Centering Connections and Collaboration in the Evaluation of STEM Education Transformation

Carrie Diaz Eaton
Bates College, RIOS Institute

Yuhao Zhao
Bates College, RIOS Institute

Robin Taylor
RTRES Consulting

In this paper, we seek to understand the formation of a national network constructed for change in STEM education. To center the role of making connections in community and collaborations between network members, we use social network analysis (SNA) methods. We examine the impact of an in-person conference with the goals to bring together disparate groups around a common issue on network collaboration structure. We also examine the effect of post-conference virtual community building activities on network collaboration structure. A major limitation of SNA is response rate which, due to the pandemic, artificially drove a loss of collaboration. However, this loss was mitigated by new collaborations, particularly by influencers and boundary spanners. In addition, a sustained, year-long suite of virtual activities designed for community building and collaboration increased the collaboration activity in the network by 12.5%.

Keywords: evaluation, professional development, STEM education, networks, collaboration

A common form of professional development in STEM is the development of a learning community or community of practice. Originally designed to minimize professional development time while maximizing impact (Vescio et al. 2008), involvement in learning communities has been shown to impact postsecondary STEM classroom instructional practice (e.g. Manduca et al. 2017) and can also positively impacts persistence in STEM professional development activities (e.g. McCourt et al. 2017). The kinds of collegial interactions and support fostered in communities of practice have become recognized as a key factor in instructor adoption of cutting edge STEM classroom practices and can outweigh other barriers to reform (McConnell et al. 2020). McCourt et al. noted that participation in networks of individuals outside of one's department or institution provided participants with much needed space for pedagogical discussions and can transmit novel ideas across institutional boundaries (2017).

Educational innovation in postsecondary STEM education is both about infusing emerging technologies into classroom content, such as data science and course-based undergraduate research experiences, and about the broader human context, considering the social justice implications and the need to broaden participation (Rodenbusch et al. 2016, Holm and Saxe, 2016, Ballen et al. 2017, Alexander et al. 2022). This reflects a broader national dialogue on STEM education reform. In this context, an alternate target of intervention is the intentional building of networks and connections to support reform in undergraduate STEM education (e.g. Diaz Eaton et al. 2017). While the studies above focus on the efficacy of educator communities of practice in affecting classroom practice, a different set of literature driven by Kezar and colleagues strives to understand how these communities of practice can become communities of transformation (Gehrke and Kezar 2015, Kezar et al. 2018, Akman et al. 2020). However, researching programs that aim to act on a national reform level is challenging given the time scale of such change. In this paper we use network analysis as a tool to explore the structure of an emergent community of transformation. We ask:

- How does an in-person meeting affect collaboration network structure?
- Does participation in an in-person meeting affect engagement/persistence in the network?
- How does the availability of virtual professional development impact network collaboration structure and growth?

- Is network structure influenced by *boundary spanners* and/or *influencers*?

For the purposes of this paper, we define *boundary spanners* as individuals which broker knowledge between clusters of individuals and *influencers* as individuals who recruit a disproportionately large number of professional collaborations during the time of the study.

Theoretical Background

The co-authors come from a variety of educational training backgrounds in STEM and education including mathematics, education, biology, economics, and evaluation and include a variety of racial and ethnic points of view as Latinx, White, and Asian. Author 1, who is Latinx, draws their understanding of networks both from personal experience with support networks and from research in mathematical ecology and sustainability. However, both perspectives intersect in the writings of Rochelle Gutiérrez in "Living Mathematx: Towards a Vision for the Future" (2017). Gutiérrez outlines three Indigenous epistemologies, In Lak'ech, reciprocity, and Nepantla, which inform her framework for the teaching of mathematics, but which also deeply resonate with our theoretical perspectives on developing communities of practice and transformation. In Lak'ech describes a mutualistic community in which individuals can see the commonalities between each other. Reciprocity describes how communities of practice help one another achieve each other's goals through the sharing of experience and knowledge. Nepantla is the work of knowledge brokers and *boundary spanners*. *Boundary spanners* weave the community of transformation, moving across learning communities, negotiating tensions across contexts and goals, and moving the network towards transformation (Gutiérrez 2017, Masuda et al. 2018). We also draw from other frameworks which focus on the theory of change, or functional aspects of designing such learning communities and broader networks, and how they connect to change theory (Wenger 1998, LeMahieu et al. 2017, Gehrke and Kezar 2015). For example, an often first step of bringing together a community around a common goal, may be considered a way to foster In Lak'ech.

