd International Conference on Quantitative Ethnography [8] has inspired us to imagine greater involvement of participants for elevating clinical nursing education and research. We reflect on the participatory culture described above, examples from fellow quantitative ethnographers, and on-going practices at Elsevier to outline possibilities and potentials of embracing participatory quantitative ethnography (PQE) at varying degrees:

- *Starting with Dissemination:* At Elsevier, nursing faculty, administrator, and students' needs, and feedback heavily impact product conception, development, delivery and management. We also publish infographics and white papers on an array of topics; we host webinars and training sessions guiding faculty on how to augment their instruction using our learning solutions. Perhaps, the first step towards adopting PQE could be the way in which we disseminate existing work to the nursing audience who may not be fluent with QE yet. For instance, we can release companion videos to our QE reports that translate the crux of the investigations in an accessible manner, highlight key findings, and emphasize

on implications for them/their programs. A preliminary example of such a video might look like this [24]. Synchronous meetings can be scheduled thereafter, almost akin to a book club meeting, where all members can engage in joint sense making.

- *Spacing Participant Involvement:* QE research is time and labor intensive even with many automated tools readily available. Currently, this impacts the time that elapses between coding, code validation, model exploration, and member-checking after concrete models are generated. It also impacts the amount of synchronous time participants and researchers can commit to. Perhaps, spacing out participant involvement and member-checking over routine intervals might prove beneficial for practical purposes. For instance, we can debrief with participants during research sessions soon after they have ended, using recordings of activities. Debriefing is commonly adopted in simulation sessions to help students assimilate knowledge, skills and attitudes essential for patient care and well-being [25]. Nursing educators also use this time to dialogue with students about what happened, what went well/did not go well, and what can be improved in the future. We can expand this debriefing tradition to include ethnographic prompts that elicit participants' reflections on what happened in the distinct phases of pre-briefing-simulation-debriefing using a grounded approach or/and anchored in relevant theoretical concepts. These insights can be used by researchers to make decisions about coding and model exploration. The value of re-engaging with participants after concrete visualizations are generated to co-interpret the activities and re-frame the phenomena have been explored successfully and should continue to serve as the additional member-checking opportunities [11].
- *Incorporating Visualizations as Thinking Tools*: The layered storytelling approach used to help faculty and students make sense of multimodal data obtained from nursing simulations is compelling [26]. Scaling the technology and access to explanatory visualizations can vastly complement simulation experiences. For instance, in nursing, it is imperative that students be exposed to a wide variety of clinical situations, especially in ways that (a) reduce the complexities of clinical practice, (b) make implicit practices of expert nurses explicit, and (c) sequence learning activities according to a developmental progression. These strategies can make authentic practice accessible to learners [27]. Perhaps, generating a bank of explanatory and interactive visualizations of expert and novice nurses engaging in simulations across multiple nursing domains can help students and faculty peel the layers, muddle with what-if situations, and reflect on transforming how we support clinical readiness.

We hope that this symposium resonates with you and energizes you to consider ways for expanding participatory approaches in your QE work. We have begun thinking of ways in which we can lower the floor, widen the walls, and heighten the ceiling so that we can engage with our participants more actively in our QE endeavors, and help them unleash the power of QE tools in their settings.

2.4 Golnaz Arastoopour Irgens and Hazel Vega, The Relationship Between PDR and QE: Implications for Developing PQE Tools

Participatory design, and related paradigms such as participatory design research, participatory action research, and community-based participatory research, challenge traditional colonized ways of constructing knowledge [1, 2, 3]. Instead, the people affected by the research co-construct knowledge with the researchers. In participatory ethnography, the participants' perspectives are central, just as in traditional ethnography, but there is also attention paid to power dynamics, historicity, and political action [5, 7].

Taking what we know from participatory ethnography, PQE combines the democratic notions of participatory research and the rigor of QE to provide new insights into QE. In particular, a participatory stance in QE suggests that researchers and participants close the interpretative loop together. This co-construction of knowledge helps us reach saturation of data and view validity in a way that is grounded in the data but involves participants in the analysis process and not just data collection. Relatedly, PQE privileges doing research with participants and welcomes multiple ways of knowing and doing. Such a multiplicity approach allows marginalized populations to be active participants in conversations and shape research paradigms in ways that benefit them and their cultures, which is a central tenet of participatory research. Thus, involving those who have traditionally not been involved in the research process beyond data collection will extend and challenge our definitions of QE and what it means to do QE work [16].

Similar to work conducted by Phillips and colleagues [11] with teachers, we have engaged with English as a Foreign Language (EFL) pre-service teachers in Costa Rica to explore processes of identity negotiation. During pre-service education, identity development is especially critical and currently under-researched. For native Spanish speakers teaching English, identity development is complicated by dominant notions of an inferior, non-White, non-native English speaker and an idealized, superior, native English speaker. In our studies, we have used QE and ENA to uncover how teachers negotiate their identities and confront existing tensions during their pre-service studies [14]. We discovered that the teachers in the study framed the native English speaker as an idealized figure in their identity formation process leading to feelings of frustration, linguistic insecurity, and inadequacy.

Building on this study, Vega [28] worked with teacher participants to collectively build an ethnographic understanding of their identity development. This initial exploration involved a pilot study in which ENA networks were simplified and shared with participants. Using collected interview data, she coded the transcripts for evidence of cultural adoption, rejection, and tensions, and created ENA networks to explore connections among these components and the dominant discourse of the idealized native English speaker. She re-interviewed teachers, displayed an ENA network that was previously created, and used a tablet to annotate the network as she and the teacher re-examined the teachers' experiences in their education program. These discussions resulted in clarifications of the researcher's analysis of the interview data, as some participants added/removed connections, added/removed nodes, and/or wanted to change the thickness of the lines. This initial experiment involving shared

representations to co-create a thick description with participants revealed implications and wonderings about the development and deployment of PQE tools:

- To work together with participants to co-interpret discourse, we must reimagine the roles of the researcher and the participant and determine what types of expertise can be leveraged to form a collective set of skills. When roles and responsibilities change, the power dynamics will also change and should be an aspect of the reflexive process of ethnography. For example, who will develop the codes, automate the codes, create discourse visualisations, and make annotations, and how do each of these choices influence the interpretations? And how can researchers be prepared to respond to these new participatory interpretations and developing tensions?
- The analysis and visualisation tools that are used to conduct research with participants must be designed such that all stakeholders have access and ability to use them to create thick descriptions. At the same time, tools need to be rich enough to be used meaningfully by those who have been practicing QE for a significant amount of time. How can we develop such "low threshold/high ceiling" PQE tools for all stakeholders?
- Affordances and features of the tools need to be carefully considered, including annotation, discussion, interactivity, and the externalization of the co-construction of knowledge. In other words, we must make choices about what is included (or not) in the tool, who will use the feature, and for what purpose. These choices will affect the roles, responsibilities, and power dynamics mentioned above. To this end, one interesting avenue is to use participatory methods to create the PQE tools themselves and co-design tools with participants.

Thinking about the ways in which participatory design and QE intersect and conflict will help shape this new notion of PQE and the subsequent tools. Moreover, the PQE tools we design will also influence how we conceptualize PQE and likely, how we conceptualize QE more broadly.

2.5 Abigail R. Wooldridge, Learning from Participatory Ergonomics

As noted by other panelists, while PQE represents an important advance in the QE field, participatory paradigms and approaches exist across other fields. Participatory ergonomics is another approach to engaging people other than researchers and scientists on research or project teams. Specifically, participatory ergonomics is defined as "the involvement of people in planning and controlling a significant amount of their own [activities], with sufficient knowledge and power to influence both process and outcomes in order to achieve desirable goals" [29]. Traditional participatory ergonomics programs focus on involving workers in making changes to work settings (e.g., manufacturing, construction, health care) to improve outcomes for the workers, like health, wellbeing and stress, and for the company, like productivity and cost reduction [30]. However, the field has advanced to conceptualize work as goal-directed activities, with or without payment or recognition as employment, opening the door for approaches in other domains, for example, the work done by patients in pursuit of health

[31]. Given the natural fit of ergonomics with QE, which I described in my keynote last year and is described elsewhere [32], we can use the well-developed frameworks for participatory ergonomics as a basis for characterizing PQE efforts, by adapting the nine dimensions to describe participatory ergonomics efforts [30] to fit QE more broadly, as follows:

- *Decision-making:* how decisions are made in the group involving individuals being studied; ranges from group delegation - group consultation - individual consultation.
- *Mix of participants:* who gets to participate; ranges from people doing the activities through direct managers/supervisors, representatives like union delegates and upper management.
- *Goal and scope:* what the participatory team is charged with accomplishing and what they can do.
- *Role of scientist:* can range from guide or facilitator (present continually or for consultation) through equal participation.
- *Involvement:* how many of the participants can participate (full to selected representatives).
- *Requirement:* if an individual can decline to participate; in research, this would always be voluntary, but in work settings participation may be required.
- *Permanence:* if the participatory effort has a clear end point or is ongoing.

Participatory ergonomics efforts result in more buy-in and ownership from workers who are asked to adopt changes, a more accurate understanding of the work situation and broader impact beyond the initial project [33]. However, they also involve managing group dynamics, including conflict, and usually involve extra time and resources to do well — these considerations likely carry for PQE efforts. Importantly, they require a fundamental shift to value the knowledge of frontline workers at least as much as, if not more than, the knowledge of ergonomists, who produce *etic* interpretations and assessments. The workers know the work better than consultant ergonomists — a fundamental tenet of the franco ergonomic tradition [33]. As PQE moves forward, we will have to determine — collectively as a field or individually as scientists — if we prioritize the emic or the etic, as they may indeed conflict.

As Arastoopour Irgens and Vega point out, participatory approaches tend to enhance equity and justice; indeed, Lusebrink and colleagues argue for genuine, rich participation to enhance equity and justice in ergonomics projects [34]. As a discipline, we may achieve broader, more lasting impact if we empower participants, allow the emic to take priority, and give our knowledge and tools away; such was the case for ergonomics [35].

3 Towards a Research Agenda for PQE

We have sketched some opening arguments for adopting an explicitly participatory orientation in QE. This poses a range of interesting, important questions to the field, which we offer as the beginnings of a PQE research agenda:

- Can we differentiate degrees of participation? In fact, could participatory purposes and practices vary along multiple dimensions? Potential candidates include participant agency, how early participants are engaged, and which aspects of the QE analysis are contestable.
- Are there QE contexts where participant engagement will be particularly valuable, and others where this is less relevant?
- What are the advantages to researchers in making their QE analyses accessible to stakeholders? To make that case, what forms of evidence of the benefits are convincing warrants to justify this kind of ethnographic 'member checking'?
- What are the costs to researchers, e.g. in terms of time, training, funding, participant access? Are there ways to mitigate these?
- What are the visual and interaction design principles and researcher skills required to engage participants in ways that empower them?
- What are the methodological implications when, for instance, participants disagree with a researcher's analysis of their activity? In what ways, if any, does permitting participants to change the results of a representation (e.g. an ENA network) change the meaning or validity of the analysis?
- Can both the emic and etic lenses be correct, serving distinctive purposes, or is such a view untenable?
- What new software requirements does a commitment to participant engagement raise for QE tools? Can we learn from related fields that have longer track records in creating flexible software tools to support participatory processes, and research into emerging forms of narrative generation?
- How can we, in the process of bridging the emic and etic worlds, strive for greater research and practice integration?
- What kind of pedagogical practices can we introduce by empowering participants to use QE tools?

In closing, we propose that *Participatory Quantitative Ethnography* is a promising new direction for the QE community to pursue, and that engaging with questions such as those above will advance this. Might this become a hallmark of the field's values, methods and tools? We hope these questions excite you, and we look forward to hearing your thoughts on questions we have missed, seeing the shape of possible answers, and forging the new collaborations required to tackle such a transdisciplinary challenge.

References

1. Bang, M., & Vossoughi, S.: Participatory design research and educational justice: Studying learning and relations within social change making. Cognition & Instruction 34(3), 173–193 doi:10.1080/07370008.2016.1181879 (2016).
2. Bang, M., Faber, L., Gurneau, J., Marin, A., & Soto, C.: Community-Based Design Research: Learning Across Generations and Strategic Transformations of Institutional Relations Toward Axiological Innovations, Mind, Culture, and Activity 23(1), 28-41, DOI: 10.1080/10749039.2015.1087572 (2016).
3. Hacker, K.: Community-based participatory research. Sage publications. (2013).

