

“These Topics are Off the Table”: Shifting Discourse Toward Critical Transformations in Mathematics Departments

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Many undergraduate mathematics departments are seeking to improve equity in their programs; however, they may struggle to translate these goals for equity into action. In this study, we used Cultural Historical Activity Theory (CHAT) theory to investigate the evolution of a Networked Improvement Community (NIC) focused on improving equity within their mathematics department, highlighting ways that NIC discourse evolved to support more critical, action-oriented activity. By examining field notes of meetings, documentation (e.g., agendas), interviews, and journal entries from NIC members, we identified key components of the NIC activity system. Our analysis revealed ways that NIC leaders mediated tensions between their object (goals) and implicit discourse norms governing NIC conversations. Specifically, we found that to make progress toward their goals, NIC leaders needed to establish an explicit rule to take certain topics “off the table” in NIC meetings. This rule facilitated discourse that was more action-focused than previously observed.

Keywords: critical transformations, equity, activity system, mathematics

Local data typically show mathematics departments have equity problems: inequitable student outcomes, encompassing not just grades, but course-taking patterns and trajectories, as well as mathematical efficacy and views on the value of mathematics in the world (e.g., Denaro et al., 2022). However, there is little in the way of coherent direction for department members to know what to do to address inequities in mathematics teaching and learning. Indeed, there is no singular “checklist for equity” that can magically “fix” inequities that have deep roots in our culture, educational systems, and institutional systems.

The ACT UP Math project partnered with three mathematics departments to establish networked improvement communities (NICs; Martin et al., 2020) as part of a research-practice partnership designed to help mathematics departments wanting to use data to make critical transformations to address inequities. A NIC is a community of people working toward a common improvement goal, in connection with others across a network. NICs typically are driven by improvement science, iteratively planning and testing improvement ideas through multiple improvement cycles of observation, reflection, planning, and action. NICs are an ideal vehicle for approaching critical transformation efforts; the emphasis across the network is adaptation to local contexts, not replication. For this paper, we focus on the activities of one of the mathematics departments - Tau University as they worked toward critical transformation. In our work (see Hagman et al., 2024), we define making critical transformations as challenging and critiquing the existing systems that create inequitable mathematical experiences.

In seeking to understand the progress of NICs, where “progress” is defined as moving toward the NIC’s improvement aim, it can be difficult to tease out the impacts of individual beliefs, collective beliefs, perceived constraints, and systemic constraints. Cultural Historical Activity

Theory (CHAT) provides a valuable lens through which to understand the activities of a NIC (Vygotsky, 1978; Engeström, 1987), particularly to understand change (Turner et al., 2017). Núñez (2021) applied CHAT perspectives to investigate equity-oriented higher education organizational and systemic change; Núñez found the application of CHAT afforded a fine-grained analysis of group activities that delve into cultural practices and how those are sustained or changed over time. CHAT provides a way to understand the roles and values of individuals, while maintaining a focus on the activity system, and allows for interrogating power dynamics and inequities. **Our overarching research question for this study is:** How did the NIC evolve as an activity system during one improvement cycle (from Summer 2023 - Spring 2024) to better support critical transformations?

Methods

Our study methodology is critical ethnography (Palmer & Caldas, 2015). As researchers engaged in a research-practice partnership (Coburn et al., 2021), we are immersed in the data as ethnographic researchers and as participants. Since Fall 2022, we have been working closely with the NICs in our project to better understand their institutional contexts and goals related to critical transformations toward diversity, equity, and inclusion and documenting all interactions.

Data for this study come from a larger project studying three NICs engaged in critical transformation efforts. The focus of this study is on the Tau University NIC, led by three faculty who all teach courses for the mathematics department but have different roles (Natalie, a lecturer; Garrett, a professor of practice and course coordinator; Olivia, a professor and college-level administrator). Tau University is a public, doctoral degree-granting university with high research activity located in the Southern United States. For this study, we draw on the following data sources collected between May 2023 and May 2024 during one improvement cycle of the NIC: individual interviews with NIC leaders (60 min/annual), structured field notes of monthly NIC meetings and planning meetings, NIC member reflective journals (approximately three times per semester), and project documentation (e.g., meeting notes; products from project activities, such as when NIC members reflected in a Google Jamboard about definitions of equity).

