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From the Editors

Dear JOMES Readers,

We are delighted to present the 13th issue of the Journal of Mixed Methods Studies, which showcases the remarkable breadth of contemporary mixed methods research across diverse disciplinary and cultural contexts. This issue features three compelling articles that collectively demonstrate how mixed methods approaches can illuminate complex phenomena from institutional research capacity to Indigenous decolonization efforts.

In our first article, "*Enhancing Doctor of Physical Therapy Pain Neuroscience Education Through Telehealth Simulation: A Mixed Methods Approach*," Shannon Logan and colleagues employ an explanatory sequential design to examine a pain neuroscience education telehealth simulation for physical therapy students. Their findings reveal statistically significant improvements in knowledge and clinical recommendations, while qualitative insights illuminate the transformative power of experiential learning. The authors demonstrate that while quantitative data alone might suggest limited impact, qualitative findings reveal profound shifts in student confidence and clinical reasoning.

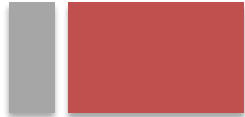
The second article, "*The Digital Evolution of the Research Ecosystem: A Strategic Analysis of Ankara University's Research Capacity and Performance via Collaborative Networks*," by Kaan Orhan, Şakir Çinkır, and their colleagues, presents a convergent parallel mixed methods analysis of institutional research capacity at Ankara University in Türkiye. By integrating bibliometric data, system logs, interviews, and focus groups, the authors uncover critical divergences between digital platform adoption and active engagement. They reveal that structural network position alone is insufficient without institutional mechanisms that convert passive membership into meaningful collaboration, offering vital insights for universities navigating digital transformation.

Our third article, "*Creative Methods and Learning with Justice Centered Mixed Methods Research: Decolonizing Systemic Inequities with Land Acknowledgments*," by Anna S. CohenMiller, Charlotta Maria Langejan, and Nayr Correia Ibrahim, offers an innovative arts based response to the call for transformative and socially meaningful research. Weaving together found poetry, collaborative autoethnography, text messaging, and a practical toolkit for land acknowledgments, the authors demonstrate how justice centered mixed methods can advance decolonization efforts in higher education. Their work stands as a powerful model for integrating social justice, inclusion, diversity, equity, and social responsibility into methodological practice while embracing vulnerability as a methodological strength.

Each article in this issue advances our understanding of mixed methods research as an integrative and transformative enterprise. Together, these studies remind us that integration, whether of quantitative and qualitative data, of technological and human dimensions, or of research and social action, lies at the heart of meaningful scholarly inquiry. We extend our deepest gratitude to our authors and to you, our readers, for your continued engagement.

Sincerely,
Professor Anthony J. Onwuegbuzie
Editor in Chief

Professor Şakir Çinkır
Deputy Editor



Enhancing Doctor of Physical Therapy Pain Neuroscience Education Through Telehealth Simulation: A Mixed-Methods Approach

Shannon Logan  Emilio J Puentedura  Adriaan Louw  Melissa Moran Tovin 

To cite this article:

Logan, S., Puentedura, E.J., Louw, A., & Moran Tovin, M. (2026). Enhancing doctor of physical therapy pain neuroscience education through telehealth simulation: A mixed-methods approach. *Journal of Mixed Methods Studies, Vol (13)*, 1-22. <https://doi.org/10.59455/jomes.74>