4. Philip, T., Bang, M., & Jackson, K.: Articulating the "How," the "For What," the "For Whom," and the "With Whom" in Concert: A Call to Broaden the Benchmarks of our Scholarship, Cognition and Instruction 36(2), 83-88, DOI: 10.1080/07370008.2018.1413530 (2018).
5. Ntelioglou, B. Y.: English language learners, participatory ethnography and embodied knowing within literacy studies. In: J. Roswell, & K. Pahl (Eds.), Routledge Handbook of Literacy Studies (pp. 532-547). New York, NY: Routledge. (2015).
6. Geertz, C.: The Interpretation of Cultures. New York, NY: Basic Books (1973).
7. Plummer, E. C., Stornaiuolo, A., & So-Qui-Li, I.: Participatory Ethnography: Developing a High School Writing Center in Partnership. Penn GSE Perspectives on Urban Education 16(1), (2019).
8. Buckingham Shum, S.: Quantitative Ethnography Visualizations as Tools for Thinking (Keynote Address). 2nd Int. Conf. on Quantitative Ethnography. simon.buckinghamshum.net/2021/02/icqe2020-keynote-qe-viz-as-tools-for-thinking (2020).
9. Selvin, A., Buckingham Shum, S. and Aakhus, M.: The Practice Level in Participatory Design Rationale: Studying Practitioner Moves and Choices. Human Technology: An Interdisciplinary Journal of Humans in ICT Environments 6(1), 71-105. humantechnology.jyu.fi/archive/vol-6/issue-1/selvin-buckingham_shum-etal6_71-105 (2010).
10. Selvin, A. and Buckingham Shum, S.: Constructing Knowledge Art: An Experiential Perspective on Crafting Participatory Representations. Morgan & Claypool, (2014). https://doi.org/10.2200/S00593ED1V01Y201408HCI023
11. Phillips, M., Siebert-Evenstone, A., Kessler, A., Gasevic, D., & Shaffer, D. W.: Professional decision making: reframing teachers' work using epistemic frame theory. In A. R. Ruis, & S. B. Lee (Eds.), Advances in Quantitative Ethnography: Second International Conference, ICQE 2020, Proceedings (1st ed., pp. 265-276). (Communications in Computer and Information Science; Vol. 1312). Springer. https://doi.org/10.1007/978-3-030-67788-6_18 (2021).
12. Birt, L., Scott, S., Cavers, D., Campbell, C., & Walter, F.: Member Checking: A Tool to Enhance Trustworthiness or Merely a Nod to Validation? Qualitative Health Research 26(13), 1802–1811. https://doi.org/10.1177/1049732316654870 (2016).
13. Wenger, E.: Communities of practice: Learning, meaning, and identity. Cambridge University Press. https://doi.org/10.1017/CBO9780511803932 (1998).
14. Vega, H., Arastoopour Irgens, G. & Bailey, C.: Negotiating Tensions: A Study of Pre-service English as Foreign Language Teachers' Sense of Identity Within Their Community of Practice. In A. R. Ruis, & S. B. Lee (Eds.), Advances in Quantitative Ethnography: Second International Conference, ICQE 2020, Proceedings (1st ed., pp. 277-291). (Communications in Computer and Information Science; Vol. 1312). Springer. https://doi.org/10.1007/978-3-030-67788-6_19 (2021).
15. Kaliisa, R, Misiejuk, K., Arastoopour Irgens, G., & Misfeldt, M.: Scoping the Emerging Field of Quantitative Ethnography: Opportunities, Challenges and Future Directions. International Conference on Quantitative Ethnography. In A. R. Ruis, & S. B. Lee (Eds.), Advances in Quantitative Ethnography: Second International Conference, ICQE 2020, Proceedings (1st ed., pp. 277-291). (Communications in Computer and Information Science; Vol. 1312). Springer. (2021).
16. Arastoopour Irgens, G.: Quantitative Ethnography Across Domains: Where we are and where we are going. (Keynote Address). 1st International Conference for Quantitative

Ethnography (ICQE). University of Wisconsin. https://mediaspace.wisc.edu/media/1_wc2vypki (2019).
17. Bayram, S. B., & Caliskan, N.: The Use of Virtual Reality Simulations in Nursing Education, and Patient Safety. In Contemporary Topics in Patient Safety-Volume 1. IntechOpen. (2020).
18. Chen, F. Q., Leng, Y. F., Ge, J. F., Wang, D. W., Li, C., Chen, B., & Sun, Z. L.: Effectiveness of Virtual Reality in Nursing Education: Meta-Analysis. Journal of Medical Internet Research, 22(9), e18290. (2020).
19. Simulation Learning System with Virtual Reality https://evolve.elsevier.com/education/simulations/simulation-learning-system-with-virtual-reality/
20. Shah, M., Siebert Evenstone, A., Eagan, B., Holthaus, R.: Modeling Teacher Use of Virtual Reality Simulations in Nursing Education Using Epistemic Network Analysis. 7th International Conference of the Immersive Learning Research Network (iLRN) 2021 (pp 1-8). Virtual. (2021). doi: 10.23919/iLRN52045.2021.9459408.
21. Shaffer, D. W., & Resnick, M.: "Thick" authenticity: New media and authentic learning. Journal of interactive learning research, 10(2), 195-216. (1999).
22. Shah, M.: Tracing and Visualizing Clinical Judgment in Virtual Reality Simulations for Nursing Education. Poster presented at the 2nd International Conference on Quantitative Ethnography, Online. (2021).
23. Shah, M., Moots, H., Eagan, B. & Siebert-Evenstone, A:. Development of Quality and Safety Education for Nursing in Virtual Reality Simulations: A Quantitative Ethnographic Examination. 3rd International Conference for Quantitative Ethnography (ICQE). Online. (2021).
24. Shah, M., Siebert Evenstone, A., Eagan, B., Holthaus, R.: Modeling Teacher Use of Virtual Reality Simulations in Nursing Education Using Epistemic Network Analysis. Companion video published at the 7th International Conference of the Immersive Learning Research Network (iLRN) 2021. Virtual. (2021). https://www.youtube.com/watch?v=b8esK9Z2shE
25. The International Nursing Association for Clinical Simulation and Learning (INACSL) Healthcare Simulation Standards of Best Practice. https://www.inacsl.org/healthcare-simulation-standards/
26. Martinez-Maldonado, R., Echeverria, V., Fernandez Nieto, G., & Buckingham Shum, S.: From data to insights: a layered storytelling approach for multimodal learning analytics. In Proc. ACM Conference on Human Factors in Computing Systems, pp. 1-15. (2020).
27. Edelson, D., & Reiser, B.: Making authentic practices accessible to learning: Design challenges and strategies. In RK Sawyer (Ed.), The Cambridge handbook of the learning sciences (pp. 335–354). New York: Cambridge University Press (2006).
28. Vega, H.: Constructing Interpretations with Participants through Epistemic Network Analysis. Poster presented at the Second Poster Session Event Connecting Research and Practice across Disciplines, Clemson, South Carolina. (2021).
29. Wilson, J.: Ergonomics and participation. In: Wilson, J.R., Corlett, E.N. (Eds.), Evaluation of Human Work: a Practical Ergonomics Methodology. Taylor & Francis Ltd., London, pp. 1071e1096.a (1995).
30. Hignett, S., Wilson, J. R., & Morris, W.: Finding ergonomic solutions - Participatory approaches. Occupational Medicine, 55(3), 200-207. http://dx.doi.org/10.1093/occmed/kqi084 (2005).
31. Holden, R. J., & Valdez, R. S. (Eds.).: The Patient Factor: Theories and Methods for Patient Ergonomics. CRC Press. (2021).

32. Lützhöft, M., Nyce, J. M., & Petersen, E. S.: Epistemology in ethnography: Assessing the quality of knowledge in human factors research. Theoretical Issues in Ergonomics Science, 11(6), 532-545. (2010).
33. Wilson, J. R.: Participation - A framework and a foundation for ergonomics? Journal of Occupational Psychology, 64, 67-80. (1991).
34. Lusebrink, R., Wooldridge, A. R., & Spiwak, M.: Advancing Equitable and Just Practices in Human Factors and Ergonomics. HFES 65th International Annual Meeting. (Accepted).
35. Corlett, E. N.: Some future directions for ergonomics. In: M. Kumashiro & E. D. Megaw (Eds.), Towards Human Work: Solutions to Problems in Occupational Health and Safety. Taylor & Francis. (1991).

Engaging Policy with a QE Lens

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Abstract. Policy is designed to improve people's lives and address problems facing society. However, policy implementations often face barriers including siloed or fragmented institutions, limited resources, and analytic inadequacies of extant research methods. Recent advances in Quantitative Ethnographic theory and application aim to address some of the existing barriers in the public policy space. Our symposium brings together researchers, methodologists, and policymakers imagining and implementing Quantitative Ethnographic approaches in the policy context. This discussion will be relevant to those developing, implementing, and evaluating policy as well as anyone interested in Quantitative Ethnography methodological development and application.

Keywords: Quantitative Ethnography, Policy Analysis, Epistemic Network Analysis, Automated Coding.

1 Introduction

Policymakers aim to improve people's lives by creating solutions to complex problems or issues of concern facing society. The policy world can be fraught with siloed institutions, complicated problem spaces, and scarcity of resources. One way of dealing with these challenges is by adopting new research methodologies that can overcome barriers to communication, efficiencies, and effectiveness.

Recent adoption of Quantitative Ethnographic techniques in the fields of healthcare and education has improved analytic capacity and quality (Csanadi et al., 2018; Eagan et al., 2019; Ruis & Lee, 2020; Siebert-Evenstone et al., 2017). Further, members of the International Society for Quantitative Ethnography (ISQE) are making efforts to bring Quantitative Ethnography (QE) to new domains, including psychology (Frey et al., 2021), digital humanities (Ruis & Shaffer, 2017), and the focus of this symposium, public policy (Allsopp et al., 2019; Hu et al., 2018; Schnaider et al., 2020).

QE methodologies can help overcome existing barriers in public policy development, implementation, and evaluation, by enabling inter-organizational efficiencies and overall program and policy effectiveness. For example, early childhood

care and education (ECCE) practices involve service sectors such as health, nutrition, education, law enforcement, and family/childcare. In most countries, these sectors are fragmented, differ in their organizational cultures, compete for limited resources, and do not operate as mutually informed systems. Recommendations to form internally consistent systems that integrate these sectors and the agencies responsible for them is the most consistent theme in ECCE research literature over the past decade. Effective ECCE policy and practice arguably has a higher return on investment than any other expenditure a government can make, yet the reality is that ECCE represents a collection of misaligned and often contradictory practices to the detriment of society's youngest.

However, in addition to these challenges, there are opportunities. Policy ecosystems often contain large volumes of textual data, such as policy documents, funding applications, plans and records of standards implementation, as well as stakeholder generated data (e.g. focus groups, town hall meetings, surveys, online discussion forums). QE is uniquely positioned to analyze complex systems embedded across different cultural contexts. QE tools are designed to meaningfully analyze large volumes of available textual data. This symposium will focus on how QE can be used to overcome barriers in how policy is developed, assessed, and refined including existing applications and ideas for the future.

2 Symposium Structure and Goals

In this symposium, we bring together six leading experts who are working on bringing QE to the policy domain. Each expert will discuss their ongoing work and potential QE applications in the following areas: promoting within-government coordination and effectiveness using QE/ENA based self-assessments, creating measurement spaces in policy contexts, analyzing free and available user generated content with QE methods to improve policy implementation. Our goal is to support a confluence of policy expertise from different streams of research and practice as our speakers come from different, yet complimentary areas of the policy world.

- Hamilton has held two directorship positions at the National Science Foundation, worked at UNESCO's International Bureau of Education, and is an early adopter of QE,
- Faul is the executive director of NORRAG, an international network for policy and cooperation in education and has extensive experience in international policy and research and has worked with Hamilton on bringing QE into the policy realm,
- Siebert-Evenstone is a thought leader and prominent methodologist in the QE community and has done foundational studies in the field including a dissertation which used QE to develop a policy-based ENA metric space based on the Next Generation Science Standards in the United States,
- Ashton and Wong are leading efforts at UW-Madison to use QE techniques on free and available user generated content to improve the Social Security Administration's Social Security Disability Insurance program in the US and have been invited by Social Security Advisory Board to present their ongoing research,

- Eagan is a bridge builder within the QE community and has experience connecting QE research and practice in many different fields.