Social Network Analysis (SNA) is a mixed-methods approach that considers people (nodes) and the connections between them (edges) as important to the research question at hand and is often used in education research to examine learning effects due to peer interaction (Carolan 2013). In postsecondary STEM education, SNA research has focused on understanding classroom interactions and scientific mentoring (Aikens et al. 2016, Grunspan et al. 2017) and more recently has been used to examine adoption of evidence-based instructional practices in communities of practice (Ma et al 2019). However, SNA research in organizational theory examines community networks in the context of organizational change and the transformation of a field. We draw from mathematical work rethinking the influencer as someone who is well connected to someone which embodies reciprocity, making new active collaborations (Jun-Lan et al 2019). Work by Masuda et al. (2018) highlights the importance of Nepantla, examining the role of boundary spanning in innovation. Research by Frank et al. (2022) intervened in a network to promote boundary spanning. Still, many STEM education projects are designing networks as interventions, but lack techniques for evaluation of the network building aspects (Diaz Eaton et al. 2017). SNA promises an avenue that helps us understand both community formation and centers the connections and reciprocity important in a decolonized view of STEM education transformation. In this paper, we use data from a National Science Foundation (NSF)-funded research coordination network (RCN) in STEM education and use SNA techniques to explore the emergent community structure and collaboration.

Methods

Data Collection

The NSF RCN UBE program funds networks of individuals to advance undergraduate biology education and "activities across disciplinary, organizational, geographic, and international boundaries are encouraged" (NSF 2022, Diaz Eaton et al. 2016). The Sustainability Strategies for Open Resources to promote and Equitable Undergraduate Biology Education (SCORE-UBE) Summit was hosted by Bates College on October 17th through 19th, 2019. The goal of SCORE was to create a network for participants with various open education (OE) and STEM education affiliations to network, learn and address issues related to sustainability of open education and centering values of social justice, equity, diversity, and inclusion within open education. A total of 35 individuals representing more than 17 OE organizations participated in the SCORE Summit. The growth of the SCORE Network continued to grow through additional participation across new initiatives sponsored by additional funding grants and OE collaborations and via virtual activities hosted on QUBES Hub (an online community of math and biology educators who share education resources and methods to support instruction of undergraduate students to use quantitative approaches to tackle real, complex, biological problems). Over the 22 months of the study, activities included two virtual peer mentoring networks on equity and inclusion in open and STEM education and open educational practices, a virtual leadership program in open STEM education, a collaborative grant program which resulted in a virtual showcase of projects, and a working group on metadata justice for OER.

By June 2021, 72 individuals were current members of the SCORE group on QUBES Hub. SCORE members represented at least 67 different organizations/institutions – including 65 academic/higher ed institutions, nonprofits focused on open education, funding agencies/foundations, consulting firms, community of practice networks, professional societies, museums, and research labs. Members were geographically located across 28 US states and India. Disciplinary degrees of the steering committee included mathematics (2), biological sciences (2), STEM education (1), and library science (1).

All participants for the SCORE-UBE Summit and members who joined the SCORE group on QUBES Hub were asked to complete surveys using a multiple-criterion recognition question approach (Singleton and Asher, 1977). Members indicated the nature of their relationship with each participant in the network by selecting one of the following response options: (1) This is me; (2) I am not familiar with this person; (3) I am familiar with this person's work; (4) I have met this person; or (4) I have professionally collaborated with this person. For the survey, "professionally collaborated" was defined as actively engaging in cooperative work with another person, and this level is the focus of the social network analysis to follow. Response rates across survey administrations were 72.2% (26 of 36) of participants surveyed at pre, 30.5% (11 of 36) at mid, and 29.5% (18 of 61) at post. Over the course of the survey administration names were removed from the survey for those who did not participate in SCORE activities (i.e., registered but no attendance) and names were added to include new members who joined the SCORE QUBES Hub platform.

