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Experience Report
Using a Hybrid Card Sorting-Affinity Diagramming Method to Teach Content Analysis

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Abstract:
In this teaching experience report, we describe a research experience for undergraduates (REU) designed to cognitively support the work of two students from a two-year college (2YC) on a funded research project that involved analyzing user-generated content for a mobile Health app. We first suggest partnerships as a move toward REU equity as students from 2YCs are not typically afforded these opportunities. We then review the role of research in undergraduate learning and posit the importance of scaffolding to safely promote cognitive leaps. Finally, we present the cognitive scaffolding we created and connect it to our hybrid data analysis method.

Keywords:
research experiences for undergraduates (REU); cognitive scaffolding; undergraduate research at two-year colleges; content analysis methodology

"Using a Hybrid Card Sorting-Affinity Diagramming Method to Design Cognitively Scaffolded Learning for Undergraduate Student Researchers and Address Two-Year College Research Opportunity Inequities"

In Technical and Professional Communication (TPC), recent curricular and programmatic research demonstrates that research skills are crucial and desired. For example, Ford and Newmark (2011) included "effectively conduct and communicate research" as an additional component to senior capstone projects (p. 312); and Ilyasova and Bridgeford (2014) incorporated research as one of their five suggested programmatic outcome categories. Further, based on their analysis of existing undergraduate TPC programmatic learning outcomes for students, Clegg, Lauer, Phelps, and Melonçon (2020) recommended TPC programmatic administrators consider research (among other knowledge and skill learning outcomes) as a secondary area through which programmatic learning outcomes can (or might be) derived. In their explanation, they noted that "Research allows students to locate and/or produce information, assess its relevance, and apply the information to address a problem or issue" (p. 10). While such programmatic concerns remain important, the more recent "social justice turn" in TPC (Walton et al., 2019), which advocates an active "social justice stance" (Jones, 2016; Jones et al., 2016, p. 211), presents the opportunity to consider how we might approach such curricular considerations in order to empower marginalized (and minoritized) groups (Jones & Walton, 2018) as well as more actively pursue equity (see Colton & Holmes, 2018).

In this instructor-oriented teaching experience report,[1] we connect these two threads—TPC's focus on undergraduate research as a programmatic learning outcome and the shift toward a social justice perspective in the field—by advocating that faculty from two- and four-year institutions work together to offer research experiences for undergraduates (REU) specifically designed for two-year college (2YC) students. Indeed, students at 2YCs are less likely than their counterparts at four-year institutions to have opportunities to participate in an REU, which are generally thought to be valuable learning experiences (Dillon, 2020; Stanford et al., 2017). Historically, 2YCs are more likely than four-year institutions to teach minority and generally underserved student populations. In fact, according to recent demographic data from the American Association of Community Colleges (AACC; 2020) for credit-earning students, 26% are Hispanic, 13% are Black, 6% are Asian/Pacific Islander, 1% are Native American, 4% are multiracial, 4% are other/unknown, and 2% are "nonresident alien" (n.p.). These demographics show that 55% of students at 2YC are either Black, Indigenous, or People of Color (BIPOC). To contextualize, for the most recent (2019-2020) Integrated Postsecondary Education Data (IPEDS, 2020) at the minority serving and Hispanic Serving Institution (HSI) 2YC where Author 1 teaches, nearly 90% of students are BIPOC (citations REMOVED for review).

We suggest that this opportunity inequity for REU can be addressed through partnerships between two- and four-year institutions that can serve as a socially just pedagogical action meant to provide momentum toward an enduring, racially equitable shift in REU in TPC. To illustrate how such a partnership might be put into practice, we describe a funded research project[2] wherein we hired two undergraduate students from Author 1's institution as research assistants (hereafter referred to as project RAs). More specifically, this project focused on analyzing user-generated content (UGC) for a civilian first responder app described in REMOVED FOR

[1] Author 1's Institutional Review Board reviewed this project and found it to be exempt.

[2] We are grateful to REMOVED FOR REVIEW that enabled this research project.