It is our hope that this symposium will attract policy researchers to ICQE and enrich conversations about connecting QE to another community of research. In discussion with the audience, we hope to share innovative approaches to policy refinement using QE and articulate new visions for how QE can overcome barriers in the policy ecosystem.

2.1 Promoting WIthin-Government Coordination and Effectiveness Following a Quantitative Ethnography of Policy Documents

Effective governance increasingly requires cross-agency coordination. Policies and practices of any agency require strategic planning informed by and reliant on operations of other agencies. This observation may appear obvious or trivial, however, in practice, the lack of coordination between agencies in any given national government is debilitating and undermines core services and progress towards an economically fair and prosperous society.

We argue for leveraging the benefits of quantitative ethnography to address coordination and documentation issues within and across government agencies. Quantitative ethnography would be especially beneficial in the analysis of policy and program documents within and across different agencies. Agencies are swimming in documentation which provides a practical advantage for document analysis of these important artifacts and reflections of agency priorities and values. But more importantly, the documents enable an analysis of policy connections between agencies— exposing areas of structural interdependence along with structural isolation. The resulting mathematical and visual models can enable the formation of agency and interagency self-assessment that in turn lead to improved governance. They can also be used to assess the maturation of productive coordination over time or to enable comparisons with peer states, where constructive.

We believe QE can take advantage of the prevalence and reliance on documents in order to allow comparisons in the following education system use cases.

Government responsibility in areas such as early childhood development and basic education lend themselves to ethnographic study in order to analyze causes and solutions for structural isolation, though such studies can be prohibitively expensive and impractical. International organizations, like UNESCO, have published analytical frameworks for cross-subagency and within ministry education system assessment such as the General Education System Quality Analysis/Diagnosis Framework (GEQAF). Such documentation could be used to generate codes that could be applied to agency documentation and allow comparison across the system. Across policy initiatives, documentation tends toward being comprehensive at the cost of usability. For example, GEQAF includes over 500 questions addressing 15 areas of education policy and practice. Such thorough documentation could benefit from natural language processing techniques and subsequent analysis methods to scan and analyze the corpus of documentation using codes made from international frameworks. Instead of people solely answering self-assessments, we believe it is possible to use extant policy

documents at least to create an initial model of how the system works and provide a faster path to organizational self-reflection.

Further, the problem of coordination may be most severe in areas of early childhood care and development, a domain of government involvement with contributions from judicial, educational, medical, social, nutritional agencies. The lack of coordination between agencies representing these domains is often cited as egregious, consistent, and the highest cost avoidable error that countries commit.

To that end, this symposium will introduce common policy coordination issues and explore how the QE framework can be applied in this arena. We will include a preliminary exploration of the QEDAF with the goal of developing preliminary codes to apply to policy documents. Such an approach will be particularly helpful for early childhood education and development, however, this process will develop a system that can allow comparisons more generally. In addition, this work will serve as a model for use QE in the policy sphere.

2.2 Creating Measurement Spaces

Recent standards-based reforms such as the Common Core State Standards and the Next Generation Science Standards (NGSS Lead States, 2013) have changed the landscape of education. These policy reforms have introduced new ways of conceptualizing what students should be able to do, changed teaching practices, and required changes in assessments. But such reforms also require the reevaluation of curriculum materials, assessments, and classroom practices to ensure that students can achieve the learning goals or perform well on standardized tests.

In the wake of these new standards, there have been many resources, articles, websites, Pinterest boards, and professional development resources created to support the understanding and implementation of the new vision. However, even teachers who attend professional development programs continue to struggle with lesson design and fostering productive science discourse (Sandoval, Kwako, Modreck, & Kawasaki, 2018). Figuring out whether or not the current curriculum and assessments meet new policy expectations for science learning is an important challenge for science educators and researchers.

One way to check the relationship between standards and new programs or measures is through the idea of alignment, that is, the degree of agreement between a set of standards and materials or activities that intend to address those standards (Bhola, Impara, & Buckendahl, 2003). In many cases, alignment studies compare standards and assessments, however, alignment is also a useful frame to compare any combination of standards, texts, instruction, teacher training, tests, or other components of a curriculum (Kurz, Elliott, Wehby, & Smithson, 2010).

Scholars and policymakers have argued that alignment is important for successful curricular implementations and that more aligned curricula increase student achievement by providing clear and consistent expectations for both teachers and students (Fulmer, Tanas, & Weiss, 2018). Moreover, states have been required to show the alignment between their standards and assessments (Polikoff, Porter, & Smithson, 2011).

To address issues, Siebert-Evenstone (2020) developed a method to identify components of the NGSS and automatically evaluate curricular materials. For this analysis, Siebert-Evenstone operationalized the key NGSS practices and concepts and defined how each practice and concept was used in different curricular materials. Based on these definitions, Siebert-Evenstone developed and validated an automated classifier for each science practice and concept used. After automated classification, each curriculum was modeled and visualized using the same set of codes using ENA. Therefore, in this method, curricular texts are classified, measured using the same core concepts, and visualized in a single measurement space. By creating codes and a measurement space based on the NGSS, this computational model can compare how each curriculum addresses or fails to address state standards.

In recent work, we have proposed expanding this method to create an innovative, automated curriculum measurement method. This tool would allow teachers and specialists to identify key content features quickly and accurately and to compare alignment between guidelines such as state or national academic standards, frameworks that draw from published research (e.g., culturally responsive pedagogy), and curricula available through online portals.

Importantly, this method is not restricted to measuring science standards. Ultimately, this is a methodology for measuring alignment between any combination of data interested in measuring connections. By creating a space based on one dataset and then coding all related materials, it is possible to analyze the alignment between any type of data instead of solely standards. In this presentation, we will describe how we used quantitative ethnography to build these computational models and how such models can be created in other contexts and arenas.

2.3 Leveraging User Generated Content with QE to Inform Policy

Existing practice in policy and program evaluations are primarily based on research surveys/interviews using self-reported data and administrative data that may not reveal individual user experience or cover financially vulnerable populations. Collecting user-generated content (UGC) from online discussion forums provides insights from the individuals' perspectives regarding user experience and knowledge sharing. Such insights include: 1) potential barriers to understanding or implementing policies; 2) how QE can be applied to these discussion threads to identify the "pinch" points in policy implementation; and 3) offers potential solutions to improve understanding and interpretation of policies.

Applying QE to Understand SSDI Applications from Online Conversations. Applications to Social Security Disability Insurance (SSDI) have declined in recent years, but it is unclear what is driving this decline. We collected user-generated content (UGC) from online discussion forums containing SSDI-related conversations. Given the data's size, we first use unsupervised machine learning algorithms to derive topics and model them using ENA via conversational connections. The resulting ENA provides insights on the structural relationships between different issues surrounding SSDI (e.g., struggles the applicants communicating with and obtaining information from SSA). Taking advantage of the longitudinal nature of the data, we also model

trajectory ENAs to investigate how these issues evolve against the backdrop of environmental and policy changes.

To provide deeper contextual value through human judgment, we use the derived topics as seed words in nCoder. The resulting codes can be used in different applications, from analyzing the efficacy of existing policy to providing tractable policy recommendations.

Application 1: Comparison between Initial and Appeal Process. We use ENA to model the discussions of individuals participating in online forums related to Social Security Disability Insurance, focusing on the difference between conversations of initial applications and appealing one's denial. The results suggest that being denied and going through the appeals process has stronger connections with pain and medical conditions and providing sufficient medical evidence.

Application 2: Introduction of iClaims and Field Office Closures. An online application system for SSDI (iClaim) was launched in 2009 as an innovation to help streamline the application process and to compensate for the closure of field offices. We use ENA to model the conversations between pre-iClaim (2004-2008) vs. post-iClaim (2009-2014) periods. Results suggest that conversations shifted from focusing on questions surrounding medical evidence and suggestions (during the pre-iClaim period) to expressions of frustration, mental health, and pain associated with medical evidence (during the post-iClaim period).

Finally, QE can be an important analytical tool in capturing customers' experience in negotiating the application and appeals process. The lessons QE can provide are unlikely to be learned from traditional sources of information (such as surveys or administrative data).

- Using machine learning, we can derive meaningful topics from online forums containing SSDI-related conversations.
- Modeling the derived topics using ENA allows us to analyze how conversations evolved on issues deemed germane to the communities of users surrounding SSDI applications.
- The derived topics can be used as seed words in nCoder to provide deeper contextual value using human judgment.
- Policymakers and practitioners should consider and evaluate how and what information is exchanged in online forums and social media platforms, given its increasing use by SSA customers.

Dissemination. An advantage of using QE is the resulting ability to present the data in ENAs, making it possible to deliver the results in ways that are accessible to non-technical audiences. We intend to publish these ENAs on the Center for Financial Security website, and also non-technical 1-page brief targeted at policymakers and the public. We intend to disseminate them through social work extension offices where SSDI applicants may seek help to file their applications. In collaboration with the SSA,

we will also compile a list of Q&A to help clarify policies and rules that pose the greatest confusion based on our findings.

We have presented at both the CFS Household Finance webinar and the SSA Work in Progress seminar. We are meeting with SSDI officials to discuss our findings and possibilities for collaboration. We plan to prepare multiple manuscripts to be submitted for publication in peer-reviewed journals with relevant audiences and presentations at conferences like the American Public Policy Analysis and Management conference and ICQE. The PI has been invited by Social Security Advisory Board to present their findings in their Round Table on Social Security Public Service May 2021 Meeting.

3 Conclusions

The public policy sphere faces barriers to addressing societal challenges, including better serving people who most need support, including children, learners, and educators, as well as people with disabilities. At the same time, QE is uniquely positioned to identify and understand these barriers and work toward creating solutions.

The empirical and potential research approaches shared during this symposium will offer examples for developing new vantage points on the policy ecosystem and ways of gaining meaningful grips on complex issues. We argue that using QE for document analysis can be leveraged to better coordinate within and across traditionally fragmented or siloed institutions. Similarly, educational policy reforms, such as the adoption of the NGSS, require alignment analyses to measure how planned and enacted curriculum corresponds to standards and desired outcomes for learners. Finally, we claim that policy implementation can benefit from researching free and available user-generated content to gain insights into how the people intended to benefit from the policy are experiencing and understanding that policy, with the hope that this leads to more effective, efficient, and enjoyable experiences.

Our team of researchers, methodologists, and policy makers will offer a symposium that will spur ongoing discussions with the QE community about the unique application of QE in the policy context. We hope that this will create an evolving problem-solving space where stakeholders can engage in both high-level policy analysis and decision-making as well as the small details of how policy affects the people it is designed to help.