The research team, who are regularly observing Tau NIC meetings and facilitating interviews, met weekly over the past year to debrief observations, discuss the goals and challenges of the NIC, and make plans to support the Tau NIC's work. As part of these discussions, we kept notes of research observations as well as themes and storylines present in the efforts of the Tau NIC. One storyline that was consistently present in the NIC data was the shift toward critical transformations in the form of discourse patterns about students at their institution. The Tau NIC leaders were introduced to an anti-deficit framing of students through a presentation from and conversations with our project team, where we drew on the equity-oriented work of Adiredja (Adiredja, 2019; Adiredja & Louie, 2020) and Gutiérrez (2009; 2013). From this point, we kept a comprehensive evidence log of data for instances where Tau NIC members defined critical transformations, described their efforts toward equitable or critical outcomes, or talked about students in their courses or at their institution. After the presentation, NIC members more clearly articulated a goal toward critical transformations and began explicitly addressing their assumptions and language about students in NIC meetings.

Our data analysis consisted of several iterations of analyses, for each data source (e.g., interviews, observation field notes, journals) and for each storyline (e.g., leader goals, discourse about students), similar to narrative coding (Saldaña, 2013). Once we determined that we were viewing the evolution of the Tau NIC as an activity system with the leaders working toward

specific goals via NIC activities, we began to align the NIC's evolution with the seven components of the Cultural Historical Activity Theory framework.

Analytic Framework: Cultural Historical Activity Theory

Cultural Historical Activity Theory (CHAT) is a theory to understand object-oriented activity undertaken by an individual. In other words, a subject's thoughts and actions are directed toward a goal or object; Vygotsky's (1978) initial theory was that the object is realized (as an outcome) through mediating tools/artifacts. Later, CHAT was extended by Engeström (1987) to emphasize the collective nature of object-oriented activity; this work added the components community, rules, and division of labor to the framework (see Figure 1). CHAT can be used to frame how we understand complex, dynamic systems, particularly those that involve tensions and evolve over time (Engeström, 2001). CHAT also examines the history of the activity system and multivoicedness of those involved, emphasizing that the subjects bring various perspectives, interests, and conventions, such as stakeholders in different roles within an educational setting (Hancock & Miller, 2018). We draw upon the second generation CHAT (Engeström, 1987) to examine the activity of the Tau NIC.

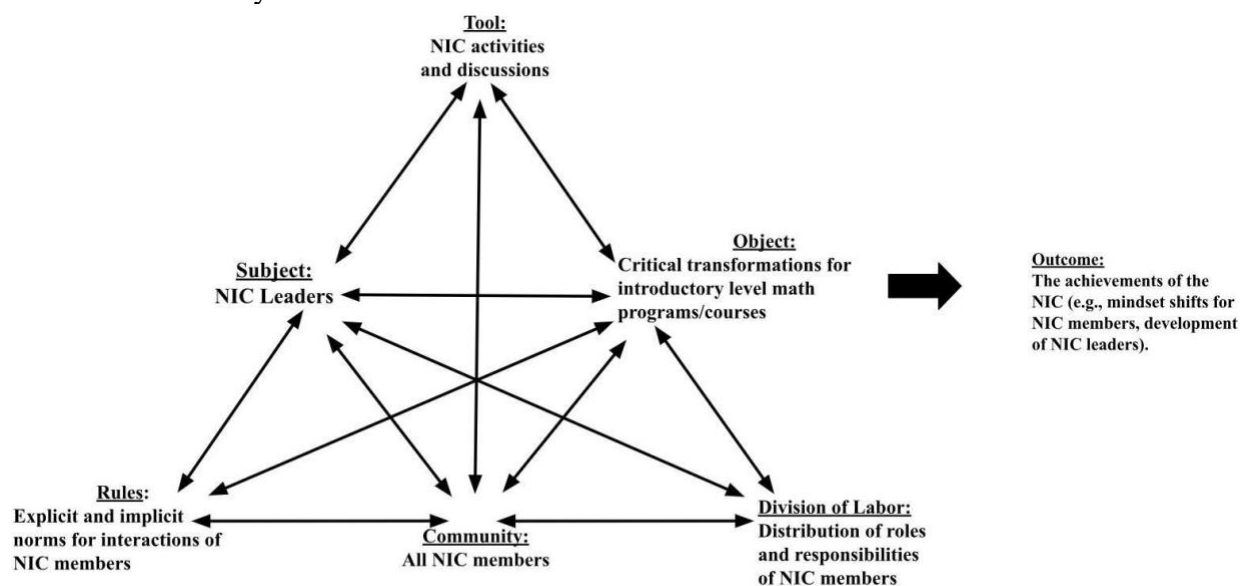


Figure 1. Second Generation CHAT Framework (Engeström, 1987) with Tau NIC activity system components