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Abstract

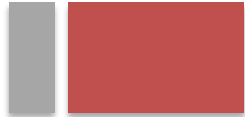
Although diverse pedagogical approaches are encouraged in physical therapy education, lectures remain the primary method for teaching modern pain science. The purpose of this study was to examine changes in knowledge, attitudes, beliefs, and clinical recommendations regarding chronic low back pain (CLBP) among entry-level Doctor of Physical Therapy (DPT) students after a pain neuroscience education (PNE) telehealth simulation. A mixed-methods QUAN-qual explanatory sequential design was used. One hundred fifteen students completed quantitative measures, and 32 participated in semi-structured focus groups. Pre- and post-simulation, students completed the Revised Neurophysiology of Pain Questionnaire (RNPQ), Healthcare Providers' Pain and Impairments Relationship Scale (HC-PAIRS), and a clinical vignette. The Simulation Effectiveness Tool-Modified (SET-M) was administered post-simulation. Results demonstrated small but significant improvements in RNPQ, HC-PAIRS, and vignette scores, although effect sizes were modest. Weak positive correlations were found between RNPQ and HC-PAIRS ($r = .155$) and vignette scores ($r = .199$). The median SET-M score was 54. Qualitative analysis identified four themes: (1) safe but realistic experience, (2) learning through discomfort, (3) validation of patient pain, and (4) value of metaphors and analogies. Findings support the integration of experiential methods, such as simulation, into pain science education.

Keywords: *Simulation; physical therapy; mixed methods; pain neuroscience*

Introduction

Clinicians use PNE to help patients shift their perspective from a purely biomedical view of pain to a more comprehensive biopsychosocial one. Rather than viewing pain as a sign of "tissue damage," PNE reframes pain as a perceived threat or the body's way of signaling the need for protection (Louw et al., 2016; Moseley & Butler, 2015). Multiple studies show that PNE improves outcomes for individuals with chronic musculoskeletal (MSK) and CLBP (Marris et al., 2021; Puentedura & Flynn, 2016; Tegner et al., 2018). Based on the evidence supporting PNE, this approach should be integrated into professional-level education including physical therapy, which is one of the most commonly prescribed interventions for chronic pain (Yong et al., 2022).

Difficulties are experienced by practicing physical therapists in managing chronic MSK pain and implementing clinical practice guidelines (CPG) for CLBP, which includes PNE (Foster et al., 2018; George et al., 2021). Physical therapists often demonstrate a more biomedical than biopsychosocial attitude and belief system, which can weaken the therapeutic alliance and fails to align with clinical practice guidelines CPG for CLBP, including recommendations for facilitating return to work utilizing PNE (George et al., 2021; Houben et al., 2005). Additionally, physical therapy students struggle to provide recommendations aligned with CPG for activity and return to work relating to CLPB (Leysen et al., 2021). Therefore, attitudes and beliefs play a



critical role in treatment selection aligned with CPGs for CLBP and should be explored when using PNE. Growing evidence supports PNE as an essential intervention for CLBP, as it can positively influence patients' attitudes and beliefs underscoring the importance of incorporating pain science education into entry-level Doctor of Physical Therapy (DPT) curricula (Foster et al., 2018).

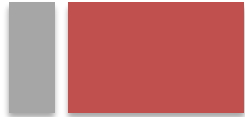
Findings from a published study that examined the views of practicing physical therapists indicate strong agreement and recognition for the importance of including PNE in DPT curricula (Louw et al., 2017). Moreover, the International Association for the Study of Pain (IASP) and the Academy of Orthopedic Physical Therapy (AOPT) have updated curricular recommendations for pain education (IASP, 2024; Shepherd et al., 2021). Despite the recommendations for PNE in education and practice, there is significant evidence that modern pain science content continues to be limited in entry-level DPT curricula (Ehrström et al., 2018; Hoeger Bement et al., 2015). Research involving PNE in DPT education often involves lectures ranging from 45 minutes to 26 hours (Adillón et al., 2015; Alodaibi et al., 2018; Colleary et al., 2017; Cox et al., 2017; Mankelow et al., 2020).