REVIEW, forthcoming 2021a and forthcoming 2021b, and also serves as an example of how cognitive scaffolding—or intentionally sequencing student learning activities to build upon previous learning and knowledge—can be used to support students in a REU in TPC.

To address REU access equity, we designed our research project specifically so that we could work with 2YC students at Author 1's institution. Furthermore, because our project was funded, we were able to hire and pay the two undergraduate RAs for their labor. The cognitively scaffolded instructional approach we employed showed the project RAs one method for conducting content analysis. Whether in the classroom or workplace, this communication design method could be used as an example or model in any learning context. To prepare the project RAs for this REU, our process included using a hybrid research method of 1) open card sorting and 2) affinity diagramming as a pedagogical approach to cognitively sequence the steps in analyzing the UGC we collected for analysis. Our full methodological approach is outlined in detail in our forthcoming publication (see REMOVED FOR REVIEW).

Framed in the value of REU in TPC and as part of an REU at a 2YC, in what follows, we explain the scholarship that informed our cognitive scaffolding instructional approach, track that approach onto our hybrid research method, discuss the potential pedagogical benefits of researching with undergraduates at 2YCs, and promote REU at 2YCs as a move toward more equitably offering research experiences to undergraduates. First, we frame our experience report by briefly reviewing the role of research in undergraduate learning and the importance of scaffolding students' learning to safely promote cognitive leaps. We then share the hybrid data analysis method we used. Next, we provide relevant context before we share our pedagogical approach, which we suggest helped make content analysis more accessible for our RAs and offered opportunities to easily scaffold to the higher order thinking skills (e.g., evaluating UGC and creating categories) required for content analysis. Finally, we discuss the pedagogical benefits of working with 2YC students, and we conclude by advocating for pedagogical approaches that address the inequity in REU opportunities experienced by students as 2YCs.

Research in Undergraduate Learning and Two-Year College Contexts

The academic and eventual professional benefits of REU in science, technology, engineering, and math are generally widely known and well established (see Bangera & Bronwell, 2014). In contrast, REUs have been called research-based learning in the social sciences, which have been defined as "students conduct[ing] their own research with the help of a supervisor" (RBL; Wessels, Rueß, Gess, Deicke, & Ziegler, 2020, p. 2) or simply described as undergraduate research (Haeger, Smith & Armstrong-Land 2020). Regardless of the term, it is likely that these research experiences vary in each disciplinary context. Yet they are similar in that they investigate some kind of empirical phenomenon with the primary objective being "to provide students with an opportunity to experience participation in research," as Wessels, Rueß, Gess, Deicke, and Ziegler (2020) put it (p. 1).

Whether at a two- or four-year institution, REUs are valuable for learners (Dillon, 2020; Stanford et al., 2017) even if "community colleges [face] unique challenges" in implementing REUs (Bock & Hewlett, 2018), which, at least anecdotally, we know that they do. To address these "unique challenges," Schuster (2018) provided a list of high-impact practices from the American Association of Colleges and Universities (p. 276). Along with capstone courses or projects and

common intellectual experiences like those experienced in learning communities, the list also included undergraduate research. Schuster's (2018) motivation derived from his argument about "the importance of starting undergraduate research when students [who] are still within their first two-years of college in general and when they are at two-year colleges in particular" (p. 277). Although 2YCs "are not [traditionally] seen as institutions where faculty members and students are engaged in scholarly research and the production of knowledge . . . undergraduate research is being conducted in community colleges [2YC] across the nation" (Boggs, 2009, p. v-vi). However, as Martin and Rose (2005) explain, "Context is important—not just for the texts we study but also for the research we undertake" (p. 251). We contend that the academic and professional value students derive from research-based learning experiences—funded or unfunded at two- or four-year institutions—depends wholly upon the careful pedagogical REU design (i.e., cognitively scaffolded) and the actual real world context (such as challenges brought on by the COVID-19 pandemic) of the research experiences themselves. These factors work in tandem either for or even possibly against the quality of REU and its value for students. As an example of an active contribution toward a socially just pedagogical practice in TPC (Jones, 2016) that encourages an equitable distribution of research opportunities, providing REU for 2YC students is a move toward (what we hope will be) a pronounced and enduring equity shift in access to research opportunities for 2YC students.

