An Initial Look at the Developing Culture of Online Global Meet-ups in Establishing a Collaborative, STEM Media-Making Community

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Abstract: This project examines a network of informal digital makerspace clubs with over 100 adolescent participants across four continents. A key component to developing the community for collaboration was the use of online global meet-ups, or facilitated video conference sessions where participants from different sites share projects and feedback. Meet-ups were key to establishing social trust and motivating project collaboration across sites. This paper examines participant discourse at different stages of the community formation process. Data from three online meetings with U.S. and Kenyan students were analyzed using epistemic network analysis (ENA). Findings show significant changes in the patterns of discourse corresponding to the development of the community over time. The initial emphasis on self-awareness and superficial information sharing shifted toward peer teaching and knowledge acquisition after six months. These observations demonstrate how the depth of interactions within online global meet-up culture evolved into more substantive interactions towards collaborative learning.

Introduction

Technology has impacted the education space in offering both innovative mediums (such as online courses and platforms) and tools (portable devices, tablets, web applications) for learning. As the world adjusts to further technology development, so will future learning environments evolve. This study examines how *computer supported collaborative learning* (CSCL) takes place through an international network of informal digital makerspace clubs focused on STEM topics. Participants hail from after school clubs in six countries on four continents, using technology to interact and collaborate both synchronously and asynchronously on the creation of STEM-oriented digital artifacts across borders. One key method of synchronous communication that has emerged from this CSCL community is the online global meet-up. These meet-ups have become critical in fostering a sense of community within the network, enhancing the collaboration experience.

Sense of community was defined by McMillan and Chavis (1986) as the feeling of belonging to a particular group, whereby participants share a feeling of mutual influence and emotional connectedness as well as the belief that their needs will be fulfilled through membership in the group. Applying this concept to the learning setting, both physical and virtual, Rovai (2002) conceptualizes the classroom community to consist of four components: spirit, trust, interaction, and the shared expectation of learning. Under this framework, spirit refers to elements such as membership, cohesion and friendship that enable students to support and challenge one another. Trust not only encompasses the confidence to rely on one another, but also the genuine interest and concern that members have for each other. Interactions may be driven by a focus on task completion or by socioemotional factors such as empathy or sharing of personal information. Here, social presence—the extent to which a person is considered to be "real" in the virtual communication contexts—plays an important role for allowing meaningful interaction and collaboration among participants (Gunawardena, 1995). Lastly, a sense of community requires the belief on the part of the members that their learning needs are being met through their active involvement (Rovai, 2002).

Development of online global meet-ups

Online global meet-ups are video conference calls that provide an opportunity for participants to communicate synchronously to share, exchange and collaborate. These meet-ups are typically facilitated by a peer and become global when participants from at least 2 different countries join. Prior to the meet-up, participants indicate their participation by listing their name and project topics on an online agenda, then return to that agenda for the conference call link. The facilitator uses the agenda to anticipate who will be present and what topics will be discussed. At the end of the meet-up, participants write reflections on their experience at the bottom of the agenda.

The idea of global meet-ups for collaboration developed spontaneously. There was a desire from both the teachers and participants to "see" each other synchronously. Initially, these meet-ups were meant as one-time introductory meetings. However, the desire to meet synchronously continued and more took place successfully out of determination from the participants and teachers to coordinate. Participants were willing to meet at

inconvenient times amidst the time differences for the opportunity to connect. At initial meet-ups, examples of previously made artifacts, such as videos, were shared by participants who were part of a previous program at their school on media-making on STEM topics. This prompted students at other sites to work on their own media-making skills and have something to present at the next meet-up. For example, in one club site in Kenya, participants who started without any experience in media-making were later able to present at least one or two video projects consistently at meet-ups.