Education theory and best practice support the use of active learning over traditional lectures, such as simulation, a form of experiential learning (Collins et al., 2021). A simulation is an educational technique that replicates real-world scenarios or environments to provide learners with hands-on learning opportunities (Pritchard et al., 2016). Simulations aim to mimic the complexity of actual situations, allowing participants to practice skills, make decisions, and solve problems in a controlled, safe, and interactive setting (Pritchard et al., 2016). In simulations, students absorb the presented knowledge and demonstrate improved clinical decision-making (Mori et al., 2015). Recently, educators have effectively implemented simulation activities in physical therapy curricula to augment the learning experience (Mori et al., 2015). Experiential learning through simulations can improve clinical decision-making skills, confidence, and overall potential to thrive in clinical experiences while promoting reflection on practice (Macauley, 2018; Smith & Crocker, 2017).

Kolb's experiential learning theory (ELT) is a frequently used approach in simulation. Knowledge results from the combination of grasping and transforming an experience (Kolb, 1984). Gaining knowledge involves both grasping and transforming an experience. The process includes four phases: concrete experience, reflective observation, abstract conceptualization, and active experimentation (Kolb, 1984; Zigmont et al., 2011). Simulation offers a concrete learning experience, followed by reflective observation during debriefing, where learners and educators analyze both individual and group performance. This reflection supports the development of clinical reasoning and may foster changes in attitudes and beliefs (Poore et al., 2014). Learners then engage in abstract conceptualization and active experimentation, using insights gained to generate new ideas and apply their learning to future clinical encounters (Poore et al., 2014; Smith & Crocker, 2017).

When applied in DPT curricula, ELT allows students to practice in a practical or "real-world" setting (Smith & Crocker, 2017). Basing activities on ELT allows educators in DPT programs to enhance student engagement, knowledge, and application. Through these experiences, students have shown increased confidence, self-efficacy, critical thinking, communication skills, promotion of reflection, and exposure to clinical situations (Lowe et al., 2022; Smith & Crocker, 2017).

A practical example of where ELT can guide simulation is via virtual telehealth experiences. The recent COVID-19 pandemic response resulted in restrictions on access to traditional in-person healthcare and, consequently, allowed for an exponential increase in the adoption of telehealth (Bettger et al., 2020). Synchronous telehealth has shown comparable effectiveness and improvements in pain, physical function, and disability in individuals with osteoarthritis and nonspecific low back pain (Cottrell et al., 2017; Dario et al., 2017). Further, PNE has successfully enhanced pain neurophysiology knowledge and shifted attitudes across various healthcare disciplines within the Department of Veterans Healthcare Administration when delivered via live-streaming (Louw et al., 2019). Thus, PNE can be effectively implemented through technology, rather than solely face-to-face, offering a potential telehealth experience in the classroom. However, telehealth education remains insufficient among healthcare providers (Bettger et al., 2020; Fergus



et al., 2021). To address this gap, curricula should incorporate telehealth to enhance students' skills and provide hands-on experience before they enter clinical practice.

There is a need to identify optimal and practical pedagogical approaches for incorporating pain science education in DPT curricula to align with current pain science competencies, recommendations, and clinical guidelines (Shepherd et al., 2021). Understanding students' personal experiences during this specific pedagogical approach to PNE supports a mixed-methods design.

Mixed Methods Research

Learning is a multifaceted process that occurs across varied contexts and through diverse approaches (National Academies of Sciences, Engineering, 2018). It does not progress in a strictly linear manner based on knowledge acquisition or memory alone, but instead develops through the interaction of multiple processes over time (National Academies of Sciences, Engineering, 2018). Certain learning experiences emphasize deliberate reflection, enabling learners to interpret new knowledge and integrate it into future practice (Kolb, 1984). Given the complexity of this reflective and applied learning process, objective measurement alone is insufficient. Accordingly, a mixed-methods design was deemed most appropriate for the present study.

Mixed-methods research incorporates both quantitative and qualitative approaches to data collection and analysis, offering a more comprehensive understanding of a phenomenon than reliance on a single method (Almeida et al., 2017; Carter et al., 2014; Kajamaa et al., 2020). A defining characteristic of mixed-methods research is integration, which may occur at one or more stages of the study and leverages the complementary strengths of both methodological traditions (Almeida et al., 2017). Such integration facilitates triangulation of findings, thereby producing a more robust and holistic perspective.