Network Analysis

Survey responses were de-identified by the evaluator in preparation for network analysis. For the purposes of the analysis below, we defined an edge between participant 1 to participant 2 if participant 1 reported that they had professionally collaborated with participant 2 (*i.e.* reported a level 5 connection in the survey). Therefore, the graphs constructed are directed graphs. For each pairwise comparison, we limited the adjacency matrix describing this network graph to those individuals who appeared in the both survey datasets, either as a respondent or as someone who was named as a collaborator. Comparisons of networks are visualized in a way that shows the transformation in collaboration during specific time intervals.

Connectance is calculated as the number of edges realized in the total network out of the possible connections. An individual is considered as an *influencer* if they gained a meaningful share of new edges during a particular time interval. An individual is considered a *boundary spanner* if multiple new collaborations are with individuals who are not already collaborating with each other.

Communities are detected using algorithm 'cluster_edge_betweenness' which calculates the *edge betweenness* (number of shortest path through the edge), removes the edge with highest value, and recalculates it, etc. Each color indicates a specific community in visualizations below.

All analyses and visualizations were conducted using the 'igraph' package in R (2022) and all code can be found on GitHub (https://github.com/yzha0/RUME_SNA).

Results

Summit's Effect on Collaborations

To gain a better understanding of how the Summit affected the network, we look at the general transformation of the network in Figure 1 over a time internal in which the SCORE Summit was held. Recall that connections in these graphs are those reported as "active collaborations." Connectance among individuals is somewhat low in pre-Summit survey (0.160), which is to be expected as the goal of this program is to bring together individuals across multiple contexts who may not have encountered each other before. From Figure 1, green links represent the new edge growth after the Summit and dotted links represent the loss of active collaboration in the network.

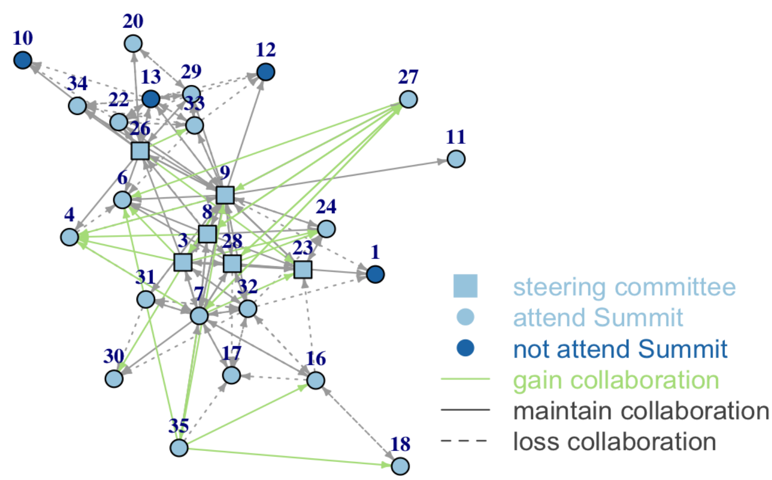

Figure 1. Change in collaboration network from prior to the SCORE Summit in October 2019 to after the SCORE Summit in February 2020. No activities other than the Summit were planned during this time interval.

Connectance decreases over this Summit time period (to 0.112). *A priori,* given the "have collaborated" language in the survey, we would not have expected any loss because historical collaboration would have continued to be reported. Indeed, very little of this loss (4 edges) were due to an individual reporting a lower collaborative status with another network member.

Instead, the majority of collaborative loss seemed to be driven by the response rate differentials. Individuals not attending the Summit (Figure 1, dark blue) suffered more collaborative loss than those who attended (Figure 1, blue), though most of these individuals did not respond to the February survey, which likely amplified this signal.

A few individuals were responsible for adding the majority of new connections, mitigating collaborative loss. Individual 3 seemed to report many new active collaborations, though the collaborators did not in all cases report them. It could be that Individual 3 was initiating collaborative discussions, whereas others saw them as more exploratory in nature. A clear influencer was Individual 27, who prior to the Summit, had weak connections to other SCORE Network participants - no active collaborations, but in some cases a familiarity with the person's work, but had never met. As a PI of a math education project, this person was an "outsider" to the "in-network" of a biology-heavy STEM education group, which brought new expertise and experience from outside the usual connections.

Promoting Collaboration via Virtual Activities

Between February 2020 and June 2021, the SCORE Network received additional funding from the Hewlett Foundation and launched multiple virtual activities. This included learning communities, a collaborative webinar series on Inclusive STEM Education, a newsletter, and a mini-grants program to foster collaborative projects within the network. While the network itself increased in size, in Figure 2 we limit ourselves to examining the change among those who were in the network in February 2020.