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References

1. Csanadi, A., Eagan, B., Shaffer, D. W., Kollar, I., & Fischer, F.: When coding-and-counting is not enough: Using epistemic network analysis (ENA) to analyze verbal data in CSCL research. *International Journal of Computer-Supported Collaborative Learning, 13(4),* 419-438 (2018).
2. Eagan, B., Misfeldt, M., & Siebert-Evenstone, A. (Eds.): *Advances in Quantitative Ethnography: First International Conference, ICQE 2019, Madison, WI, USA, October 20–22, 2019, Proceedings.* Springer. (2019).
3. Ruis, A.R. & Lee, S.B. (Eds.): *Advances in Quantitative Ethnography: Second International Conference, ICQE 2020, Malibu, CA, USA, February 1-3, 2021, Proceedings*. Springer. (2020).
4. Siebert-Evenstone, A. L., Arastoopour Irgens, G., Collier, W., Swiecki, Z., Ruis, A. R., & Shaffer, D. W.: In search of conversational grain size: Modelling semantic structure using moving stanza windows. *Journal of Learning Analytics, 4*(3), 123–139 (2017).
5. Frey, K.S., McDonald, K.L., Onyewuenyi, A.C., Germinaro, K. & Eagan, B.: "I Felt Like a Hero:" Adolescents' understanding of resolution-promoting and vengeful actions on behalf of their peers. *Journal of Youth Adolescence, 50***,** 521–535 (2021).
6. Ruis, A. R., & Shaffer, D. W.: Annals and analytics: The practice of history in the age of big data. *Medical History, 61*(2), 336–339 (2017).
7. Allsopp, B. B., Dreyøe, J., Tamborg, A. L**.,** Eagan, B**.,** Tabatabai, S., Shaffer, D. W., & Misfeldt, M.: Exploring teachers' assignment of mathematical competencies to planned lessons using Epistemic Network Analysis. In *11th Congress of European Research in Mathematics Education*. (2019).
8. Hu, S., Torphy, K., Chen, Z**.,** Eagan, B**.:** How Do US Teachers Align Instructional Resources to The Common Core State Standards: A Case of Pinterest. *Proceedings of the 9th International Conference on Social Media and Society* (pp. 315-319). Copenhagen, Denmark: SMSociety '18. (2018).
9. Schnaider, K., Schiavetto, S., Meier, F., Wasson, B., Allsopp, B. B., & Spikol, D.: Governmental Response to the COVID-19 Pandemic-A Quantitative Ethnographic Comparison of Public Health Authorities' Communication in Denmark, Norway, and Sweden. In *International Conference on Quantitative Ethnography* (pp. 406-421). Springer, Cham. (2021).
10. NGSS Lead States. *Next Generation Science Standards: For States, By States*. Washington, DC: National Academies Press. (2013). https://doi.org/10.17226/18290
11. Sandoval, W. A., Kwako, A., Modreck, A., & Kawasaki, J.: Patterns of classroom talk through participation in discourse-focused professional development. In J. Kay & R. Luckin (Eds.), *Proceedings of the Rethinking learning in the digital age: Making the learning sciences count: The international conference of the learning sciences (ICLS) 2018* (pp. 760–767). London: ISLS. (2018).

12. Bhola, D. S., Impara, J. C., & Buckendahl, C. W.: Aligning Tests with States' Content Standards: Methods and Issues. *Educational Measurement: Issues and Practice*, *22*(3), 21–29. (2003). https://doi.org/10.1111/j.1745-3992.2003.tb00134.x
13. Kurz, A., Elliott, S. N., Wehby, J. H., & Smithson, J. L.: Alignment of the intended, planned, and enacted curriculum in general and special education and its relation to student achievement. *Journal of Special Education*, *44*(3), 131–145 (2010). https://doi.org/10.1177/0022466909341196
14. Fulmer, G. W., Tanas, J., & Weiss, K. A.: The challenges of alignment for the Next Generation Science Standards. *Journal of Research in Science Teaching*, *55*(7), 1076–1100 (2018). https://doi.org/10.1002/tea.21481
15. Polikoff, M. S., Porter, A. C., & Smithson, J.: How well aligned are state assessments of student achievement with state content standards? *American Educational Research Journal*, *48*(4), 965–995 (2011). https://doi.org/10.3102/0002831211410684
16. Siebert-Evenstone, A. L.: *Investigating 3-Dimensional Learning and Alignment*. The University of Wisconsin-Madison. (2020).

Indigenous Quantitative Ethnography

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Abstract. Quantitative Ethnography (QE)'s integration of quantitative and ethnographic data and analysis provides an opportunity to cross traditional methodological boundaries. Indigenous researchers also seek to cross the boundaries: not only of quantitative and qualitative methods, but also Indigenous and non-Indigenous ways of knowing and meaning-making. Many Indigenous methods prioritize stories as a valuable source of knowledge and knowledge sharing. The integration of stories into QE offers opportunities to support that boundary crossing for Indigenous researchers, and to potentially enhance QE with Indigenous approaches to engaging with stories and culture. However, integrating QE into Indigenous research is fraught with challenges stemming from colonization. In this symposium, Indigenous and QE researchers share our thoughts on the opportunities and challenges, and invite the QE community to join the conversation on a collaborative and mutually-beneficial way forward.

Keywords: Indigenous Methodologies, Stories, Metaphor, Data Visualization, Culturally Sustaining Research.

1 Overall Focus

The field of Quantitative Ethnography (QE) is concerned with how quantitative methods might elevate the kind and connections of stories, and also how stories might give meaning to statistical analysis of large datasets [1]. This integration of quantitative and ethnographic analysis offers a way to engage in boundary crossing [2] across methodological traditions and can result in richer descriptions and insights.

This symposium invites conversation around QE and Indigenous knowledge systems and methodologies. How might Indigenous understandings of how we categorize (code), how we identify meaningful parts (segment dialogue), and how we understand language through story and metaphor interface with quantitative ethnography, so that more just and reciprocal ways of seeing and analyses are possible? As the QE community seeks to be more relevant in increasingly diverse non-WEIRD (Western,

Educated, industrialized, rich and developed) contexts, we will need to better understand culture as fundamental to our methods of analysis.

2 Symposium Format and Goals

In this symposium, we bring together five scholars who are thinking about QE across cultural contexts, with a focus on Indigenous perspectives on QE and QE within Indigenous research. Meixi and Kahiwa Sebire are junior scholars who belong to and work within Indigenous contexts and are relatively newcomers to the QE community. David Shaffer is an expert in QE methodologies at large, Peter Mataira is an expert and Indigenous methodologies and Indigenous evaluation, and Jason De Santolo is creative producer and scholar in Indigenous storywork and creative media.

The symposium is structured by presenting two problems of practice of QE in Indigenous research. First, the two junior Indigenous scholars will present an example of Indigenous approach to integrating data and making meaning. They will then outline the challenges they see when working in Indigenous-related research that QE may provide an opportunity to address. This is followed-up by a discussion of the case from the three senior scholars with differing expertise (QE and Indigenous methodologies). This panel concludes with a dialogue across all the four scholars with input and comments from the audience around the opportunities and challenges of QE within Indigenous contexts, with broader implications for field around the role of culture in analysis and what it means to deeply account for the "E" (ethnography) in "QE".

Given the broad range of cultural contexts the QE community belongs to and operates within, we hope to generate conversation with other QE researchers around what data, rigor, validity, and impact might mean across contexts (Indigenous and non-Indigenous), and how we might foreground these considerations in our research.

2.1 Indigenous Knowledge Systems, Methodologies, and QE

There seem to be important synergies across Indigenous knowledge systems and research methodologies and QE. First, QE is interested in culture. Numerous publications address cultural considerations in how we code [3,4] and how we segment data [5], given that one theoretical foundation of QE is based in "discourse" and the epistemic frames that structure "Discourse" [1, 6, 7]. Second, epistemic network analysis, a signature methodology in QE, importantly highlights the structure of connections between codes and adopts a more system-grounded approach rather than one that is interested in discrete components. Similar to contemporary fields such as Complex Systems Thinking, many Indigenous cultures derive meaning and understanding about one thing by considering the context of its place and relationship to other things (e.g. [8]. This approach to knowing is in stark contrast to mechanistic views of breaking something down to its discrete components to be analyzed separately. Finally, stories and narratives seem to be in many QE studies (e.g. [5, 9, 10]). Many Indigenous cultures highly value stories and the use of metaphors and abstraction as part of sense-making and truth-telling [11-13].

This symposium builds on the important foundations of QE, which remind us that all data and analyses are subject to biases and it is the responsibility of the researcher to acknowledge and account for fairness in coding and analysis [3]. At the same time, critical studies in ethnography, and its predecessor anthropology, have historically been built from a colonial lens and for empire [14] , and are inherently based on non-Indigenous ways of knowing and understanding the world.

While our current methods of analysis might carry emic and etic perspectives, the questions we ask with our data, the relational commitments to those who participate in our studies are deeply cultural, ethical, and political. These cultural and ethical dimensions and decisions matter in the kinds of codes we choose and can attend to. They align with our worldviews and positionalities we need to account for that in the ways we understand our codes, our methodologies, and our algorithms.

Additionally, there is often been a mismatch between Western notions of ontology and epistemology and the understandings held by different Indigenous communities. Historically, research has been a "dirty word" in many Indigenous communities [15]. For example, research from within Indigenous knowledge systems and relationality is ceremony [16], is relational and based on ethics of reciprocity [17], and often has decolonizing goals that uphold the desires and well-being of Indigenous communities [18].

Given these synergies and challenges, we present two case studies in this symposium for collective thought and discussion with the QE community: (1) the use of metaphor and stories within Indigenous understandings of language and discourse, and (2) Indigenous understandings of data, analysis, and visualization. Interwoven within these is a core question around considering the cultural, ethical, and political dimensions of QE's methodologies and forms of analyses. We hope to also facilitate discussion about etic/emic perspectives of QE analysis and encourage Indigenous and non-Indigenous researchers to analyze the same data and discuss possible limitations and expanded possibilities of analysis across perspectives.

2.2 Case Study 1: Metaphors & Stories

Storytelling is a central element of Indigenous methodology [11, 19]. Often, the purpose of a story is less about the specific details and more a way to share beliefs and values, connect storyteller and listener, and respect 'diversities of truth' [20]. Rather than extracting a story from its context, however, it is important to "be reflexive about who is telling the story; who is in the audience, listening; what parts of the story are included, which are removed; what language it is told in; and what its effects are hoped to be"[11]. Indigenous stories are also often not linear but go in circles; "there are stories inside and between stories, and finding your way through them is as easy and as hard as finding your way home" [21]. Furthermore, Cajete & Williams [12] remind us that metaphors within stories are employed by the great teachers across human history. Metaphors are the "facilitator of the creative process; it invents, integrates, and applies the deep levels of human perception and intuition to the task of living" (p. 1715).

Knowing that the richness of metaphorical language and the complexity of stories might mean something distinct in various contexts and times, across different people, how might we more deeply understand the multiple, layered meanings of particular words, language, and discourse? Furthermore, how responsive are our current processes of automated coding within larger datasets to these nuances? What might we begin to see if we stay within a metaphor as we run an analysis or an epistemic network graph?

Within this case study, we present an epistemic network graph of a conversation between two Indigenous scholars and their use of metaphors as a starting point of conversation.

2.3 Case Study 2: Data, Analysis, and Visualization

Opaskwayak Cree scholar Wilson reminds us that Indigenous research is ceremony, that data is sacred, and relational accountability guides how and what we study [16]. The "with who", "how" and "towards what ends" of our research matters [22]. Within Indigenous studies, there have been growing work around data sovereignty [23] to highlight the sovereignty of tribes' and the axiological distinctions between colonial institutions and Indigenous understandings of data. Data is a sacred relationship. If we deeply consider Indigenous understandings of data as gift, how might this impact the segmentation of our dataset, how might this impact how we code?

Relatedly, Indigenous scholars and artists have also been attentive to the way that codes and other data has been presented through culturally-appropriate aesthetics and creative production [24]. The *Every One* [25] data visualization project on Missing and Murdered Indigenous Women, Girls, Queer and Trans People is an example of data visualization that is based on a distinct aesthetic. How might our data visualization reflect the cultural contexts and aesthetic of people and place? How might we think of coding as artwork?

In this case study, we present a variety of data visualization practices from within Indigenous ethics and aesthetics to generate dialogue with the growing field of data visualization within QE (e.g. [26]).

3 Collective Contributions

Within the QE field, there have been a few studies in the QE community drawing from work in Indigenous contexts [27, 28]. However, the vast majority of research using QE has been conducted by non-Indigenous researchers, in non-Indigenous contexts, using non-Indigenous methods and approaches. The lack of Indigenous-related research in the QE field is unsurprising, given the limited number of Indigenous researchers (let alone those leading projects) [29] and limited awareness of Indigenous methods and approaches [15].

QE's approach to unifying different types of data including the value of narrative and relationships offers an opportunity to bring important insights about how we know, who we know with, and what is knowing from multiple epistemic frames. Through interfacing QE with Indigenous knowledge systems and methodologies, we hope this symposium is an opening to discuss possible ways that QE could support Indigenous research and how QE as a methodology could shift through Indigenous ethics. We are specifically interested in the QE within Indigenous contexts, as a potential tool of wellbeing, self-determination, and equity for our families and communities.

We view this symposium as an opportunity for the QE community to begin to interrogate its ethics and how research might further the goals of equitable research for other marginalized and minority communities. We invite the QE community to consider culture, then, as not something to be studied; rather, culture as the grounds by which our algorithms are developed, the ethics and politics of how we code, the frames of what we understand to be good, true, rigorous and valid, and how our research is consequential for the flourishing of multiple forms of life [30].