Many refinements to the organizational structure of meet-ups helped to shape the current global meet-up culture. As many participants and teachers initially encountered challenges with utilizing the video conference software, a technology protocol was developed as a resource for participants to review in advance to minimize technical difficulties undermining the meet-up experience. Early meet-ups had no limitation on the number of participants nor required advance notice of attendance. This resulted in large groups that limited active participation by individuals and created large periods of silence that required increased inclusive techniques by the facilitator. Following those experiences, Google Doc online agendas were developed as a place for participants to indicate their participation in advance and limit the size to four to five students to allow for richer interactions from each participant. Online agendas not only served as an organizing tool, but a common place for written reflections immediately following the end of the meeting. By visually observing the synchronous updating of written reflections by fellow participants, students and teachers alike were further motivated to write their reflections. Initial meet-ups were facilitated by the research team, but gradually transitioned to student facilitators after supportive training and mentoring. These adjustments allowed for predictable structural stability with meet-ups optimized for participants to focus on their interactions with one another.

Online global meet-ups have emerged as a key component to enhancing this CSCL community. The opportunity for visual, synchronous communication both motivated and built social trust among the participants which has increased the depth of interactions with time and experience. As more meet-ups took place, a shared understanding of the culture and behavior at meet-ups emerged. This included a shared understanding of the roles within the meet-ups, such as a facilitator that guides the conversation and presenter(s) who share their project. Increased social trust built from meet-up experiences appeared to increase the comfort in interacting with one another to be more collaborative and curious.

Methods

Epistemic network analysis (ENA) is a quantitative ethnographic technique for modeling the structure of connections in data. ENA assumes: (1) that it is possible to systematically identify a set of meaningful features in the data; (2) that the data has local structure (conversations); and (3) that an important feature of the data is the way that codes are connected to one another within conversations (Shaffer, 2017; Shaffer, Collier, & Ruis, 2016; Shaffer & Ruis, 2017). ENA models the connections between coded constructs by quantifying the co-occurrence of codes within conversations, producing a weighted network of co-occurrences, along with associated visualizations for each unit of analysis in the data. ENA analyzes all of the networks simultaneously, resulting in a set of networks that can be compared both visually and statistically. The ENA algorithm uses a moving window to construct a network model for each line in the data, showing how codes in the current line of an utterance are connected to codes that occur within the recent temporal context (Siebert-Evenstone et al., 2017), defined in this model as 5 lines (each line plus the 4 previous lines) within a given conversation. The resulting networks were aggregated for all lines for each participant.

The data set used in this analysis came from three online global meet-ups: the first global meet-up that took place in March 2017, and later meet-ups in May and October 2017. The March 2017 meet-up included 22 total participants across two sites in the U.S. and two sites in Kenya. The May 2017 meet-up had 16 total participants from one site in Kenya and two sites in the U.S. The October 2018 meet-up included four participants from one site each in Kenya and the U.S. Meet-ups were transcribed and each line spoken by participants was considered an utterance. Binary coding was used to code for the presence of seven constructs: CURIOSITY, SELF-AWARENESS, FEEDBACK, CONTENT-FOCUS, PARTICIPATORY TEACHING, KNOWLEDGE ACQUISITION, and SOCIAL DISPOSITION. A total of 674 utterances were coded separately by two raters. This was followed by a process of social moderation, which allowed the two raters to reach agreement on the coding of each utterance in the data (Frederiksen et al., 1998; Herrenkohl & Cornelius, 2013). The coded data was then uploaded onto the ENA web-tool (http://app.epistemicnetwork.org) for visualization and analysis.