By exploring the change in knowledge, attitudes, beliefs, and behavior from a quantitative perspective, educators gain further data to support the benefits of simulation as a pedagogical approach to pain science education in the curricula. Qualitative analysis will result in a deeper understanding and holistic perspective of students' educational experience in the simulation and their attitudes and beliefs about PNE as a clinical approach. The purpose of this study is to explore changes in knowledge, attitudes, beliefs, behaviors, and experiences of physical therapy students who participate in a PNE telehealth simulation.

Research Questions

1. Is there a change in knowledge, attitudes and beliefs and clinical recommendations pre- and post-telehealth simulation in PNE for CLBP?
2. What is the perceived effectiveness of the simulation?
3. Is there a correlation between any outcome variables pre- and post-telehealth simulation in PNE for CLBP?
4. What is the experience of students while participating in a PNE-specific telehealth simulation activity for CLBP?

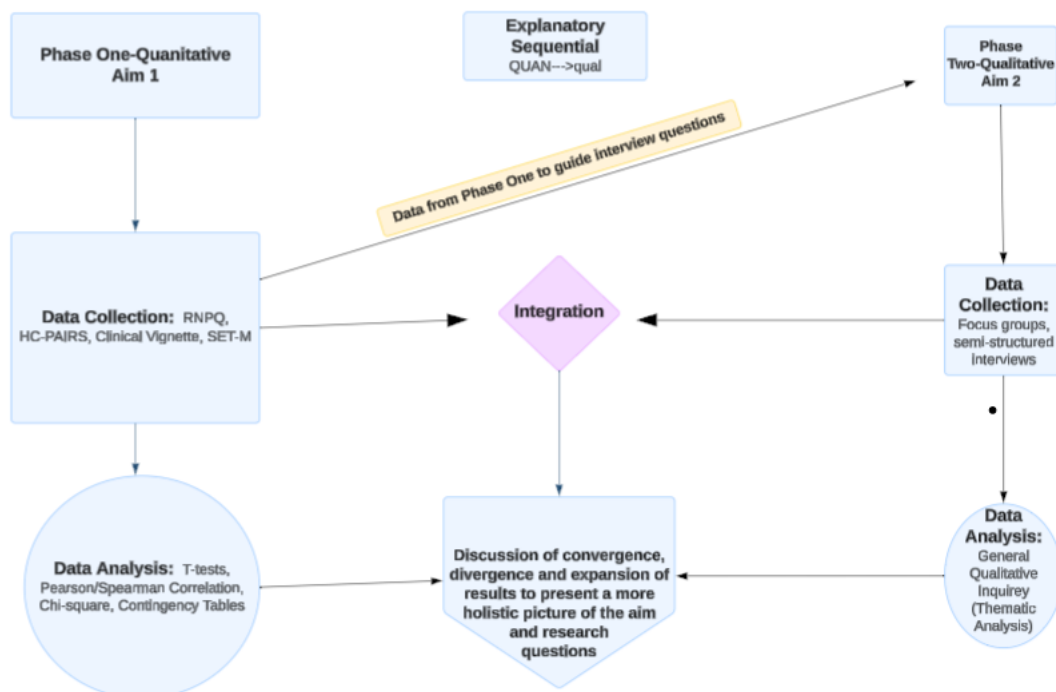
Method

Study Design

This study utilized an explanatory sequential Quantitative→qualitative (QUAN→qual) mixed-methods design. This study followed Mixed Methods Reporting Standards for Health Sciences (MMR-RHS) (Tovin & Wormley, 2023). This design includes two distinct phases: Phase 1 consists of quantitative methods, and Phase 2 consists of qualitative methods. The methods were integrated at two points. First, findings from Phase 1 data collection and analysis informed the semi-structured interview questions (see Figure 1).