References

1. Shaffer, D. W.: *Quantitative Ethnography*. Cathcart Press, Madison, WI (2017).
2. Akkerman, S., F., & Bakker, A.: Boundary crossing and boundary objects. *Review of Educational Research*, *81*(2), 132–169 (2011).
3. Shaffer, D. W., Collier, W., & Ruis, A. R.: A Tutorial on Epistemic Network Analysis: Analyzing the Structure of Connections in Cognitive, Social, and Interaction Data. *Journal of Learning Analytics*, *3*(3), 9–45 (2016). https://doi.org/10.18608/jla.2016.33.3
4. Frey, K., Nguyen, H., Kwak-Tanguay, S., & Germinaro, K.: What Do Honor and Face Norms Have to Do with Peer Relations? Adolescents Make Sense of Revenge. *ICQE 2020: Advances in Quantitative Ethnography*, 348–361 (2021). https://doi.org/10.1007/978-3-030-67788-6_24
5. Zörgő, S., & Peters, G.-J. Y.: Epistemic Network Analysis for Semi-structured Interviews and Other Continuous Narratives: Challenges and Insights. In B. Eagan, M. Misfeldt, & A. Siebert-Evenstone (Eds.), *Advances in Quantitative Ethnography* (pp. 267–277). Springer International Publishing (2019). https://doi.org/10.1007/978-3-030-33232-7_23
6. Hamilton, E., & Hobbs, W.: Epistemic Frames and Political Discourse Modeling. *ICQE 2020: Advances in Quantitative Ethnography*, 32–46 (2021). https://doi.org/10.1007/978-3-030-67788-6_3
7. Kaliisa, R., Misiejuk, K., Arastoopour, G., & Misfeldt, M.: Scoping the Emerging Field of Quantitative Ethnography: Opportunities, Challenges and Future Directions. *ICQE 2020: Advances in Quantitative Ethnography*, 3–17 (2021). https://doi.org/10.1007/978-3-030-67788-6_1
8. Stewart, G. T.: Māori Philosophy: Indigenous thinking from Aotearoa. Bloomsbury Academic. (2020).
9. Arastoopour Irgens, G.: *Using quantitative ethnography to tell stories that have not been told before*. (2020). https://www.youtube.com/watch?v=HGfmOEUP68Y&ab_channel=InternationalSocietyforQuantitativeEthnography

10. Martinez-Maldonado, R., Echeverria, V., Fernandez Nieto, G., & Buckingham Shum, S.: From Data to Insights: A Layered Storytelling Approach for Multimodal Learning Analytics. *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*, 1–15 (2020). https://doi.org/10.1145/3313831.3376148
11. Archibald, J. Q. Q. X.: Indigenous Storywork: Educating the Heart, Mind, Body, and Spirit. UBC Press. (2008).
12. Cajete, G. A., & Williams, D. R.: Eco-aesthetics, Metaphor, Story, and Symbolism: An Indigenous Perspective. In A. Cutter-Mackenzie-Knowles, K. Malone, & E. Barratt Hacking (Eds.), *Research Handbook on Childhoodnature: Assemblages of Childhood and Nature Research* (pp. 1707–1733) (2020). Springer International Publishing. https://doi.org/10.1007/978-3-319-67286-1_96
13. Kovach, M. Indigenous Methodologies: Characteristics, Conversations, and Contexts. University of Toronto Press. (2009).
14. Simpson, A.: On ethnographic refusal: Indigeneity, voice and colonial citizenship. *Junctures*, *9*, 69–80 (2007).
15. Smith, L. T.: Decolonizing Methodologies: Research and Indigenous Peoples (2 edition). Zed Books. (2012).
16. Wilson, S.: Research is ceremony: Indigenous research methods. Fernwood Publishing. (2009).
17. Sumida Huaman, E., & Martin, N. D.: *Indigenous Knowledge Systems and Research Methodologies: Local Solutions and Global Opportunities*. Canadian Scholars. (2020). http://ebookcentral.proquest.com/lib/umn/detail.action?docID=6324726
18. Tuck, E.: Suspending Damage: A Letter to Communities. *Harvard Educational Review*, *79*(3), 409–428 (2009). https://doi.org/10.17763/haer.79.3.n0016675661t3n15
19. Brayboy, B. J. M.: Toward a tribal critical race theory in education. *The Urban Review*, *37*(5), 425–446 (2008).
20. Walter, M., & Andersen, C.: *Indigenous Statistics: A Quantitative Research Methodology* (1 edition). Routledge., p. 76 (2013).
21. Tafoya, T.: Finding Harmony: Balancing Traditional Values with Western Science in Therapy. *Canadian Journal of Native Education*, *21*(Supplement), 7–27., p. 12 (1995).
22. Phillip, T., Bang, M., & Jackson, K.: Articulating the "how," the "for what," the "for whom," and the "with whom" in concert: A call to broaden the benchmarks of our scholarship. *Cognition and Instruction*, *36*(2), 83–88 (2018).
23. Harry, D.: *Data Sovereignty & Indigenous Knowledge by Dr. Debra Harry*. (2020). https://www.youtube.com/watch?v=qW0tz50LWlo&ab_channel=JacquelineColby
24. De Santolo, J.: The emergence of Yarnbar Jarngkurr from Indigenous homelands: A creative Indigenous methodology. In J. Q. Q. X. Archibald, J. B. J. Lee-Morgan, & J. De Santolo (Eds.), *Decolonizing Research Indigenous Storywork As Methodology* (pp. 239–259). Zed Books. (2019).
25. Hanska Luger, C.: Every one: Missing and Murdered Indigenous Women, Girls, Queer and Trans People Bead Project. Cannupa Hanska. (2018). http://www.cannupahanska.com/mmiwqtbeadproject
26. Buckingham Shum, S., Echeverria, V., & Martinez-Maldonado, R.: The Multimodal Matrix as a Quantitative Ethnography Methodology. In B. Eagan, M. Misfeldt, & A. Siebert-Evenstone (Eds.), *Advances in Quantitative Ethnography* (pp. 26–40). Springer International Publishing. (2019). https://doi.org/10.1007/978-3-030-33232-7_3
27. Trinidad, S. B.: Co-Learning in an Intercultural Community-University Research Partnership. *ICQE 2019: Conference Proceedings Supplement*, 79–80 (2019).

http://icqe19.epistemicanalytics.org/wp-content/uploads/sites/9/2019/11/ICQE-2019-proceedings-supplement-final2.pdf
28. Meixi.: *Towards Schools for Indigenous Futures: Storywork & Epistemic Network Analysis* [Poster presentation]. International conference on quantitative ethnography, Madison, WI. (2019). http://icqe19.epistemicanalytics.org/wp-content/uploads/sites/9/2019/11/ICQE-2019-proceedings-supplement-final2.pdf
29. Australian Research Council. *Evaluation of ARC support for Indigenous researchers and Indigenous research: ARC Response (June 2018)* [Text]. Australian Research Council. (2018).
30. Jurow, A. S., Teeters, L., Shea, M., & Steenis, E. V.: Extending the Consequentiality of "Invisible Work" in the Food Justice Movement. *Cognition and Instruction*, *34*(3), 210–221 (2016). https://doi.org/10.1080/07370008.2016.1172833

Considerations for the Use of Quantitative Ethnography in Healthcare

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1 Introduction

Healthcare is a complex adaptive system in which government, industry, academia, medicine, and the public intersect to improve clinical outcomes for people. When considering patient care pathways, it is easy to assume treatment is provided based on best practice given the resources available. The many considerations, such as health policy, healthcare governance, evidence-based medicine, and patient advocacy, play an essential role in how care is provided and the quality and safety of that care. How the various sectors interact and influence each other have an impact at the patient level. Complex problems do not always require complex solutions when the system is well understood by those wishing to improve or innovate on existing care.

Stakeholder engagement with clinician and patient partners is now recognized as a critical component to the success of health services and clinical research. As researchers, we must first understand the complexity of the healthcare system to act better from within it. The concept of 'nothing about us without us' has taken hold across multiple countries worldwide as an important consideration for researchers to involve people living with disease and clinicians in various sub-specialties in the research process. An increase in societal awareness of systemic racism and the nuances of power and privilege have illuminated a greater need for equity, diversity, and inclusion within all facets of research. Engaging in meaningful dialogue with these considerations will build capacity for healthcare institutions to adapt to more inclusive environments that allow educators to develop better care pathways.

The International Society for Quantitative Ethnography has evolved throughout several iterations of scientific meetings. Since the first annual International Conference on Quantitative Ethnography took place in 2019, scientists from all over the world have gathered to discuss where and how quantitative ethnography (QE) fits within the scientific community. While complex world issues remain the focus of discussion in other symposia, this symposium aims to develop a consensus on how to conduct QE within the healthcare system from both from a systems thinking perspective.

2 Symposium Structure and Goals

The ICQE21 Healthcare Symposium will feature a panel of five leading QE experts whose research focuses on healthcare, be it in different domains or through different paradigms. For this symposium, we have selected five key areas of interest across the domains of stakeholder engagement, including: participatory QE such as patient-oriented research in QE, engaging healthcare providers in QE, and integration of research and practice, including: using QE for healthcare quality improvement, implementation science, and healthcare systems engineering. The goal of the first domain is to address questions related to who should be engaged in QE research and what perspectives are important for successful QE. The second domain addresses how we can improve current healthcare solutions through exaptation with QE. Each expert will provide their perspectives in these topic areas as they relate to their health-related disciplines (Boisvenue: public health epidemiology and partner-oriented research; H.S. Jung: health education and assessment methods; S. Jung: health sciences education and research; Woolridge: human factors and systems engineer; Ruis: historian of science, medicine, and technology; Popov: team learning scientist; Zörgő: medical anthropologist). Audience members will have the opportunity to ask questions to panelists while building relationships with other members of the QE community, such as new mentorships, collaborations, and networking. Our goal will be to illuminate current QE health research and build capacity for future ongoing QE symposia.

2.1 Patient-Oriented Research & Participatory QE

Research is considered to be patient-oriented when patients are "actively engaged in governance, priority setting, developing the research questions, and even performing certain parts of the research itself" [1]. More formally, patient-oriented research is a continuum of research that engages patients as partners, focusing on patient-identified priorities to improve health outcomes [2]. This research if often conducted in a multidisciplinary way through partnerships relevant to the topic area. The goal is to apply the knowledge generated from the research to improve healthcare practice. While many believe that patient-oriented research emerged from evidence demonstrating a positive impact on care, it was created out of a moral, ethical, and political need to remove the barriers between patients and providers [3]. More recently, patient-oriented research is more widely regarded as partner-oriented research as clinicians have also taken an interest in playing an active part in working together with researchers to improve uptake into practice, though this remains debated.

Patient-oriented research intends to focus on priorities that matter to those affected by a specific disease. While the word patient implies that the individuals themselves living with a disease are the partners, it can also include family and friends of patients to draw on valuable perspectives of managing illness. It is not unusual for qualitative study designs to involve partners in research although, understanding complex methods such as QE can be confusing to the non-scientist. Pair the ambiguity of QE and the power hierarchy between patient and researcher or clinician, researchers must take extra care to find a balance that does not overburden study partners while allowing them to feel empowered. We have begun to see greater inclusivity of healthcare providers in participatory QE through learning analytics research focused on developing models to

process and visualize multimodal data from nursing team simulations [4]. Community-based research will play an important role in evolution QE. Engaging in meaningful dialogue about the role of QE in this symposium will illuminate the opportunities and challenges of adapting this discipline in healthcare.

There are three important considerations for patient engagement in patient-oriented research: (1) patients have a right to engage in and contribute to research, and researchers must ensure that engagement; (2) patients bring their perspectives and lived experience into the research design; and (3) patient engagement increases research transparency, relevance, and accountability within the research [5]. There is no shortage of frameworks developed to support patient-oriented research. Further, there is no universally acknowledged framework that exists for researchers and most frameworks are not used beyond the groups that develop them. It is self-evident that researchers would benefit more from a synthesis of evidence on patient-oriented research specific to their field. At present, there is no generated evidence of patient partner engagement within QE research. Given that QE has important implications for clinical practice, it would be advantageous for researchers to develop a process for engaging patient and clinician partners in participatory QE research for greater uptake and impact on healthcare.