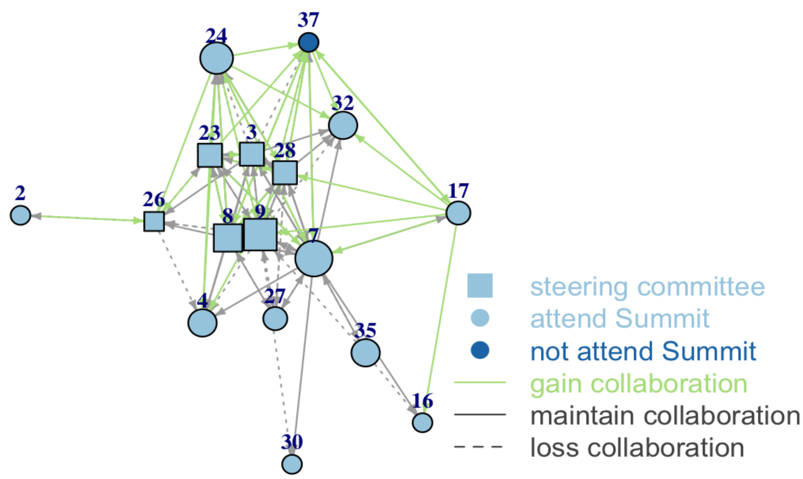

Figure 2. Change in collaboration network from just after the SCORE Summit in February 2020 to June 2021 at the end of the NSF SCORE-UBE grant period. A number of virtual and community building activities were planned during this time interval. Node size is scaled to the number of learning communities and mini-grants activities in which the individual actively participated during this time.

Despite another significant response rate drop among initially surveyed members, which should artificially drive connectance down, professional collaboration connectance in the network among survey respondents increased from 0.235 to 0.265, an effect size increase of 12.5%. By cross referencing the collaborations list to activity participation list, we can attribute a portion of this increase to a SCORE Network mini-grants program and joint authorship on an article about the Summit themes. The mini-grants program supported intentional collaborations across members to pursue and implement additional funding to support centering equity within

STEM Open Education as well as collaborations of members across multiple open education organizations to combine resources to support sustainability of their own initiatives.

At this point, SCORE Network members who were included in the initial survey, but ultimately did not attend the Summit are now no longer connected - ultimately they did not actively persist in this professional development network. However, we do see influencers and boundary spanners acting in this network. Individual 37 is a new member introduced to the network through virtual activities. They become an influencer in this network, gaining a significant number of active collaborations. Individual 17, who attended the Summit, becomes an influencer in the network and also a boundary spanner in the network, as their collaborations span across individuals that do not already have connections between each other.

In Figure 2, individuals that took part in multiple SCORE activities are represented with a larger node size. One can visually see that SCORE-sponsored activity participation does not necessarily correlate with increased collaborations.

Building an Interdisciplinary Community

Prior to the Summit, among the invitees, there were distinct two clusters of active collaboration in the network (see Figure 3, left), which together included approximately 43% of all nodes. The green cluster was primarily related to life and environmental science education and strongly tied to the QUBES community. The yellow cluster was related to the hosting location, Bates College. All other individuals did not have a strong clustering to each other and affiliation areas included Open Education, math, libraries, and non-profit foundations. By June 2021, the clustering has changed, so that approximately 82% of all nodes are now part of one cluster (see Figure 3, right) with open education, mathematics, and biology clustered together.