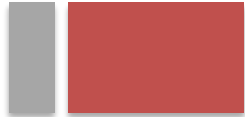
Figure 1
Mixed-Methods Design



Phase 2 data collection and analysis enabled integration of findings from both phases, allowing for comparison and interrelation through integration. This mixed-methods approach included a discussion of convergence and expansion (Aarons et al., 2012; Cresswell et al., 2018). Trustworthiness and rigor were established by addressing credibility, dependability, confirmability, and transferability (Lincoln & Guba, 1985) (see Table 1).

Table 1
Specific Actions for Rigor/Trustworthiness

Component	Actions
Credibility	participation review/member checking of testing
Transferability	1. Demographics provided 2. Thick and descriptive findings with interpretation
Dependability	1. Audit Trail/Use of Consolidate Criteria for Reporting Qualitative Research (COREQ)
Confirmability	1. Audit trail 2. Raw data 3. Reflexive journaling and field notes 4. Data integration 5. Data reconstruction/process and synthesis working with committee member



Sampling and Recruitment

Participants were recruited through purposive convenience sampling from the final MSK course of an entry-level DPT program, completed during the last term of didactic work immediately preceding their terminal clinical experiences. The curriculum incorporated PNE concepts, which were scaffolded throughout various courses and primarily delivered through lectures. The curriculum did not include a standalone pain science course or fully align with IASP curricular guidelines, leading to some variation in the delivery of these concepts. The study included three separate campuses of a mid-sized, private, for-profit university in the United States. A total of 161 students were eligible. All participants completed the informed consent before participating in the study to screen for inclusion and exclusion criteria, consent for data release, and willingness to be randomly selected for focus group interviews one week after the simulation. Inclusion criteria included current enrollment in the specified course and completion of the simulation. Participants who provided consent to be contacted for potential follow-up qualitative interviews were also included. In contrast, exclusion criteria consisted of a self-reported history of specific and formal PNE training outside of the curriculum, including continuing education (CE), and any student unwilling to sign the informed consent. Each participant was assigned a unique identifying number to ensure confidentiality.

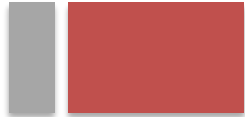
Phase 1: Quantitative Data Collection

Researchers originally developed the Neurophysiology of Pain Questionnaire (NPQ) to assess a person's understanding of the biological mechanisms behind their pain. The NPQ comprises 19 closed-ended questions answered as true, false, or undecided. Correct responses are awarded one point, and incorrect (or undecided) responses are awarded zero points. Scores can range from 0 to 19, with higher scores indicating greater pain neurophysiology knowledge. The original NPQ is a valid and reliable measurement for health care professionals, patients, and physical therapy students with a Pearson Separation Index of .84 and an acceptable test-retest reliability of 0.97 (G. L. Moseley, 2004; L. Moseley, 2003). Subsequently, the 12-item RNPQ was developed after Rasch Analysis and has been deemed reliable and valid with good test-retest reliability of .989 in patients with chronic spine pain (Catley et al., 2013).

The original HC-PAIRS is an outcome measure used to explore the relationship between healthcare providers' attitudes and beliefs and the relationship between CLBP and impairment. The questionnaire comprises 15 items using a 7-point Likert rating scale ('Completely disagree' = 1 to 'Completely agree' = 7). Scores can range from 7 to 105, with lower scores suggesting positive beliefs and attitudes that pain complaints do not justify impairment or disability. The original HC-PAIRS Cronbach's alpha was 0.78, with good validity relating to work and activity recommendations (Rainville et al., 1995).

The original Simulation Effectiveness Tool (SET) consisted of 19 items using a 3-point Likert scale with 3 = strong agree and 1 = do not agree (Cordi et al., 2012). A modified version, SET-M, was developed to align with current simulation standards. It includes 13 items and additional components that assess pre-briefing, learning, confidence, and debriefing, all using the same 3-point Likert scale. A higher calculated score typically indicates a more positive evaluation of the simulation experience. The intraclass correlation coefficient (ICC) is 0.833 for pre-briefing, 0.852 for learning, 0.913 for confidence, and 0.908 for debriefing indicating good to excellent reliability. Further, the SET-M demonstrates construct validity and a similar factor structure to the original SET after modifications (Leighton et al., 2015).