Research Team Context

Typically, the kind of valuable immersive research experience Author 1 had participated in previously with students at a 2YC took place in independent study courses or National Science Foundation grant-funded science courses with communication components. However, at Author 1's institution, due to budgetary restrictions, independent study opportunities, unless they directly result in or contribute to an academic credential (i.e., degree or certificate), are not available currently for students. At the same time, with generous funding through a REMOVED FOR REVIEW grant, the research project described in this report included a team—comprised of two faculty members (Author 1 from a 2YC and Author 2 from a four-year institution) and two project RAs (both from Author 1's 2YC)—and provided compensation for the project RA's labor. Previously, Author 1 worked with the students,[3] as RAs on another extended research project examining TPC curricula and programs at 2YCs[4] (see REMOVED FOR REVIEW, 2020a; removed for review, 2020b).

In order to acquaint Author 2 with the RAs and vice versa, we convened in May 2019 (meeting 1) at the REMOVED FOR REVIEW[5] in Chicago, Illinois. In a conference room, we met to discuss the scope of the research project and to field questions from the RAs. During this initial research team meeting, all research team members were provided an opportunity to informally talk, as well as ask questions related to the project. For example, since the RAs were nearing graduation from the 2YC (spring 2020), they were encouraged to ask questions about Author 2's four-year institution. Then, later that year in November 2019 (meeting 2), the entire research team met at Author 1's institution for a day-long research meeting to discuss, define, and

[3] Authors 1 and 2 are thankful for the RA's labor as student research assistants on the research team.

[4] Author 1 is grateful to the REMOVED FOR REVIEW for a grant award that funded this project.

[5] Author 1 is grateful to the REMOVED FOR REVIEW their willingness to furnish a space for meeting 2 for the research team.

practice analyzing the project's data set (see REMOVED FOR REVIEW, 2021a); basically, it was a formal training session.

However, prior to meeting 2, the RAs met separately with Author 1 to receive hard copy printouts of the review comments—our UGC dataset for analysis—and the open card sorting materials (e.g., notecards, markers, and envelopes). During these meetings, Author 1 asked the RAs about their current respective workloads (it was just past the midterm of the semester; both were employed part-time and enrolled in full-time studies), and Author 1 described card sorting and affinity diagramming. Later, they were emailed instructions (Appendix A) regarding open card sorting and background readings about card sorting and affinity diagramming. Each research team member was required to complete open card sorting with the comments to become familiar with their content and to create preliminary codes prior to meeting 2. The starting point of meeting 2 was a full research team discussion about the preliminary coding from the individual open card sorting—one of the cognitively scaffolded learning activities we integrated into the research and analysis process for them. For a detailed discussion of our categorization and analytical process, please see REMOVED FOR PEER REVIEW (2021a).