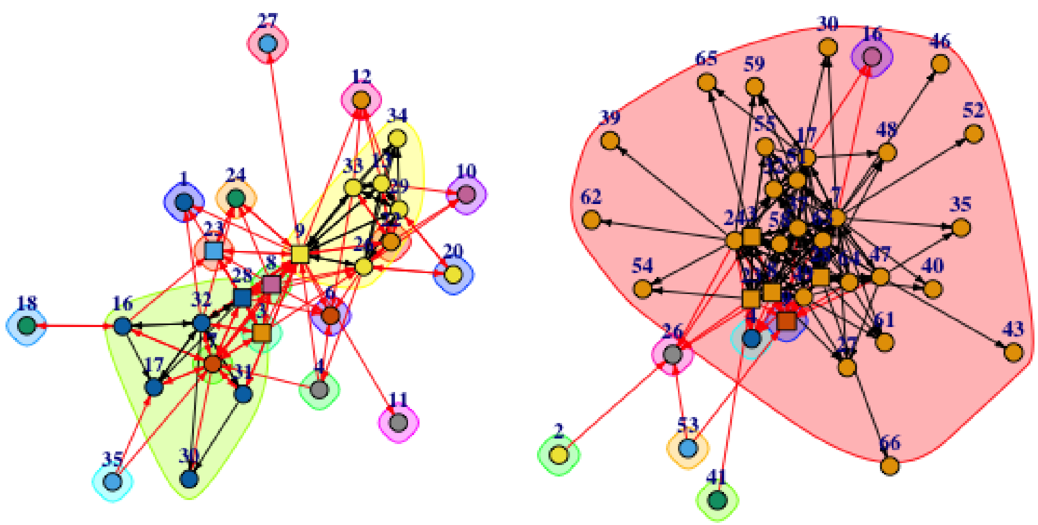

Figure 3. (Left) Clustering of the collaboration network in 2019 before SCORE activities. Navy nodes are included in the green-shaded cluster and yellow nodes are included in the yellow-shaded cluster. (Right) Clustering of the collaboration network after Summit and Virtual activities in June 2021. Orange nodes are included in the red-shaded cluster.

Discussion

The goals of the SCORE Summit were to help the community see commonalities, form relationships, and spark conversations about new directions and collaboration. The Summit itself did not provide a vehicle for active collaboration, yet individuals with new and boundary spanning interests provided an opportunity for new collaborations to launch. Attending the in-person summit seemed to affect persistence in the network for those that were present in the network early into the formation of SCORE. However, many more members joined during the virtual activities period, indicating that virtual activities are important to continued network growth. In addition, the vast majority of new collaborations were gained during virtual activities, and many virtual activities were led or co-led by SUMMIT participants. These virtual programs were designed to foster new and continued discussions on equity and inclusion and collaborations and spur new collaborations among Network members. This supports prior work pointing to the effectiveness of hybrid approaches (Brooks 2010, Hayward and Laursen, 2018). A network participant reflects on influence of this network in mathematics education reform:

> *"The [redacted mathematics society committee] has expressed an interest making considerations of diversity, equity, and inclusion more intentional and systematic in the way we think about the mathematics curriculum…Thanks in good part to the SCORE network and our summer study group, I feel more equipped to contribute to these discussions than I did a year or two ago."*

SNA allows us to quantify the increased collaboration and visualize the way that the structure of collaborations in the network has changed after a combination of in-person and virtual programming. We see a more unified community, possible indications of In Lak'ech - seeing commonalities. We can also see how particular *boundary spanners* and *influencers* aid in Nepantla, modifying the weave of the network to achieve this change.

Joining this structural data with qualitative surveys of learning due to the activities would help us better evaluate reciprocity - whether and how these structural bridges might reflect collaborative learning across the network. This would build on and connect to other work in STEM education studying communities of practice, such as Hayward and Laursen's paper (2018) which used SNA alongside qualitative techniques to understand the importance of receiving peer support and encouragement in implementing new ideas.

The determination of actors and relationships included in the pre-survey study were bounded by those who registered to attend the SCORE Summit, and while subsequent survey administrations sought to capture the relational data of new members to the network at these different time periods, this multiple-criterion recognition question approach (Singleton and Asher, 1977) did not capture changes in relationships for these additional members over time since new members were not included in previous survey administrations. Another limitation to examining network growth was the low response rates at mid- and final-survey administration resulting in an underrepresentation of network growth. While many factors are found to contribute to low response rates, it is uncertain how the increased use of survey-based research activities during the COVID-19 pandemic might have resulted in survey fatigue and decreased response rates (de Koning et al. 2021, Grandstaff and Webber 2021). Future network analysis which examines growth for communities of practice which evolve across time may consider different wording for multiple recognition questions or utilize an alternative approach such as the multiple name generator approach (Kogovsek et al., 2002). Despite these limitations with data collection, SNA provided valuable insights into structural changes in the network which may help support SCORE in a move towards a community of transformation.

Acknowledgments

This material is based upon work supported by the National Science Foundation (DBI #1919879) and by the William and Flora Hewlett Foundation (#2020-1363 and #2021-2923).