A case vignette relating to CLBP was utilized to examine participant behavior or clinical recommendations. The vignette and questions were adapted from previous studies (Bishop et al., 2008; Maguire, N., Chesterton, & Ryan, 2019). The participants answered four multiple-choice questions based on the case information. Participants were instructed to provide recommendations regarding usual daily activities, work, exercise, and bed rest based on the case information. The percentage of recommendations consistent with clinical guidelines was recorded, with higher scores indicating better alignment with best practices.



Phase 2: Qualitative Data Collection

A pilot study of the simulation explored the feasibility of the simulation, reliability of semi-structured interview questions and execution of focus group interviews by SL (Logan, 2024). The reliability of the interview data was supported by audio-recording all focus group sessions using a Sony ICD-PX370 Mono Digital Voice Recorder with built-in USB, followed by verbatim transcription.

Sample Size

An a priori power analysis using G*Power 3.1 was conducted to estimate the required sample size for the quantitative arm. Analysis was calculated using a conventional Cohen's d effect size of 0.5 (moderate), power of 0.80, and alpha of 0.05 for an independent t-test. To account for a 25% exclusion or missing data rate, the final estimated sample size was 50 participants. The qualitative sample size was guided by the principle of data saturation, with estimates suggesting that 90-94% saturation could be achieved within three to six focus groups sufficient to capture the most prevalent themes without the emergence of novel information (Guest et al., 2017; Hennink et al., 2019). Between five to eight participants were included in each focus group.

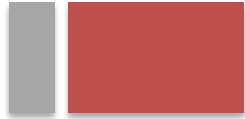
Procedures

An electronic survey was embedded into the course learning management system, in which the primary investigator was not a lead instructor. The baseline survey was completed in week one, before engaging in the course's didactic content and designed simulation preparatory activities. The survey included demographics, RN PQ, HC-PAIRS, and the clinical vignette. During the required course lab session, participants engaged in a one-hour simulation with a standardized patient, led by the primary author (SL) and lead lab faculty. The simulation was pilot-tested and designed according to best practice standards to achieve the specified learning objectives (Logan, 2024; Watts et al., 2021). The preparation activities before the simulation sessions included a one-hour faculty recorded video reviewing pain science and education concepts including an example of PNE delivery based on the "Why You Hurt: Pain Neuroscience System." (Louw, 2014) The main themes of this educational approach have been used in prior research and included basic PNE concepts that were included in the simulation objectives (Puentedura & Flynn, 2016; Rufa et al., 2019). Participants were required to review the video during the week of the lab activity, as it was not available for review prior to that time. They had the opportunity to revisit it until the simulation was delivered. Immediately before the simulation, the students reviewed a short pre-brief explaining learning objectives, expectations, ground rules, and content. Participants immediately completed the post-survey post simulation, which included the aforementioned, with the addition of the SET-M.

Those who indicated their willingness to participate in focus groups on informed consent were recruited via the Microsoft Excel random number generator to ensure that each participant has equal chance of being selected. The focus group lasted approximately one hour and was conducted by the primary author (SL) via password-protected Zoom 6.0 video conferencing (Zoom Video Conferencing Inc., California). Quantitative results were used to inform the semi-structured interview questions.

Quantitative Data Analysis

Data was analyzed using SPSS 26 (IBM, New York). Descriptive analysis was employed to summarize data, including demographic characteristics. Normality and assumption analysis did not follow a normal distribution, therefore nonparametric statistical tests included the Wilcoxon signed-rank test and Spearman correlation to evaluate changes in outcomes pre and post-simulation as well as correlations. Cohen's d was used to calculate effect size, with standard interpretations: small (0.2), moderate (0.5), and large (0.8). A McNemar test and contingency tables were used to analyze clinical vignette question scores pre and post simulation. Significance levels were set at $\alpha = 0.05$.