2.2 **Engaging Healthcare Providers in Participatory QE**

Evidence-based medicine has revolutionized healthcare delivery. While applying traditional medical based training, clinicians are expected to maintain an up-to-date understanding of current clinical evidence to inform their practice and provide the best care. Evidence-based medicine gives clinicians the ability to deal with the uncertainties of clinical medicine and adapt teachings for continuing medical education and new generations of healthcare providers [6]. While keeping informed of rapidly evolving scientific literature, clinicians have grown an interest in participating in clinician engaged research. The benefits to clinicians becoming involved in clinical research improves job satisfaction, professional confidence, and builds capacity for an appreciation for research to inform clinical care [7]. While healthcare services and researchers work to meet the needs of patients and communities better, several barriers to engaging clinicians in the research process remain. Representing the bulk of the healthcare workforce, allied healthcare professionals appear to be less engaged in research than medical professionals [8]. More practice-based evidence including engaging clinicians in impactful community-based clinical research will serve to improve evidence informed care [9].

Quantitative ethnography has the potential to capture patient needs and insights from lived experiences and convey these experiences in a way that is relatable to the numbers-oriented clinical culture of medicine. Particularly, QE can identify the most relevant factors and how each interacts in a complex network. Epistemic Network Analysis (ENA) is a method that can be used to look at relationships between such factors. The findings of qualitative studies are highly contextual and can provide evidence on questions clinicians have about their patient panels. Clinicians have limited time and day-to-day clinical activities leave little room for research-related activities, and for many allied healthcare providers, research is not part of the job. Engaging in research can seem like information overload and the main concern most clinicians have

is whether the evidence is directly applicable to routine clinical practice. These challenges can be overcome by engaging clinicians at every step of the research process with absolute transparency. Framing research participation as part of continuing professional development is an important perspective but remains unsupported by health organizations in many healthcare systems. The goal for QE researchers should be to co-design methods with clinician partners that make QE understandable to lay audiences while focusing on relevant questions that are adaptable to routine clinical practice.

2.3 QE Methods for Quality Improvement

Understanding continuous quality improvement from the patient and clinician perspectives is central to improving care pathways. Measuring the quality of healthcare delivery has important implications for health policy and governance, and by contrast, moves our focus away from individual system actors towards a broader examination of system-level processes [10]. Regardless, the need for patient and clinician involvement in healthcare design requires human connection beyond a structural process and recognition that involvement is part of the rights of citizenship.

Multidisciplinary teams are now recognized as the gold standard for providing good quality care across multiple clinical specialties. Many healthcare systems adopt complex quality improvement initiatives yet struggle to embed tools and methods into how care teams collaborate [11]. Several studies have shown the benefits of using QE methods to understand how care teams learn and adapt to growing system changes [12,13]. It is possible that QE methods like ENA can be used as a valuable quality improvement tool to inform clinical practices about how healthcare teams learn. Principles of adult education and continual professional development are closely aligned with concepts of quality improvement. Given an emphasis on systematically identifying gaps in knowledge, understanding problems relevant to practice, and developing skills to assess system level issues critically, the use of QE in quality improvement has yet to be elucidated. There are potential mechanisms in QE by which healthcare providers can understand deep learning processes to adjust to improve healthcare processes. Adopting QE methods to quality improvement could be the missing link to understanding the nuances of highly complex adaptive systems like healthcare.

2.4 Implementation Science

Implementation science is defined as "the systematic uptake of research findings and other evidence-based practices into routine practice, and, hence, to improve the quality and effectiveness of health services" aims to close the research-to-practice gap by incorporating a broader scope to include patient and provider, organizational, and policy levels of healthcare [14]. Implementation science and quality improvement share common characteristics. The goal of each is to improve quality of healthcare however, quality improvement is problem specific to a distinct area of care, leading to human-centered design modalities that improve specific components of healthcare systems. Implementation science, by contrast, operates under the guise of evidence-based practice by identifying gaps in quality of care and addresses those gaps to improve both

provider knowledge and ways in which it can be applied to other areas of the healthcare system.

Since strategies for implementation seek to integrate discrete interventions for specific system barriers, strategies targeting audiences at the patient or provider level may include quality improvement tools to assist in learning. It would then seem that the use of QE has applications in both quality improvement and implementation science fields. Given that the most common strategies used in implementation include education design, learning collaboratives, and team-based coaching, there is great potential for QE methods to contribute to building a learning healthcare system.

2.5 **Healthcare Systems Engineering**

The previously recognized quality and safety concerns in healthcare, combined with the acknowledged complexity of healthcare as a system has resulted in recognition that disciplines such as human factors (or ergonomics) and systems engineering are necessary to ensure the provision of safe, high-quality care. The science of ergonomics is grounded in the idea that system outcomes (e.g., quality of care, patient safety, patient outcomes) can be jointly optimized with healthcare worker outcomes (e.g., reducing stress, preventing occupational burnout, musculoskeletal injuries) and organizational outcomes (e.g., employee turnover). As such, calls emerged - and remain - to use HF/SE to re-engineer the healthcare system [15].

The ergonomic approach, especially in the francoergonomic tradition, is rooted in the idea that the *worker* (i.e., the one performing the work in the healthcare system that is any activity someone engages in to pursue better health for themselves or other) is the expert on how to do the *work* (i.e., activities). Therefore, if we wish to re-engineer the healthcare system to improve outcomes, we had best engage the worker(s) and value their *emic* perspectives. This distinction and explicit valuation of the emic - in ergonomics literature, called *activity* [16] or work as done `- over management's *etic* perception of the work, which we call *task* [16] or work as imagined [17] fits nicely with the philosophy and approach underlying QE. Thus, the methods, and tools of QE extend the analytic capabilities of prior human factors and systems engineering work [12,18] supporting the engineering of healthcare systems to improve outcomes for all workers including: healthcare professionals, patients, family and other informal caregivers. In addition, it is possible that theories, methods, and approaches from human factors and systems engineering can inform the development of QE as a broader discipline.

3 **Conclusion**

The emerging science of quantitative ethnography as an application to other methods is an important consideration as part of a systemized approach to identifying and addressing complex healthcare system-level issues. Thus, QE is a critical component of a learning healthcare system and will continue to improve patient care. Herein, we present some of the challenges that healthcare researchers continually face in engaging patients and clinicians as partners in the research process, conducting good quality improvement strategies and implementation science, and how QE can be adapted to

compliment and innovate on the current methods used in these areas. The advantage of QE is that it presents unified methods to complex real-world problems that often need to be answered with both qualitative narratives and system-level numerical data. Healthcare systems are increasingly complex, ever-changing, and interconnected with government and industry. To meet the demand of providing quality care as a basic human right, health services and clinical research must work in parallel to demonstrate the importance of community involvement in research.

Quantitative ethnography has the unique ability to provide healthcare stakeholders with tangible research findings in a way that is consistent with clinical culture. The diverse epistemological stances within QE raise questions regarding validity and relevance but are important for broader acceptance into healthcare scientific communities. It is only through using QE in various fields such as patient and clinician community led research, quality improvement, and healthcare systems engineering, that this science will demonstrate its transferability and applicability to complex system-level problems.

References

1. Canadian Institutes of Health Research. Patient engagement - CIHR [Internet]. 2021 Available from: https://cihr-irsc.gc.ca/e/45851.html
2. Strategy for Patient-Oriented Research - Patient Engagement Framework - CIHR [Internet]. Available from: https://cihr-irsc.gc.ca/e/48413.html
3. Entwistle VA, Renfrew MJ, Yearley S, Forrester J, Lamont T. Lay perspectives: Advantages for health research. Br Med J., 316[7129], 463–6 (1998).
4. Zorgo, S., Peters, G.-J.Y.: Epistemic Network Analysis for Semi-structured Interviews and Other Continuous Narratives: Challenges and Insights. Vol. 1, Advances in Quantitative Ethnography. 267–277 (2019).
5. Greenhalgh, T., Hinton, L., Finlay, T., Macfarlane, A., Fahy, N., Clyde, B., Chant, A.: Frameworks for supporting patient and public involvement in research: Systematic review and co-design pilot. Heal Expect. 22[4], 785–801 (2019).
6. Group W. Evidence-Based Medicine: A New Approach to Teaching the Practice of Medicine. JAMA - J Am Med Assoc. 268[17], 2420–5 (1992).
7. Zallman, L., Tendulkar, S., Bhuyia, N., Dube, B., Early, S., Arredondo, M., Puleo, R., Sengupta, N., Alsan, B., Hacker, K.: Provider's perspectives on building research and quality improvement capacity in primary care: A strategy to improve workforce satisfaction. Clin Transl Sci. 6[5], 404–8 (2013).
8. Mickan, S., Wenke, R., Weir, K., Bialocerkowski A, Noble C. Strategies for research engagement of clinicians in allied health (STRETCH): A mixed methods research protocol. BMJ Open. 7[9], 1–9 (2017).
9. Potter, M., Goldstein, E.: UCSF Manual with Community-Based Clinicians/Research.
10. Renedo, A., Marston, C.: Developing patient-centred care: An ethnographic study of patient perceptions and influence on quality improvement. BMC Health Serv Res. 15[1], 15–7 (2015).
11. Kostal, G., Shah, A.: Putting improvement in everyone's hands: Opening up healthcare improvement by simplifying, supporting and refocusing on core purpose. Br J Heal Care Manag. 27[2], 1–6 (2021).

12. Wooldridge, A.R., Haefli, R.A.: Using Epistemic Network Analysis to Explore Outcomes of Care Transitions. Commun Comput Inf Sci. 1112, 245–56 (2019).
13. Ruis, A.R., Rosser, A.A., Quandt-Walle, C., Nathwani, J.N., Shaffer, D.W., Pugh, C.M.: The hands and head of a surgeon: Modeling operative competency with multimodal epistemic network analysis. Am J Surg. 216[5], 835–40 (2018).
14. Bauer, M.S., Damschroder, L., Hagedorn, H., Smith, J., Kilbourne, A.M.: An introduction to implementation science for the non-specialist. BMC Psychol. 3[1], 1–12 (2015).
15. Carayon, P., Wooldridge, A., Hose, B.-Z., Salwei, M., Benneyan, J.: Challenges and Opportunities For Improving Patient Safety Through Human Factors and Systems Engineering. Heal Aff. 37[11], 1862–9 (2018).
16. Leplat, J.: Error analysis, instrument and object of task analysis. Ergonomics. 32[7], 813–22 (1989).
17. Wears, R.L., Hollnagel, E.: Why is Work-as-Imagined Different from Work-as- Done? In: Resilient Health Care, Volume 2. CRC Press; p. 279–94 (2020).
18. Wooldridge, A.R., Carayon, P., Shaffer, D.W., Eagan, B.: Quantifying the qualitative with epistemic network analysis: A human factors case study of task-allocation communication in a primary care team. IISE Trans Healthc Syst Eng.; 8[1], 72–82 (2018).

Special Session

Cyberinfrastructure for a Transmethodological Research Community

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Abstract. Quantitative ethnography (QE) unifies qualitative and quantitative methods, enabling researchers to conduct analyses that lead to grounded conclusions supported by mathematically rigorous representations. So far, the QE community has focused on a few core tools that function as boundary objects between people in different disciplines and different epistemological traditions. As the community grows, new tools—and new algorithms and approaches for existing methods—are being developed. As a starting point for discussion in a special session at the *Third International Conference on Quantitative Ethnography* (ICQE21), this white paper describes whether and how we might design, build, and maintain infrastructure to support the development and use of new QE tools that both interface seamlessly with existing QE techniques and create new possibilities for analysis and visualization.

Keywords: Transmethodological Research, Cyberinfrastructure, Computational Techniques, Unified Methods.

1 Goal

This white paper outlines a vision for growth of the quantitative ethnography community. A draft version was discussed in a special session at the *Third International Conference on Quantitative Ethnography* (ICQE21), and this version is the result of that session. It is intended as a roadmap for cyberinfrastructure development to support the continued growth of the quantitative ethnography (QE) community's shared transmethodological work.