This work was supported in part by the NSF SIARM for Stem Institute (RC #111744) and we would like to acknowledge key feedback from SIAM mentor, Ken Frank, and the reviewers.

References

Aikens, M. L., Sadselia, S., Watkins, K., Evans, M., Eby, L. T., & Dolan, E. L. (2016). A social capital perspective on the mentoring of Undergraduate Life Science Researchers: An empirical study of undergraduate–postgraduate–faculty triads. *CBE—Life Sciences Education*, *15*(2). https://doi.org/10.1187/cbe.15-10-0208

Akman, O., Eaton, C. D., Hrozencik, D., Jenkins, K. P., & Thompson, K. V. (2020, August 8). *Building community-based approaches to systemic reform in Mathematical Biology Education*. Bulletin of mathematical biology. Retrieved August 23, 2022, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7414635/

Alexander, N., Eaton, C. D., Shrout, A. H., Tsinnajinnie, B., & Tsosie, K. (2022). *Beyond ethics: Considerations for centering equity-minded data science*. Journal of Humanistic Mathematics, Volume 12 Issue 2. Retrieved August 23, 2022, from https://scholarship.claremont.edu/jhm/vol12/iss2/14/

Ballen, C. J., Blum, J. E., Brownell, S., Hebert, S., Hewlett, J., Klein, J. R., McDonald, E. A., Monti, D. L., Nold, S. C., Slemmons, K. E., Soneral, P. A., & Cotner, S. (2017). A call to develop course-based undergraduate research experiences (cures) for nonmajors courses. *CBE—Life Sciences Education*, *16*(2). https://doi.org/10.1187/cbe.16-12-0352

Brooks, C. F. (2010). Toward 'hybridised' faculty development for the twenty‐first century: Blending online communities of Practice and face‐to‐face meetings in instructional and professional support programmes. *Innovations in Education and Teaching International*, *47*(3), 261–270. https://doi.org/10.1080/14703297.2010.498177

Carolan, B. V. (2014). *Social network analysis and education: Theory, methods & applications*. SAGE.

de Koning, R., Egiz, A., Kotecha, J., Ciuculete, A. C., Ooi, S. Z., Bankole, N. D., Erhabor, J., Higginbotham, G., Khan, M., Dalle, D. U., Sichimba, D., Bandyopadhyay, S., & Kanmounye, U. S. (2021). Survey fatigue during the COVID-19 pandemic: An analysis of neurosurgery survey response rates. *Frontiers in Surgery*, *8*. https://doi.org/10.3389/fsurg.2021.690680

Eaton, C. D., Allen, D., Anderson, L. J., Bowser, G., Pauley, M. A., Williams, K. S., & Uno, G. E. (2016). Summit of the Research Coordination Networks for Undergraduate Biology Education. *CBE—Life Sciences Education*, *15*(4). https://doi.org/10.1187/cbe.16-03-0147

Frank, K. A., Chen, T., Brown, E., Larsen, A., & Baule, W. 'B. J. (2022). A network intervention for natural resource management in the context of climate change. *Social Networks*. https://doi.org/10.1016/j.socnet.2022.03.003

Freeman, L. C. (1989). *Research methods in social network analysis*. Mason Univ. Pr.

Gehrke, S., & Kezar, A. (2016). STEM reform outcomes through communities of transformation. *Change: The Magazine of Higher Learning*, *48*(1), 30–38. https://doi.org/10.1080/00091383.2016.1121084

Grunspan, D. Z., Wiggins, B. L., & Goodreau, S. M. (2014). Understanding classrooms through social network analysis: A Primer for Social Network Analysis in education research. *CBE—Life Sciences Education*, *13*(2), 167–178. https://doi.org/10.1187/cbe.13-08-0162

Gutiérrez, R. (2017, September 30). *Living mathematx: Towards a vision for the future.* North American Chapter of the International Group for the Psychology of Mathematics Education. Retrieved August 23, 2022, from https://eric.ed.gov/?id=ED581384

Hayward, C. N., & Laursen, S. L. (2018). Supporting instructional change in mathematics: Using social network analysis to understand online support processes following professional development workshops. *International Journal of STEM Education*, *5*(1). https://doi.org/10.1186/s40594-018-0120-9