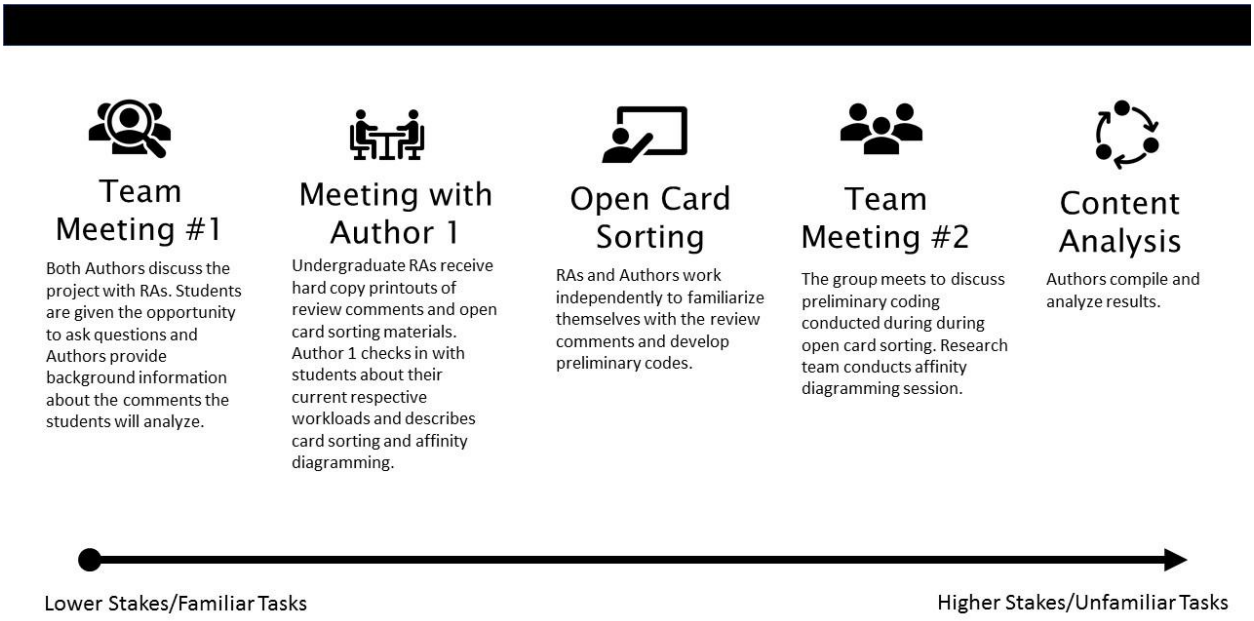
Scaffolding to Help Student-Researchers Make Cognitive Leaps During Meeting 2

In her work examining an experienced writing tutor's verbal and nonverbal work with students in a Writing Center, Thompson (2005) reviewed the pedagogical origin of the term scaffolding, noting that it was initially used in the 1970s by Bruner and colleagues; then it was taken up by Vygotsky regarding infant language acquisition (p. 417). Cognitive scaffolding (see Cromley & Azevedo, 2005) is a pedagogical concept or learning practice that encompasses different kinds of instructional moves made to help a student or any learner solve a problem on their own. Thompson defines cognitive scaffolding as "lead[ing] and support[ing] the student in making correct and useful responses" and motivational scaffolding as "provid[ing] feedback and help[ing] maintain focus on the task and motivation" (p. 417). Although the distinctions between these kinds of scaffolding are useful, this teaching experience report focuses on the method we used to cognitively scaffold learning activities. To do so, we used open card sorting and affinity diagramming as a hybrid method to sequence knowledge building during the learning process to prepare for content analysis. For example, the cognitive scaffolding we designed presented an opportunity to elide two methods commonly used in technical communication—open card sorting and affinity diagramming—to gently lead and support the RAs in the cognitive work required to use content analysis to examine the UGC dataset.

Grady (2006) discussed scaffolding within the context of online pedagogy, as a strategy used to "help learners span a cognitive gap or leap a learning hurdle" (p. 148; see also Grady and Davis, 2005/2017). Our intention for the pre-meeting 2 assignment tasks was two-fold: to introduce card sorting and affinity diagramming via content readings and to provide a low-stakes learning activity to practice open card sorting prior to the research team meeting. We reasoned that the open card sorting would prepare the RAs for meeting 2's dedicated affinity diagramming, which was the preparatory learning activity preceding content analysis. In this way, we wanted to "lead and support" (Cromley & Azevedo, 2005, p. 417) the project RAs as they became acquainted with and understood the content of the UGC. Then, as they began to better understand the UGC dataset, they cognitively moved to the evaluative and creative skills that content analysis requires. To prepare for the upcoming at-home UGC content analysis, meeting 2 was designed as

a training workshop (with breakfast and lunch served). In this way, and as shown in Figure 1, their learning process was supported via the cognitive scaffolding content readings, preparatory activities, and the research meetings' discussions, and certainly via motivational scaffolding, because Author 1 and Author 2 provided gentle, encouraging, supportive feedback, guidance, and training during each of the research team meetings.