Results

Figure 1 presents the individual ENA network models representing the discourse patterns of the three meet-ups held in March, May and October of 2017. The network model for the March meet-up (in red) depicts a prominent connection between CONTENT-FOCUS in the center and SELF-AWARENESS to the left. While thinner lines link

other constructs, including CURIOSITY, it can be seen that virtually no connections are made to KNOWLEDGE ACQUISITION and PARTICIPATORY TEACHING. This can be attributed to the introductory nature of the March meet-up, where students—meeting for the first time—mainly shared their interests around STEM topics. The May meet-up (in blue), however, shows strong associations between CONTENT-FOCUS, FEEDBACK and SOCIAL DISPOSITION. Slightly thinner connections can be observed linking these constructs to CURIOSITY and KNOWLEDGE ACQUISITION as well as to SELF-AWARENESS. The model is indicative of the increasing willingness of participants to interact socially and to offer suggestions about each other's projects and presentations. In the network model for October (in purple), it is possible to see that the connections to SELF-AWARENESS have all but disappeared, whereas the most prominent associations have been made between CONTENT-FOCUS, CURIOSITY and FEEDBACK. A relatively thick connection is shown between CONTENT-FOCUS and SOCIAL DISPOSITION as well as PARTICIPATORY TEACHING. The model has shifted further to the right, representing a greater emphasis in the participants' discourse on the learning and peer-teaching dimensions.

Figure 2 displays the means of the ENA network models (squares) with their confidence intervals (dotted lines) for the three meet-ups. The plotted points (dots) represent weighted centroid of the networks for each participant. The x-axis distinguishes between connections to SELF-AWARENESS on the left and connections between the codes KNOWLEDGE ACQUISITION, PARTICIPATORY TEACHING, and CURIOSITY on the right. The network mean for the March meet-up is located on the left, indicating stronger linkages to SELF-AWARENESS. The means of the May and October networks are situated further to the right of the ENA space, which signifies an increase in the prevalence of connections made to KNOWLEDGE ACQUISITION, PARTICIPATORY TEACHING, and CURIOSITY. Statistical comparison of the location of the means—conducted through a two sample t-test assuming unequal variances—showed significant differences along the x-axis between the March and May meet-ups, $t(35.41) = 5.34$, $p < 0.001$, $d=1.64$, as well as between the May and October meet-ups, $t(16.00) = 7.10$, $p < 0.001$, $d = 1.98$.

| (a) | (b) | (c) |
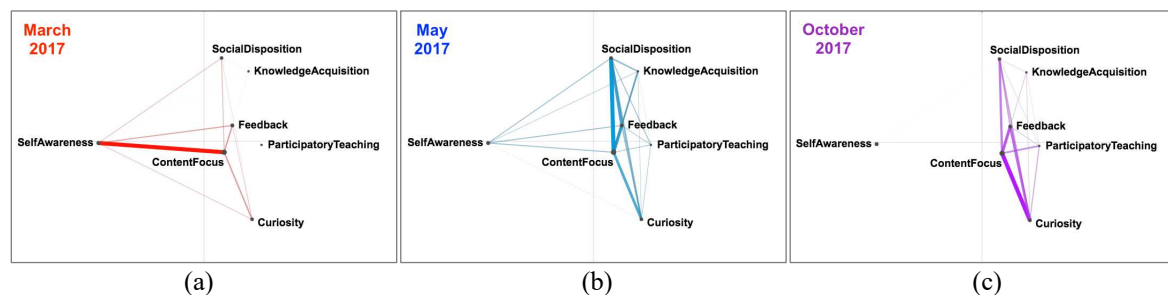
Figure 1. ENA network models for three online global meet-ups in (a) March, (b) May, and (c) October 2017.
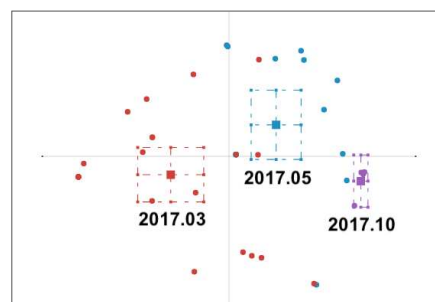
Figure 2. Plotted points, network means, and confidence intervals for the three online global meet-ups.