Holm, T., & Saxe, K. (2016). *A common vision for undergraduate mathematics*. Notices of the American. Mathematics. Society. Retrieved August 23, 2022, from https://www.ams.org/publications/journals/notices/201606/rnoti-p630.pdf

Igraph: Network Analysis and visualization. (2022). Retrieved August 24, 2022, from https://igraph.org/r/pdf/latest/igraph.pdf

Jun-Lan, X., Shu-Bin, S., Dong-Li, D., Chang-Chun, L., & Fei-Fei, X. (2019). Identification of influencers in networks with dynamic behaviors. *Physica A: Statistical Mechanics and Its Applications*, *527*, 121318. https://doi.org/10.1016/j.physa.2019.121318

Kezar, A., Gehrke, S., & Bernstein-Sierra, S. (2018). Communities of transformation: Creating changes to deeply entrenched issues. *The Journal of Higher Education*, *89*(6), 832–864. https://doi.org/10.1080/00221546.2018.1441108

Kogovšek, T., Ferligoj, A., Coenders, G., & Saris, W. E. (2002). Estimating the reliability and validity of personal support measures: Full information ML estimation with planned incomplete data. *Social Networks*, *24*(1), 1–20. https://doi.org/10.1016/s0378-8733(01)00047-8

LeMahieu, P. G., Grunow, A., Baker, L., Nordstrum, L. E., & Gomez, L. M. (2016, November 30). *Networked Improvement Communities: The discipline of improvement science meets the power of networks.* Quality Assurance in Education: An International Perspective. Retrieved August 23, 2022, from https://eric.ed.gov/?id=EJ1129297

Ma, S., Herman, G. L., West, M., Tomkin, J., & Mestre, J. (2019). Studying stem faculty communities of practice through social network analysis. *The Journal of Higher Education*, *90*(5), 773–799. https://doi.org/10.1080/00221546.2018.1557100

Manduca, C. A., Iverson, E. R., Luxenberg, M., Macdonald, R. H., McConnell, D. A., Mogk, D. W., & Tewksbury, B. J. (2017). Improving undergraduate stem education: The efficacy of discipline-based professional development. *Science Advances*, *3*(2). https://doi.org/10.1126/sciadv.1600193

Masuda, Y. J., Liu, Y., Reddy, S. M., Frank, K. A., Burford, K., Fisher, J. R., & Montambault, J. (2018). Innovation diffusion within large environmental ngos through informal network agents. *Nature Sustainability*, *1*(4), 190–197. https://doi.org/10.1038/s41893-018-0045-9

McConnell, M., Montplaisir, L., & Offerdahl, E. G. (2020). A model of peer effects on instructor innovation adoption. *International Journal of STEM Education*, *7*(1). https://doi.org/10.1186/s40594-020-00255-y

McCourt, J. S., Andrews, T. C., Knight, J. K., Merrill, J. E., Nehm, R. H., Pelletreau, K. N., Prevost, L. B., Smith, M. K., Urban-Lurain, M., & Lemons, P. P. (2017). What motivates biology instructors to engage and persist in teaching professional development? *CBE—Life Sciences Education*, *16*(3). https://doi.org/10.1187/cbe.16-08-0241

Research Coordination Networks in Undergraduate Biology Education (RCN-ube). NSF. (2022.). Retrieved August 26, 2022, from https://www.nsf.gov/pubs/2022/nsf22522/nsf22522.htm

Rodenbusch, S. E., Hernandez, P. R., Simmons, S. L., & Dolan, E. L. (2016). Early engagement in course-based research increases graduation rates and completion of Science, engineering, and Mathematics degrees. *CBE—Life Sciences Education*, *15*(2). https://doi.org/10.1187/cbe.16-03-0117

Survey research during COVID-19: The challenges grow even larger. IHE Research Project Series. (2021). Retrieved September 3, 2022, from https://ihe.uga.edu/sites/default/files/inline-files/Webber_SAIR_Survey_2021.pdf

Vescio, V., Ross, D., & Adams, A. (2008). A review of research on the impact of Professional Learning Communities on teaching practice and student learning. *Teaching and Teacher Education*, *24*(1), 80–91. https://doi.org/10.1016/j.tate.2007.01.004

Wenger, E. (2018). *Communities of Practice: Learning, meaning, and identity*. Cambridge University Press.