2 Background

Over the last decade, the QE community has organized around a set of methodologies and analysis techniques with the goal of unifying qualitative and quantitative approaches to making meaning from data. That is, the QE community is attempting to move beyond mixed methods, where qualitative and quantitative analyses are conducted separately—often on different data from the same setting—and then the results are triangulated, or the results from one form of inquiry are used to drive the

other (for example, using a survey to determine subjects for qualitative interviews). In quantitative ethnography, both qualitative and quantitative approaches address the same hypothesis about the same data: that is, each provides a warrant for the other using the same data and coding. Central to this enterprise is that such analyses be *fair* [1], in the sense that results are accurate reflections of the data, tied to underlying hypotheses or theories, and equitably represent subpopulations.

The results of such analyses are grounded conclusions that are supported by compelling and mathematically meaningful visualizations combined with numerical representations of the grounded conclusions and statistical tests on those numerical representations. Quantitative ethnography is thus a transmethodological approach to data analysis with the goal of producing findings that are meaningful—in the sense that the models mean what we think they mean—and that accurately reflect the meaning of the events being modeled.

This approach has necessitated the development of novel analytic techniques, which have been developed as tools that facilitate transmethodological inquiry. These tools are artifacts that:

1. Embody or enact key principles of quantitative ethnography to provide fair and meaningful analyses;
2. Are designed and built using a rigorous mathematical formalism that articulates some approach to data analysis;
3. Are encoded in an actual algorithm that lets researchers use the mathematical formalism;
4. Are available as computer code (typically in R); and
5. Provide (in most cases) graphical user interfaces that makes it easy for both novice QE researchers and QE researchers who are not quantitatively or computationally proficient to use the algorithms—and thus to apply QE techniques to their data.

Central to the organization of the QE community and of the methodological tools that support it is a recognition that principles need to be reduced to practice such that both researchers who are experts in qualitative methods and researchers who are computationally and quantitatively sophisticated can engage with the same tools to address the same questions in ways that are fair and that preserve the original meanings in the data.

For example, *epistemic network analysis* (ENA) [2] represents data as a discourse network of the connections that people make between key concepts as they act and interact. The network formalisms are represented in R code [3], but also in a graphical user interface [4] that includes a tutorial mode and easy-to-use menus and produces basic visual and statistical results for non-programmers. A central feature of ENA (and the R code, and the graphical user interface) is the ability to look at the networks in the model and see the events in the data that each connection in the networks represents. Other work by scholars in the QE community has developed ROCK [5], a tool (implemented as an R package [6]) that enables qualitative researchers to manually code their data and then formats it for QE analyses.

In this sense, tools in the QE community function as *boundary objects* [7] between people in different disciplines and different epistemological traditions. And it is precisely this ability for people to come together from these different perspectives with

a respect for the importance of meaning and equity that has been the strength of the QE community.

3 Challenges

As the QE community has grown, new challenges and opportunities have emerged:

1. The QE community is attracting researchers from more disciplines, with a wider range of backgrounds, so existing QE tools need to be extended to cover new situations.
2. A larger number of researchers have started to develop (or want to incorporate) additional tools and approaches into their QE analyses.
3. The methodological toolkit of statistics and computational methods is expanding rapidly, and QE researchers want to be able to use those approaches in QE analyses.
4. New contexts, data types and sources, and tools are raising new and more complex questions of about what data "means" and how to analyze it fairly.

While there are many opportunities to expand the scope of QE research, not all researchers with new ideas for a QE algorithm will be able to build a high-quality user interface to implement it—and even if that could be done, issues such as cross-compatibility among tools or data formatting could discourage productive integration of different QE techniques. Nor will it work to simply implement tools in R or Python, because then members of the community who are not quantitatively or computationally proficient will be unable to use and extend them.

4 Proposed Solution

Given these challenges, we argue that the QE community needs a cyberinfrastructure, a platform of *smart computational objects* that could interact with each other within a shared graphical user interface and a shared ontology.

4.1 Requirements

Some key design requirements that such a system would need to fulfill include the following:

1. Each tool (in the sense above) would be an object in this cyberinfrastructure.
2. Tools could be programmed in R, Python, C++, or Java, and developers could add modules to enable the cyberinfrastructure to interface with programs written in any language.
3. Tools would share a common language of quantitative ethnography. That is, there would be a shared and extendable QE vocabulary of mathematical and theoretical concepts, including variables and codes; qualitative examples and statistical significance; goodness-of-fit and member checking; subgroup fairness and model transparency.

4. Tools would function as objects in object-oriented programming: each would "know" what it needs to function and what kinds of outputs it can produce—and therefore which other tools it can interact with.
5. Tools would have a simplified graphical user interface that can be used to create sharable, dynamic analysis workflows—similar to the way users can assemble blocks to make programs using Scratch. New tools could be created by adding new kinds of blocks, or by combining existing tools into a particular configuration that could itself become a new tool for others. These analysis workflows would be shareable in the sense that complex data analysis pathways could be given as one piece to another researcher, and they would be dynamic in the sense that the entire workflow could recompute if any element were changed.
6. Tools would display simple information and allow simple changes to parameters in the workflow itself (i.e., on the "blocks"), or blocks could "open out" to their own graphical interfaces where more complex settings can be adjusted or where non-programmers could see a graphical interface designed by the tool developer. In either case, the inputs and outputs of one specific interface and tool would be consistent with other tools in the QE cyberinfrastructure. Of course, tools could be as simple as function calls to R or Python or any other programming language, "opening out" to just the source code.
7. The system would contain a tutorial mode and other training materials for new users.
8. The system would contain templates both for the creation of workflows for standard tasks and for creating or integrating new tools, for example, a template for an object that passes information to an external web tool such as Amazon Rekognition.
9. The system would be open source.
10. Finally, the whole cyberinfrastructure could be downloaded and installed locally, much as R or Python can be, with modules, workflows, and tools available for download in a central repository or by downloading and installing code. This would enable researchers with sensitive data or data access issues to run all analyses locally.

4.2 Prior Art

There is ample prior art for such an undertaking, but no system that we know of affords all of the features that the QE community needs. For example:

1. There is a long history of object-oriented programming, in which pieces of code and data are able to "publish" their inputs and outputs.
2. Programming languages are increasingly interoperable; for example, programs in R can run Python and C++ code and produce outputs in Java.
3. R and R studio are a downloadable and extendable workspace, but with no clear ontology and no graphical programming interface; they allow users to create graphical interfaces for functions and code.

4. Tidyverse, built on top of R, provides a model for a set of functions with a common ontology and the ability to interface with one another without a user specifying how the output of one function relates to the input of another, thus creating workflows around simple data management and statistical operations; however, there is no graphical interface, and the ontology is limited to well-formed and well-known statistical operations.
5. Platforms like R and Tidyverse are open source and are sustained by their communities of users; both have robust models for best practices in documentation and worked examples to ensure that tools in their ecosystems are useable.
6. Existing QE tools demonstrate the success of the "dual representation" of algorithms/mathematical operations as code objects that experts can manipulate and user-friendly graphical interfaces. For example, a user can construct and refine a simple model in the graphical user interface of a QE tool, then export that model to R and embed it into a more complex Monte Carlo simulation to test the robustness of the model.
7. As described above, existing QE tools also demonstrate that tools can be constructed that scaffold creation of meaningful and fair models.

In other words, nearly every aspect of the cyberinfrastructure the QE community needs has prior art that shows it can be accomplished.

4.3 Development Path

Creating such a cyberinfrastructure to support the work of a transdisciplinary and transmethodological community would not be a trivial undertaking. For example, developers would need to:

1. Design an ontology that captures the breadth of qualitative and quantitative methods across multiple disciplines but that is not so comprehensive as to be unwieldy, and that leverages commonalities across research languages and traditions that appear different;
2. Make that ontology easy to use but also extensible;
3. Determine guidelines and norms for creating tools within the cyberinfrastructure;
4. Determine needs across a broad and evolving community;
5. Create a community-engaged participatory design process both to identify needs and to ensure that the cyberinfrastructure meets them;
6. Determine how to design for future users from disciplines that are not yet represented in the community;
7. Design features and processes for the cyberinfrastructure to ensure that work within the system follows best practices for assuring fairness in the treatment of data and the people who produce it;
8. Design a system of support and training for a transdisciplinary enterprise that is robust and sustainable; and
9. Design a cyberinfrastructure that is stable and reliable while still allowing users to create new tools, workflows, practices, and concepts.

In other words, such a project would take proven ideas and recombine and extend them into a robust cyberinfrastructure for transdisciplinary and transmethodological research by engaging a diverse community working across multiple disciplines and research traditions.

5 Conclusion

We believe that developing the cyberinfrastructure for transmethodological research described above presents a grand challenge for the QE community: a development that will unlock the full potential of quantitative ethnography and the QE community.

References

1. Shaffer, D.W., Ruis, A.R.: How We Code. In: Ruis, A.R. and Lee, S.B. (eds.) Advances in Quantitative Ethnography: Second International Conference, ICQE 2020, Malibu, CA, USA, February 1–3, 2021, Proceedings. pp. 62–77. Springer (2021).
2. Shaffer, D.W., Collier, W., Ruis, A.R.: A Tutorial on Epistemic Network Analysis: Analyzing the Structure of Connections in Cognitive, Social, and Interaction Data. Journal of Learning Analytics. 3, 9–45 (2016).
3. Marquart, C., Swiecki, Z., Collier, W., Eagan, B.R., Woodward, R., Shaffer, D.W.: rENA: Epistemic Network Analysis. (2019).
4. Marquart, C., Hinojosa, C.L., Swiecki, Z., Eagan, B.R., Shaffer, D.W.: Epistemic Network Analysis. (2019).
5. Zörgő, S. Peters, G.-J.Y.: The ROCK Book. Available: http://rockbook.org.
6. Peters, G.-J.Y., Zörgő, S.: rock: Reproducible Open Coding Kit. (2021).
7. Star, S.L.: The Structure of Ill-Structured Solutions: Boundary Objects and Heterogeneous Distributed Problem Solving. In: Gasser, L. and Huhns, M.N. (eds.) Distributed Artificial Intelligence. pp. 37–54. Morgan Kaufmann (1989).

Workshops

Open Science in Qualitative Research and Quantitative Ethnography

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Abstract. Open Science (OS) aims to transform scientific practice to address the challenges, opportunities, and risks of the ubiquitous digital era to increase the societal impact of science in response to the growing and complex global issues facing humanity. The aim of the workshop is to discuss and start to define the degree and applicability of OS in Quantitative Ethnography (QE). QE presents a unified quantitative-qualitative methodology aimed at analyzing and modelling discourse data and other data. Therefore, how can OS be applied to qualitative and QE research, and what would its implementation signify? The output of the workshop can be a draft of a formal or informal manifesto, a journal article, a submission to ICQE22, QE reporting standards, or just a memoir of the workshop. Participants will decide what kind of output they would like to create and how they would like to co-create it.

1 Introduction

Open Science (OS) is a movement aimed at transforming scientific practice in order to address "the changes, challenges, opportunities and risks of the 21st century digital era and to increase the societal impact of science in response to the growing and complex global issues facing humanity" [1]. OS can be seen as a novel paradigm for scientific initiatives, promoting transparency, sharing, and sustainability. One of the main tenets of OS is fostering collaboration and inclusivity by encouraging new social actors to be actively involved in knowledge production, as well as the inclusion of scholarly knowledge by marginalized groups. OS directs attention to and aspires to reduce inequalities regarding access to scientific development and infrastructures via advocating open-source software that is publicly available under an open license, granting access to all in the (re)use and modification of the software and its source code. OS also aims to enhance access to scientific knowledge by addressing existing systemic inequalities, ensuring "that scientific knowledge, data and expertise are universally and openly accessible and their benefits universally and equitably shared" [1]. Through the spread of open access practices, researchers and the general public are able to gain full

access to scientific outputs including, but not limited to academic publications. By promoting transparency throughout the research process, OS inevitably spurs methodological rigor and verifiability via the possibility to scrutinize and openly evaluate processes of knowledge production. This increases the reliability of scientific evidence serving as the basis for decision-making and policy. Open processes further science and improve the effectiveness of scientific systems e.g., by increasing reusability and reducing research waste.

OS has gained momentum regarding quantitative methods and data, but are OS tenets and practices applicable to qualitative methods and data as well? The implementation of OS principles and its benefits in qualitative paradigms are still unclear. Certain aspects of OS introduce risks or seem less viable regarding qualitative data and processes. The degree and applicability of OS in Quantitative Ethnography (QE) [2], a unified quantitative-qualitative methodology aimed at analyzing and modelling discourse data (and other types of data), are also up for debate. Should OS be applied to qualitative and QE research, and what would its implementation signify?