When applying the CHAT framework as an analytic tool, one of the initial steps is to operationalize the framework by determining what are the subject, object, tools, rules, community, division of labor, and outcomes in the activity system. Figure 1 briefly describes the Tau NIC features we drew upon to determine each CHAT component. The subject, community, and division of labor were operationalized based on observations of NIC planning meetings and artifacts, and our understanding of the formation of the Tau NIC. We operationalized the object, tools, and rules of this activity system based on an in-depth qualitative analysis of journal entries, leader interviews, observational field notes, and (ongoing) outcomes of the NIC within their institution. From this analysis, we identified a significant evolution in the rules of discourse governing the NIC, brought about by tensions between the object of the NIC activity system and the implicit rules governing how NIC members interacted with one another. This evolution supported the NIC's capacity for critical transformation. In the findings section, we describe this evolution in detail.

Findings

In this section, we focus on the NIC leaders' creation of an explicit rule for discourse due to tensions between the goals (object) and implicit rules for discourse established within the NIC's activity system. Based on observations of planning meeting between the three Tau NIC leaders and their journal entries, we identified three primary goals guiding the activities of the NIC:

1. Improve diversity, equity, and inclusion in mathematics at Tau University
2. Improve student experiences in mathematics at Tau University
3. Support mathematics faculty in creating equitable and inclusive experiences at Tau University

Meetings with the ACT UP Math research team in August 2023 equipped leaders with ideas for NIC activities (tools) which could support NIC members in thinking about critical transformations, including promoting an “anti-deficit” perspective of students. Natalie highlighted the importance of this critical language to her goals, “I have learned a lot about my own biases. The biggest impact on my attitude has been the phrase ‘students are experts on their own experiences,’ rather than just novices in the classroom” (Fall 2023 journal). Similarly, in a Fall 2023 journal entry Olivia wrote, “And a big part of [achieving those goals] is shifting the way that they look at our students, not from a deficit standpoint, but from looking at their student's potential.” Thus, for at least one NIC leader, a major goal was to shift faculty mindsets in support of critical change.

Two Relevant Rules for Discourse

The NIC activity system had two rules which we identified as important in understanding the NIC leaders' decision to introduce a more explicit rule governing the NIC's discourse. One rule was that NIC members trust one another and are open to sharing about their experiences. The second rule is that NIC members are allowed to share frustration about students, including a perceived systemic lack of mathematical preparation of the students in their classes. We next describe the formation of these two rules, and the ways in which they supported or inhibited the object of the Tau NIC activity system.

Rule: NIC members trust one another and are open to sharing about their experiences. Evidence from observations indicates that most NIC members were willing to share vulnerable teaching experiences with one another. This was likely supported by the example set by NIC leaders. For example, Garrett often shared his “mistakes” and personal realizations with the group, and we observed Garrett and Natalie intentionally planning what experiences they would share in whole group meetings as a way to model vulnerability with others and ways to question one's practices. This openness often supported the NIC in thinking critically about practices and in working to understand student experiences. However, the level of trust and openness that NIC members felt for each other also supported an implicit rule which at times impeded the object of the NIC, namely a rule that NIC members could share their frustrations. Olivia commented on how the NIC has a “tendency to focus on the negative” in conversations (Tau NIC Planning Meeting - 2023.02.16). Often these frustrations turned to negative comments about students, particularly a perceived lack of preparation for precalculus courses.

Rule: NIC members are allowed to share frustration about students, including a perceived systemic lack of mathematical preparation of the students in their classes. Since the beginning of the NIC, it was apparent that NIC members felt comfortable sharing their frustrations about students, particularly frustrations with their prerequisite mathematical knowledge. We observed multiple occasions of faculty publicly discussing their frustrations during NIC meetings. In the first NIC planning meeting, Garrett expressed being nervous “that

people will just complain about students if there is extra [unplanned] time” during NIC activities (Tau NIC Planning Meeting - 2023.01.19). At first, the NIC leaders seemed to operate as if this was inevitable, and planned around it. For example, in one planning meeting Garrett described how he chose to share data and analysis from his own classroom (mediating tool) to help shift the conversation away from complaining about students:

I know that whenever faculty get together, we just talk about whatever is bothering us. So we got into that [complaining] and I was like, ‘oh I have to get us out of that conversation’. So then I started talking about my data and just sharing my analysis.