Figure 1 Research Team Scaffolding Milestones and Lower/Familiar–Higher/Unfamiliar Stakes Range

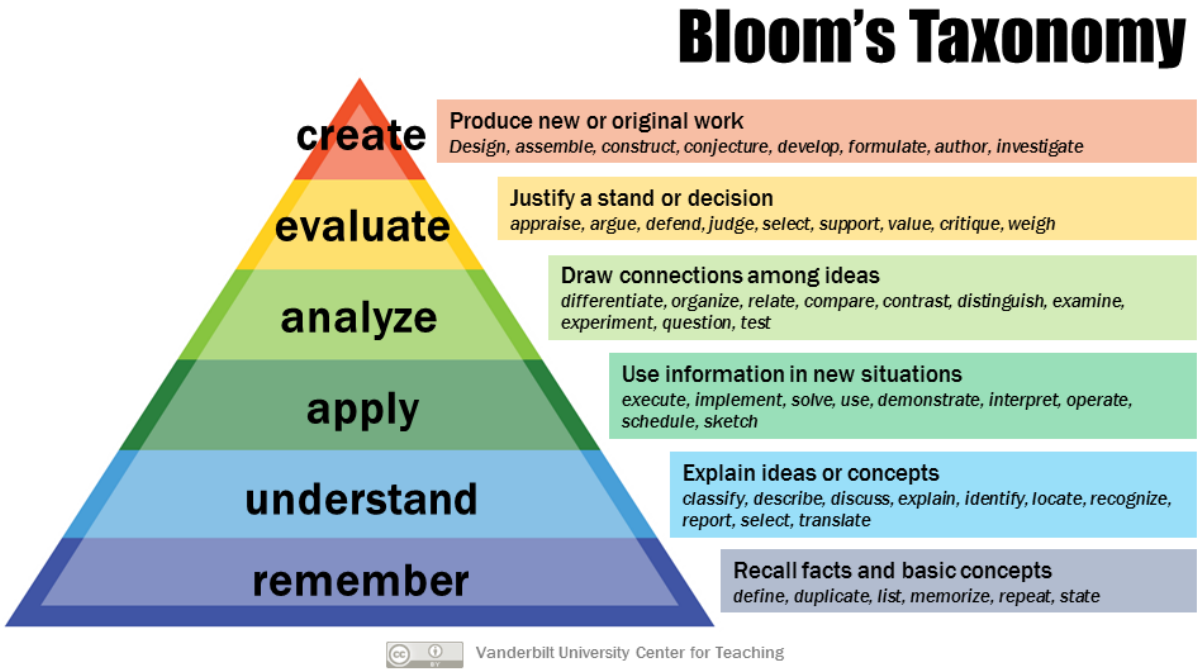


Building Content Analysis Knowledge Skills through Open Card Sorting and Affinity Diagramming

In TPC, content analyses can either be qualitative (e.g., Geisler, 2018) or quantitative (e.g., Brumberger & Lauer, 2015) and require familiarity with the text in order to identify and define analytical categories before developing the conditions or rules that dictate how to code content. Essentially, content analysis requires decisions about the level of analysis and how many categories to code for, as well as how to value the occurrence of a code and its frequency. Without making these decisions, content analysis can be difficult and overwhelming, especially for novice researchers or practitioners in any kind of learning or training context.

We designed the learning activities (e.g., content readings and open card sorting) based on our research project's ultimate learning objective of analyzing the UGC. Moving backwards from that objective, we cognitively scaffolded each learning activity using the revised Bloom's Taxonomy of learning (see Figure 2). By doing so, we could sequence the activity, such as content readings about card sorting and affinity diagramming, to provide a learning opportunity for the RAs to move from one revised Bloom's Taxonomy level, such as understanding open card sorting content to applying those understandings of open card sorting content.

Figure 2 A graphic depicting the revised Bloom's Taxonomy of learning with the most foundational learning skills building from the bottom to the top.