Discussion

Findings from the epistemic network analysis show significant changes in the patterns of discourse corresponding to the increase in the sense of community over time. A progressive development of the elements comprising a sense of community according to Rovai (2002) can be identified across meet-ups from March to October 2017, as shown in Table 1. Sharing information about themselves and their interests during the initial session—as captured in the connection between SELF-AWARENESS and CONTENT-FOCUS—allowed the participants to build comradery and foster a spirit of membership in the group. The interactions were mainly task-driven, with discussions focusing on STEM topics. The May meet-up reflected a greater presence of pro-social interactions among the participants (SOCIAL DISPOSITION) as well as a growing sense of trust. This can be observed in their willingness to seek clarification and provide substantive comments about each other's projects, as demonstrated

by the linkages between FEEDBACK, CURIOSITY and CONTENT-FOCUS. Participation in the meet-up has also created learning opportunities for students (KNOWLEDGE ACQUISITION). The October session presents a similar pattern, only with the learning dimension displaying a stronger emphasis on peer teaching (PARTICIPATORY TEACHING). These observations demonstrate how the depth of interactions within online global meet-up culture evolved into more substantive interactions towards collaborative learning.

Table 1: Development of elements comprising a sense of community from March to October 2017

Elements of Sense of Community (Adapted from Rovai, 2002)		March 2017 Meet-up	May 2017 Meet-up	October 2017 Meet-up
Spirit of membership		✓	✓	✓
Trust			✓	✓
Interaction	Task-driven	✓	✓	✓
	Socioemotionally-driven		✓	✓
Learning	Knowledge-based		✓	✓
	Collaborative			✓

These results contribute to a larger examination of learning beyond the traditional classroom experience. Future workforce environments are likely to embody the characteristics of integrated technology use and global interaction and collaboration embodied in this project, making the findings pioneering and relevant for future learning environments (Marope, 2017). Learning should go beyond the passing of knowledge acquisition from teacher to student, and be an engaged and involved process for the student (Freire, 1972). The peer-driven, CSCL settings from this project allows students to be actively engaged in their own learning, as observed by the sense of community developed by an online meet-up culture among participants which demonstrated increased curiosity and participatory teaching. Research on such learning environments set the stage for future, innovative approaches to education.

References

Frederiksen, J. R., Sipusic, M., Sherin, M., & Wolfe, E. W. (1998). Video portfolio assessment: Creating a framework for viewing the functions of teaching. *Educational Assessment, 5,* 4, 225-97.

Freire, P. (1972). *Pedagogy of the oppressed*. New York: Herder and Herder.

Gunawardena, C. N. (1995). Social presence theory and implications of interaction and collaborative learning in computer conferences. *International Journal of Educational Telecommunications*, *1*(2–3), 147–166.

Herrenkohl, L. R., & Cornelius, L. (2013). Investigating elementary students' scientific and historical argumentation. *Journal of the Learning Sciences, 22,* 3, 413-461.

McMillan, D. W., & Chavis, D. M. (1986). Sense of community: A definition and theory. Special Issue: Psychological sense of community, I: Theory and concepts. *Journal of Community Psychology*, *14*(1), 6–23.

Marope, M. (2017). Future competences for future generations. *International Bureau of Education: In Focus*, 2, 80-87. Retrieved from http://ibe-infocus.org/wp-content/uploads/2018/03/In-Focus-2017.pdf

Rovai, A. P. (2002). Building sense of community at a distance. *International Review of Research in Open & Distance Learning*, *3*(1), 1–16.

Shaffer, D. W. (2017). *Quantitative ethnography*. Madison, WI: Cathcart Press.

Shaffer, D. W., Collier, W., & Ruis, A. R. (2016). 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.

Shaffer, D. W., & Ruis, A. R. (2017). Epistemic Network Analysis: A worked example of theory-based learning analytics. *Handbook of Learning Analytics*, 175–187.

Siebert-Evenstone, A., Arastoopour Irgens, G., Collier, W., Swiecki, Z., Ruis, A. R., & Williamson Shaffer, D. (2017). In search of conversational grain size: Modelling semantic structure using moving stanza windows. *Journal of Learning Analytics*, 4(3), 123–139.

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