In another planning meeting, Garrett shared an additional strategy (mediating tool) for shifting conversations away from complaining: “if it comes to where people start complaining, I will try to have some questions in my pocket.” (Tau NIC Planning Meeting - 2023.10.23) In a later meeting, Olivia assured Garrett that she would “jump in” if faculty did start going “off the rails” (Tau NIC Planning Meeting - 2023.11.08). Thus, it seems that the leaders desired to minimize deficit discourse about students, but it was an implicit goal that was not shared with the other NIC members (community). There was also some evidence that NIC leaders felt empathy for faculty members as they shared their frustrations. In his Spring 2024 interview, Garrett described how when “you’re in your class, and these things are happening, and then you are in some sort of situation where there’s other people with a shared experience, and you want to share - you vent.” Garrett felt that this venting was not “necessarily deficit” oriented and stressed the importance of having discussion prompts planned ahead of time so that when instructors “start grumbling” he can move them “forward.” In fact, Natalie’s observation of her own “venting” and its effects prompted an introduction of a new, explicit rule in the Tau NIC activity system, which we describe below. Garrett was drawing on his experience as a course coordinator when he normalized instructor complaints about students, and also argued that part of the role of facilitating instructor meetings is having explicit strategies or tools (e.g., discussion questions) that can move a group forward. Such tools were used by NIC leaders to shift discourse, but a lack of progress toward critical transformations in the NIC eventually contributed to a desire to make more explicit rules for discourse about students within the NIC activity system.

Explicit Shifts in Discourse: Re-examining What is on the Conversation Table

During Spring 2024, the NIC leaders observed that deficit conversations about students were impeding their ability to reach their goals of critical transformation. In a journal entry, Olivia reflected on the mindset of some NIC members, “I think some of our faculty are still in a space of, it’s the students and it’s really their problem.” She highlighted that at times students are discussed from a deficit viewpoint but continued with a hopeful observation of NIC members, “But I do think that there’s some evidence that some of our faculty recognize that there are things that we can do to better support our students, but they’re just not really sure how.” At this point, shifting discourse about students (within the NIC and among faculty in the department) became a new goal for the NIC leaders and an explicit rule about leaving deficit-oriented conversation “off the table” was shared with the NIC. The following excerpt illustrates how the Tau leaders decided on this rule.

In a planning meeting, the three leaders discussed the structure of their final semester meeting in April 2024. Olivia suggested questions to guide NIC members to consider what they are noticing when viewing data from their classrooms: “What is the problem we’re seeing, what are the opportunities we can impact? Maybe strengths? Let’s get them thinking about what they’ve been noticing.” Natalie agreed that it would be a good idea to focus on identifying

potential problems. Garrett recalled a conversation with NIC members where he tried to challenge traditional notions and goals in the department about mathematical content and procedures in these courses (e.g., focused on computational fluency). Based on these reflections, the leaders discussed how they should facilitate this conversation in the April NIC meeting:

Natalie: How do we stop focusing on what we can't change, and focus on what we can control?

Olivia: Should this conversation take place in a small group?

Natalie: Sure

Olivia: Then come to the large group; people can vent in the small group, then have a productive conversation in the large group. [...]

Garrett: What are some potential problems we can actually address that may come up? Obviously I'm focused on changing the computational fluency and thinking everything needs to be this hard. What other problems will come up?

Natalie: What we always go back to, is complaining about student prerequisite knowledge. On the one hand, the prereqs don't have to be that hard, on the other hand, they're way too easy.

Garrett: Do we want to change their minds on this?

Garrett and Natalie continued to discuss NIC members' and their own views on students' prerequisite knowledge. This exchange ended with Natalie saying "I'm just venting now." In response, Olivia joined the conversation with a suggestion of taking prerequisite knowledge "off the table" for discussion during the April NIC meeting:

Olivia: Ok, these things are off the table for today's conversation. We can't say "we can't do this because of X,Y, Z."