2 Workshop Goals and Structure

The workshop aspires to: 1) Provide a forum for discussing the possibilities for implementing OS principles in qualitative and QE research, as well as for debating the advantages, disadvantages, risks, and benefits of such practices; 2) Compile and document these various insights in an open manner; and 3) Spur further discussions within qualitative and QE research communities beyond ICQE21.

The workshop consists of two subsections that provide a space for delving deeper into OS-related topics. In both of these subsections, workshop participants will discuss their ideas in smaller groups then share their insights among all workshop participants. Breaking into small groups will be preceded in both subsections by a short presentation regarding the OS-related topic and some open-ended questions. The last subsection of the workshop will focus on the co-creation of a document with our aggregated insights. Below is a basic timeline of planned activities:

ACTIVITY	DESCRIPTION	DURATION
Introductions	Arrival, warm-up, initial discussions	10mins
Topic 1	Short talk given by a workshop facilitator	5mins
	Discussion in subgroups	10mins
	Discussion in main group	10mins
Break (10mins)		
Topic 2	Short talk given by a workshop facilitator	5mins
	Discussion in subgroups	10mins
	Discussion in main group	10mins
Break (10mins)		
Topic 3	Co-creation of workshop output	30mins

The output of the workshop can be a draft of a formal or informal manifesto, a journal article, a submission to ICQE22, QE reporting standards, or just a memoir of the

workshop. Participants will decide what kind of output they would like to create and how they would like to co-create it.

3 Areas of Discussion

3.1 Topic 1: Open Data and Process

OS is primarily associated with one of its aspects: promoting the sharing of datasets along the lines of standards such as FAIR guidelines, European Open Science Cloud and Open Science Skills. Although open data can be considered a spectrum, not a dichotomy, it still raises anonymity and GDPR concerns regarding qualitative data. Additionally, such data may involve sensitive topics, vulnerable individuals, and minority populations, where risks of sharing data may outweigh any potential benefits. How can qualitative data be anonymized, if at all? Provided we remove sensitive aspects of our data, are we removing its essence? Do we have much to gain from open qualitative data in terms of e.g., reusability or verifiability?

A qualitative or QE research process may include *Conceptualization* (key terms and their descriptions/definitions, theoretical framework, etc.), *Operationalization* (research questions, type of measurement, sampling strategy, sample size planning, recruitment, etc.), *Process of data collection* (tools: interview structure, focus group discussion guide, etc., stopping criteria, type of data collected), *Code development* (different versions of code structure and rounds of triangulation/iterative refinement, final codebook, etc.), *Coding process* (changes in codes while coding: merges, splits, additions, etc., software used, number of raters, inter-rater reliability measures, etc.), *Analysis* (analytical approach, analytical tools, analysis scripts, etc.), and *Credibility strategies* (respondent validation, peer debriefing, etc.). Can these decisions and their justifications be made explicit? Should they be explicit? If so, how can they be logged in a way that fosters transparency, accessibility, and sustainability?

3.2 Topic 2: QE-specific Considerations and Implications for the Community

As QE methods generally involve the quantification of Discourse data, there may be further considerations in QE processes or specific to QE tools, such as Epistemic Network Analysis (ENA). Possible considerations may include: *Segmentation and data transformation* (considerations and actual transformations, etc.), *ENA model parameters* (unit, conversation, stanza window, SVD/means rotation, edge weights, etc.) and justifications for these. What are facets of QE methods/tools that may benefit from open discussion, documentation, and scrutiny? Are justifications needed concerning these methodological decisions? Do we have a system of sources that support such justifications? What types of analyses need to be conducted and what infrastructure is necessary to scaffold such decision-making?

If OS can be implemented in qualitative and QE research, and it is a desired aspiration within a community, it necessitates knowledge generation and transmission on best practices and infrastructure with which it can be realized. Ways to comply with open standards, strategies for implementing certain OS practices, tools with which to achieve transparency, and reporting standards are all valuable vehicles of successful

implementation. Of these, what do we have at our disposal and how can we modify them to be more effective? What new tools or strategies need to be created? Can articulating OS principles in a QE context aid in the development of robust and rigorous QE methods? Similarly, can these efforts positively influence the intellectual trajectory of the community?

3.3 QE Contributions to OS and Co-creation of Workshop Output

OS stands at the crossroads of widespread adoption; currently there is a lack of agreement on key definitions that hinders the development, the discussion around, and the potential adaptation of OS. QE is a well-suited approach that combines quantitative and qualitative research with a set of tools that embrace open approaches. For researchers, institutions, funding agencies, and the public, OS-related terminological and conceptual unclarity creates challenges. QE can play a role in helping to investigate how different communities understand OS and more importantly, as a set of tools, provide ways for different stakeholders to become more transparent in their processes. How can QE approaches help define, support, and explain OS? Can QE support the visualisations of OS practices and provide new ways for educating people about the benefits and challenges?

4 Potential Participants

We invite anyone from within or outside of the QE community to participate and contribute to our discussions on methodology, transparency, and reporting standards within a unified methodological framework. These discussions will be exploratory; all opinions are welcome and will be considered valid. Many of us are aware of the challenges that OS presents to various aspects of our research processes, this workshop is aimed to give voice to those concerns and to find acceptable solutions to common problems, weigh insights and opinions, and bring to light some of the affordances and constraints that OS presents in qualitative and QE research.

References

1. UNESCO Recommendation on Open Science (2019); available at: https://en.unesco.org/science-sustainable-future/open-science/recommendation.
2. Shaffer, D. W.: Quantitative Ethnography. Cathcart Press. (2017).

Introduction to the Reproducible Open Coding Kit

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1. Overall Focus of Workshop

We will walk through the fundamentals of the Reproducible Open Coding Kit with a special focus on how it can be employed for Quantitative Ethnographic (QE) analyses.

1.1 The Reproducible Open Coding Kit

The Reproducible Open Coding Kit (ROCK) is a standard and convention that enables transparent qualitative research. This standard is implemented in two Free/Libre Open Source Software applications: an R package (rock) and a graphical interface (iROCK). The ROCK helps researchers organize data sources, designate attributes to the providers of those data, code (and segment) narratives, as well as perform various analyses. In accordance with the ROCK standard, the R package allows making these steps explicit and transparent, thus improving transparency, inclusivity, and accessibility of research while minimizing research waste. Furthermore, the ROCK facilitates sharing coded qualitative data, enabling other researchers to reproduce the coding process, compare results, and collaborate by sharing or expanding the coding system.

1.2 The ROCK as Applied to Quantitative Ethnography

The ROCK can also be employed to prepare data for Epistemic Network Analysis (ENA) software. Code trees can be specified with the standard, and the graphical interface eases manual coding and segmentation. At the end of the coding process, sources can be downloaded and processed as a CSV file. This file can then be uploaded into the ENA webtool or processed further with the rENA package.

2 Who Would Benefit from the Workshop?

All are welcome at the workshop. The activities may be of more interest to researchers working with qualitative data manually and looking for a system with which to code and segment their narratives.

Knowledge of or experience with R and R Studio is not a prerequisite for attendance, but if you would like to participate, we strongly suggest you download these and become somewhat familiar with them prior to the workshop. The same applies to a

basic knowledge of qualitative research (e.g. coding, thematic analysis) – it is not required, but having some experience in these tasks is beneficial to getting the most out of workshop activities.

3 Schedule and Activities

TIMEFRAME	TASK	DESCRIPTION
Part 1	Introductions	-Get to know the ROCK (basic functionality and workflow) -Hear a bit about data management
Part 2	Coding and Segmenting	Participants will learn to: -assign attributes to sources of data -code and segment raw data with iROCK
Short break		
Part 3	Analysis	Participants will learn to: -perform basic analyses with the ROCK -prepare their data for use in ENA

4 Expected Outcomes

Participants will attain familiarity with a standard and toolkit with which they can conduct qualitative research in an open and reproducible manner. Pertaining to QE specifically, participants will learn a method to prepare data for use in ENA manually.

Introduction to Epistemic Network Analysis (ENA)

Yuanru Tan and Golnaz Arastoopour-Irgens

This workshop introduces the participants to the basics of the Epistemic Network Analysis (ENA) by analyzing two Shakespeare plays: Romeo and Juliet, and Hamlet. The goal of the workshop is to learn how to use the ENA web tool independently, and how to develop and interpret ENA graphs. The workshop consists of three parts: 1) theory, 2) step-by-step tutorial, and 3) group work. The topics of the first part are the differences between social network analysis and ENA, and data coding challenges. In the second part, the participants are introduced to the ENA web tool in order to compare the discourse between Romeo and Juliet, and Hamlet. Finally, the participants put their newly acquired skills into practice in the group work exercises.

Advanced ENA Interpretations

David Williamson Shaffer and Amanda Barany

This advanced workshop on interpreting Epistemic Network Analysis (ENA) models introduces participants to key issues with interpretation of ENA dimensions, network features, and statistical results. Participants learn about key elements of ENA mathematics, with an emphasis on rotation and dimensional reduction; explore how ENA results are visualized as two coordinated representations in a single metric space; and gain a deeper understanding of how to analyze and refine ENA models.

Introduction to nCoder

Amanda Siebert-Everstone, Jaeyoon Choi and Brett Puetz

This workshop will introduce methods for valid and reliable automated coding of text data using the nCoder webtool and R package. During the workshop, participants will work individually and in teams to step through the process of creating an automated and validated code. In this interactive workshop, participants will learn how to (1) combine qualitative and quantitative perspectives for text analysis, (2) create codebooks for code validation and publication, (3) develop and test automated classifiers to code text data, and (4) validate automated coding schemes. We will also provide an R script for participants who wish to use the R package version of this technique.

Advanced ENA and rENA

Yeyu Wang and Zachari Swiecki

In this workshop, we will introduce participants to advanced features of epistemic network analysis (ENA) available in the webtool and the rENA package for R, including weighted models, projection, masking, and trajectories. Participants will work in groups to apply these features on one of several sample datasets. Our emphasis be on how to implement the features, as well as how to determine whether they should be used. The workshop will culminate with an rENA analysis using ENA outputs in a subsequent technique, such as regression. Familiarity with ENA theory, the webtool, and rENA is preferred; however, we will provide brief overviews of each. We will also provide an R script for participants to use as a reference during and after the workshop.

Keynotes

Quantitative Ethnography within Learning Analytics: Past, Present, and Future

Vitomir Kovanovic
Department of Education Futures and Centre for Change and Complexity in Learning
University of South Australia

Over the past few years, Quantitative Ethnography (QE) has been one of the most rapidly growing methodologies within the learning analytics (LA) field, drawing attention from both quantitative and qualitative researchers. By combining data analytics and human qualitative interpretation, QE provides novel insights into human learning, bridging the gap between researchers from different backgrounds and research traditions. With the growing number of LA researchers starting to use QE, it is important to reflect on how these techniques have been used so far, and what benefits and challenges of such techniques for understanding and improving learning. This talk will first provide an overview of how QE has been used so far, and outline important directions for future research in QE and LA fields.

How We Mean, and What That Means for Interpretation in Ethnography

Adam Lefstein
Ben Gurion University of the Negev

Meaning making is central to ethnography – including quantitative ethnography – as both a key object of inquiry and as an inherent part of the research process. However, meaning is an elusive object and meaning making an unreliable process. Ortega y Gasset (1959) eloquently captured the problematics of meaning making with his two "strange and antithetical" principles at work in all human communication: (1) "'Every utterance is deficient' – it says less than it wishes to say'; (2) "'Every utterance is exuberant' – it conveys more than it plans". These principles pose formidable challenges for social scientists seeking to interpret discourse and social interaction: How can we make sense of utterances given their inherent ambiguity and instability? What methods, if any, can we use to ensure that our interpretations are valid? In this talk I will critically discuss a linguistic ethnographic approach to interpretation of discourse data, highlighting in particular the roles of theory, subjectivity, reflexivity, co-construction, and collaboration. I'll discuss and illustrate what meaning making involves, implications for interpretation, how to practically proceed in analyzing discourse data, and problems and limitations with my approach. I'm hopeful that quantitative ethnographers may find this approach useful in both opening and closing interpretive loops and may also rise to the challenges it poses for how we might mathematically model meaning in all its exuberances and deficiencies.