From understanding the UGC comments before meeting 2 through independent open card sorting to eventually practicing evaluating the UGC to create categories via affinity diagramming during meeting 2, we worked to cognitively sequence these learning activities to encourage achieving a specific learning outcome (as shown in Table 1). For example, meeting with Author 1 provided the opportunity to share the card sorting and affinity diagramming content readings and UGC to prepare to *remember*, *understand*, *analyze*, and *evaluate* the UGC via independent card sorting. And, during meeting 2, the entire research team used their independent open card sorting to *analyze* and *evaluate* the UGC and ultimately to *create* (the revised Bloom's Taxonomy of learning's highest cognitive process) categories for the UGC as shown in Table 1 below.

Table 1. Revised Bloom's Taxonomy and our Designed Learning Activities

Revised Bloom's Taxonomy Verbs	**Verb Description**	**Learning Activity Designed to Cognitively Scaffold Learning**
Create	Produce new or original work.	—developed independent content analysis of UGC —constructed categories through affinity diagramming —assembled UGC into preliminary categories through open card sorting
Evaluate	Justify a stand or decision.	—defended UGC category placement post affinity diagramming —valued UGC via affinity diagramming —appraised UGC through open card sorting
Analyze	Draw connections among ideas.	—questioned the categorizations of others, post affinity diagramming —related similarities among UGC during affinity diagramming —organized UGC into categories during open card sorting
Apply	Use information in new situations.	—implemented card sorting content readings —implemented affinity diagramming content readings —demonstrated card sorting and affinity diagramming knowledge
Understand	Explain ideas or concepts.	—reported issues related to card sorting and affinity diagramming —discussed open card sorting process at outset of meeting 2 —identified and selected relevant card sorting and affinity diagramming knowledge for future use
Remember	Recall facts and basic concepts.	—repeated affinity diagramming process after training —duplicated open card sorting method process independently —memorized open card sorting and affinity diagramming processes

Since content analysis also requires decisions around how categories will be defined or described (i.e., in the revised Bloom's taxonomic terms from Figure 2, *evaluate* and *create*) so they reliably suit the content's codes, an additional motivation for the at-home open card sorting was the lower-stake experience of practicing grouping UGC and defining categories in different ways prior to sharing the UGC open card sorting results at meeting 2. For example, both RAs were allocated at least 10 days to become familiar with the UGC to *create* and *define* preliminary categories prior to meeting 2. To show the value of their labor and this process, they tracked their RA hours and were paid for their work, which we think also offered an additional motivation. Through their at-home open card sorting, they were able to develop rules for coding content to make decisions about what to do with non-substantive or unusable content. This work became the starting place for team meeting 2. The above-mentioned open card sorting groundwork was a necessity prior to coding the UGC, which was a precursor to the affinity diagramming and content analysis. In other words, the low-stakes at-home open card sorting was a prerequisite learning activity to cognitively scaffold that provided movement from content familiarity to *understand* to eventually *analyze* and *evaluate* that content.

During meeting 2, after we discussed our independent open card sorting results, described those results, talked through any coding discrepancies, and created and defined categories, our design of this REU next required a silent affinity diagramming session with our preliminary categories over about two hours. To help the research team focus, each team member was provided meals and encouraged to step out of the room for breaks as needed. The purpose of the affinity diagramming was to visualize the categorization of each comment, while doing so in a supportive environment where we could eventually discuss problematic or confounding comments in the UGC data set. After our preliminary coding of the nearly 500 UGC mHealth app comments, we talked about our preliminary categories, collapsing some into broader ones and deciding what to do if a team member was unsure where a comment belonged. In addition to visualizing the content analysis process through the affinity diagramming, the aim was to address any potential kerfuffle, discuss the remedy, and code the comments consistently. Furthermore, the affinity diagramming was the last in-person supportive instructional practice prior to analyzing the UGC comments at home. In other words, in our REU design, meeting 2 was the final formal, cognitively scaffolded learning activity, training session, and preparatory step before independent content analysis. Prior to closing team meeting 2, the preliminary codes had been finalized and recorded, and we were confident that we had guided them through the cognitive sequencing necessary to independently analyze the UGC. Based on meeting 2, we shared data coding instructions (Appendix B) via email, described the content analysis process (p. 1) as a reminder, and disseminated the agreed upon categories and example codes (p. 2) from meeting 2 for the RAs at-home coding.