Natalie: I like that. We all know that's an issue, let's not talk about that.

Olivia: Yeah, and more so, today we're identifying potential areas of places we can consider. Today is about determining the problem that needs to be addressed.

Natalie: Then, items off the table: Prerequisite preparation has to be off the table. We all know it's an issue and we have a problem with it.

Garrett: Maybe co-construct this list with the NIC members.

Natalie: Initially, the other [item] is higher up things we can't change [i.e., trying to make Calculus 1 two semesters long].

Olivia: Maybe leave [the list of items off the table] as an open thing, and if they don't say it, then we say it [i.e., we suggest adding it to the list].

In the subsequent Spring 2024 NIC meetings, the Tau leaders established their new rule and worked to navigate conversations away from deficit discourse and toward more productive avenues. Garrett explained, "I don't think it's productive to repeatedly come up with the same challenges." In her interview, Natalie reflected on the impact of their decision to take deficit discourse about students off the table:

We should focus on what we can fix. Regardless of how you want to label the problem, taking that off the conversation table still didn't remove it completely, but it didn't take up 50% of the conversation, instead 10-15%. I hope the NIC members understand why it was taken off the table. I hope we can train our brains to stop complaining about things we can't fix.

The NIC leaders realized that if their overall goal was to work toward critical transformations in their undergraduate mathematics programs, then they needed a collective, explicitly stated rule to focus on productive areas rather than get bogged down in deficit discourses about students.

Discussion and Conclusion

In institutional or departmental change efforts, there need to be clearly established norms or “rules” for the community of change agents. In the Tau NIC, working toward critical transformations and improving student experiences meant that it was necessary to shift the discourse that was occurring in the meetings and take on an anti-deficit perspective (e.g., Adiredja, 2019). Whereas NIC members collectively viewed students’ mathematical preparation as a problem in their introductory mathematics courses, it was not productive to dwell on what students were lacking. Instead, the NIC leaders guided the community to notice students’ strengths and attend to challenges they have the agency to address.

The CHAT framework emphasizes the evolution of the NIC through the interaction of the CHAT components, especially the objects, tools, and rules within the community. Viewed through this lens, the object evolved over one year to include a focus on shifting discourse and perspectives about students, and NIC leaders worked to achieve this through the tools of the NIC activities and the established rule of taking specific topics and anti-deficit discourse “off the table” for conversation. CHAT highlights how this shift was a result of observed tensions within the activity system and required clarification of objects and new rules and tools to address the tensions. CHAT was a helpful framework to analyze the multi-voiced activity system, as NIC leaders operated within a community of various stakeholders situated within a large mathematics department at a diverse institution, which complexified the decisions and impacts of their work.

Our work so far has focused on the second generation CHAT framework (Engeström, 1987) to understand the evolution of the NIC as an activity system across one improvement cycle. One of the most prominent shifts in the NIC occurred due to tensions between the object and goals of NIC leaders, and the rules governing discourse within the NIC. Future research could extend by applying third generation CHAT to look at tensions among connected activity systems. Third generation CHAT is better able to consider power dynamics within and across activity systems (Engeström, 2009), along with the inherent tensions involved in negotiating human activities (Sannino et al., 2009). In our case, since ACT UP Math is a research-practice partnership, we plan to examine the research team activity system together with the Tau NIC activity system, and how those systems interact to influence the progression of the NIC activity system. Future work can also apply CHAT to additional NICs – both those within the larger ACT UP Math project and those in other settings.

Finally, one implication of the application of CHAT to understanding NIC evolution is for NIC leaders to explicitly engage NIC members in discussing their activity system as a NIC. Applying a CHAT framework to an activity system or set of activity systems can help system participants see the objects and illuminate what are often implicit rules. Transformation work is more effective when participants are working toward a common goal (Kezar, 2014; Martin et al., 2020), and having a NIC map out their activity system in a CHAT framework can be useful in encouraging conversation about common goals and rules governing collective action.