Pedagogical Benefits of Researching with Undergraduates at Two-Year Colleges

Recently, a tweet by professor and writer Bowles (2020) reminded readers that historically, education—from Aristotle through the next 2,500 years or so—was intended for the elite, and only in the last 150 years has education been offered to the public. He noted that "no human society had ever attempted to formally educate the entire populace," and described contemporary public education as "smack-dab in the middle of the largest experiment on children ever done." For any educator, an awareness of the relative newness of public education within the context of the history of humankind might be a sobering, humbling thought. In fact, it might put any

instructional design or pedagogical method, like using the revised Bloom's Taxonomy of learning to design an REU, into question. In fact, Bloom's original taxonomy of learning was published in 1956, then revised in 2001. We would hypothesize that as more is understood about the design of learning in communication contexts with regard to REU in TPC, perhaps part of Bloom's Taxonomy—usually used in K-12 educational settings—might not directly correlate to learning contexts in higher education (or even K-12). For example, the social aspects of learning are not included in Bloom's framework, and as learning remotely has shown us during the COVID-19 pandemic, socialization is an important (and for some, the most important) element of learning. As we designed this REU, we were mindful of the preeminence of socialization in learning and collaboration, which is why we met together as a research team during meetings 1 and 2. In fact, for Authors 1 and 2, although these meetings were integral for planning, they were also sources of enrichment and motivation through experiencing the collaborative joy of participating in cross-institutional research and working on a team—unforeseeable, valuable, and affective project outcomes outside of our design of these learning activities and likely REU in general.

In tandem with TPC scholars' calls to assess and prioritize research for undergraduates (Ford & Newmark, 2011; Ilyasova & Bridgeford, 2014; Clegg, Lauer, Phelps, & Melonçon, 2020), we suggest partnerships, like the project we undertook be implemented across two- and four-year institutions. Out of 1,235 public and private not-for-profit 2YCs, (REMOVED FOR REVIEW, 2020a and 2020b), 990 2YCs offer at least 1 TPC course, which is 80% of these schools. In their content analysis of these 1,235 2YC (REMOVED FOR REVIEW, 2020a; 2020b), these scholars created a state-by-state list of 2YCs offering TPC curricula and programs. Using this list as a starting point to institutionally locate potential collaborators to form partnerships, we advocate that faculty from four-year institutions work with faculty from 2YC feeder schools—the schools that 2YC transfer students primarily matriculate from—to design cross-institutional, context-specific research and learning experiences for undergraduate students. By doing so, these TPC instructors can intentionally contribute to efforts to address research opportunity inequities.

Our instructor-oriented teaching experience report describes researching with project RAs at a 2YC. In the process, we also demonstrated how to cognitively scaffold and design learning activities with at-home, lower stakes open card sorting to in-person, higher stake affinity diagramming that cognitively prepared these project RAs to analyze content independently and consistently. Our example provides a model for students and practitioners alike to learn about content analysis through the hybrid open card sorting-affinity diagramming method in any learning or training context. At the same time, we advocate for creating and sharing (paid) TPC research opportunities or REUs like this for students and that faculty from four-year institutions might be better positioned to procure internal and even external funding for such endeavors. For this reason, we suggest that faculty at four-year institutions look for opportunities to work with colleagues at 2YCs to form partnerships like the one we describe. As our teaching experience report shows, the design of the REU we recounted in the previous paragraphs moves us toward actively pursuing research opportunity equity for undergraduates—a meaningful, feasible, and ideally enduring pedagogical action aimed to contribute to socially just and racially equitable REU in TPC that we wholeheartedly endorse.

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