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References

- Adiredja, A. P. (2019). Anti-deficit narratives: Engaging the politics of research on mathematical sense making. *Journal for Research in Mathematics Education*, 50(4), 401-435.
- Adiredja, A. P., & Louie, N. (2020). Untangling the web of deficit discourses in mathematics education. *For the Learning of Mathematics*, 40(1), 42-46.
- Coburn, C.E., Penuel, W.R., & Farrell, C.C. (2021). Fostering educational improvement with research-practice partnerships. *Phi Delta Kappan*, 102 (7), 14-19.
- Denaro, K., Dennin, K., Dennin, M., & Sato, B. (2022). Identifying systemic inequity in higher education and opportunities for improvement. *PLOS ONE*, 17(4): e0264059. <https://doi.org/10.1371/journal.pone.0264059>
- Engeström, Y. (1987). *Learning by expanding: An activity-theoretical approach to developmental research*. Orienta-Konsult Oy.
- Engeström, Y. (2001). Expansive Learning at Work: Toward an Activity Theoretical Reconceptualization. *Journal of Education and Work*, 14(1), 133–156. doi:10.1080/13639080020028747.
- Engeström, Y. (2009). The future of activity theory: A rough draft. In A. Sannino, H. Daniels, & K. D. Gutiérrez (Eds.) *Learning and Expanding with Activity Theory* (pp. 303-328). Cambridge University Press.
- Engeström, Y., & Sannino, A. (2010). Studies of expansive learning: Foundations, findings and future challenges. *Educational Research Review*, 5(1), 1-24. <https://doi.org/10.1016/j.edurev.2009.12.002>
- Gutiérrez, R. (2009). Framing equity: Helping students “play the game” and “change the game”. *Teaching for excellence and equity in mathematics*, 1(1).
- Gutiérrez, R. (2013). The sociopolitical turn in mathematics education. *Journal for Research in Mathematics Education*, 44(1), 37–68. <https://doi.org/10.5951/jresmetheduc.44.1.0037>
- Hagman, J. E., Voigt, M., Bennett, A. B., Nicole, F., Bolick, M. A., Pai, L., Kress, N., Quaisley, K., Tremaine, R., Funk, R., Hill, P. W., & Smith, W. M. (2024). Experiencing tensions of nepantla with inner-departmental change groups. *Frontiers in Education*, 9(1454303), 1-14. <https://doi.org/10.3389/feduc.2024.1454303>
- Hancock, C. L., & Miller, A. L. (2018). Using cultural historical activity theory to uncover praxis for inclusive education. *International Journal of Inclusive Education*, 22(9), 937–953. <https://doi.org/10.1080/13603116.2017.1412517>
- Kezar, A. (2014). *How colleges change: Understanding, leading, and enacting change*. Routledge.
- Martin, W. G., Lischka, A., Smith, W. M., & Lawler, B. R. (Eds.) (2020). *The Mathematics Teacher Education Partnership: The power of a networked improvement community to transform secondary mathematics teacher preparation*. Volume 4 in B. Benken (Ed.), Association of Mathematics Teacher Educators Professional Book Series. Information Age Publishing.
- Núñez, A. M. (2021). Applying Cultural Historical Activity Theory (CHAT) perspectives toward equity in higher education organizations and systems. In L.W. Perna (Ed.), *Higher Education: Handbook of Theory and Research*. Higher Education: Handbook of Theory and Research, vol 37. Springer, Cham. https://doi.org/10.1007/978-3-030-66959-1_10-1
- Palmer, D., & Caldas, B. (2015). Critical ethnography. In K. King et al. (Eds.), *Research Methods in Language and Education, Encyclopedia of Language and Education* (pp. 1-12). Springer: Cham. DOI 10.1007/978-3-319-02329-8_28-1.

- Sannino, A., Daniels, H., & Gutiérrez, K. D. (2009). *Learning and Expanding with Activity Theory*. Cambridge University Press.
- Turner, J. C., Christensen, A., Kackar-Cam, H. Z., Fulmer, S. M., & Trucano, M. (2017). The Development of Professional Learning Communities and Their Teacher Leaders: An Activity Systems Analysis. *Journal of the Learning Sciences*, 27(1), 49–88.
<https://doi.org/10.1080/10508406.2017.1381962>
- Voigt, M., Hagman, J. E., Gehrtz, J., Ratliff, B., Alexander, N. & Levy, R. (Eds.). (2023). *Justice through the lens of calculus: Framing new possibilities for diversity, equity, and inclusion*. Mathematical Association of America.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.
- Wilson, T.D. 2006. A re-examination of information seeking behaviour in the context of activity theory. *Information Research* 11, no. 4: paper 260. <http://InformationR.net/ir/11-4/paper260.html> (accessed February 14, 2010).