Qualitative Data Analysis

Qualitative data was managed through NVivo 12 software (QSR International, Melbourne, Australia). Qualitative content analysis (QCA) was conducted by the primary investigator, SL, based on the methods described by Creswell while utilizing in-vivo coding. In-vivo coding emphasizes the participants' actual spoken words and highlights their voices, giving meaning to the data (Saldana, 2021; Schreier, 2012). A co-author (MT), considered an expert in qualitative research and education, reviewed qualitative data analysis and theme development. In the analysis phase an iterative and constant comparison process, open coding, grouping, categorizing, and generating themes (Saldana, 2021). Saturation was achieved when no new novel information was gathered and illustrative quotes were identified, replacing participants' names with pseudonyms.

Results

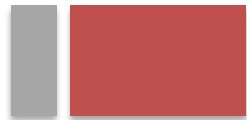
Quantitative

Out of 161 eligible participants, 115 (71.42%) were eligible via the informed consent and included in the study, while a subset of 32 participants completed the focus group interviews. Table 2 displays the demographic characteristics for both the quantitative and qualitative data sets.

Table 2
Demographics

Quantitative		
Campus		
	Campus 1	36
	Campus 2	33
	Campus 3	46
Gender		
	Female	68
	Male	47
Type of Program delivery		
	Blended	14
	Traditional	101
Age – Mean (Standard Deviation)		26.9(3.30)
Licenses or Certification		
	CSCS	2
	PTA	2
	Dietician	0
	EMT	1
	Athletic Trainer	2
	Other	16
Qualitative		
Participants		32
Age-Mean (Standard Deviation)		27.84(+4.39)
Licenses or Certification		
	CSCS	2
	PTA	2
	Other	2

Note. CSCS, Certified Strength and Conditioning Specialist; PTA, Physical Therapy Assistant; EMT, Emergency Medical Technician



Participating in a PNE simulation led to statistically significant changes in attitudes and beliefs, as measured by the HC-PAIRS ($z = -4.981, p < .001$), though the effect size was small ($ES = 0.328$). Similarly, the RNPQ showed a significant pre-test to post-test difference ($z = -4.844, p < .001$) with a small effect size ($ES = 0.319$). Clinical vignette scores also varied significantly between the two periods ($z = -2.461, p = .014$), but the effect size remained small ($ES = 0.162$). While these findings indicate meaningful change, the modest effect sizes suggest the overall impact was limited. Scores on the SET-M were considered high, with a median score of 54 ± 6.477 (see Table 3).

Table 3
Wilcoxon Signed Rank Outcome Analysis

Outcome	Pre		Post		Mean ranks		Z	p
	Median	IQR	Median	IQR	Positive	Negative		
Attitudes and Beliefs	59	12	53	16	52.95	58.34	-4.981	< .001
Knowledge of Pain Neurophysiology	5	2	6	2	41.25	35.44	-4.844	< .001
Clinical vignette scores	4	3	6	3	40.46	47.46	-2.461	.014

Note. IQR = Inter-Quartile Range

The RNPQ and HC-PAIRS had a weak positive and significant correlation, $r(228) = .155, p = .019$. The correlation between the RNPQ and clinical vignette was significant and positive at $r(228) = .199, p = .03$. The SET-M had no significant correlation with the other variables. There was a significant difference in overall clinical vignette scores between the two periods ($z = -2.461, p = .014$). A contingency table was used to compare the pre- and post-survey periods regarding correct recommendations for individual questions (see Table 4).

Table 4
Correlations

	1	2	3	4
1. HC-PAIRS				
2. RNPQ	.155*			
3. Clinical Vignette	-.099	.199*		
4. SET-M	.100	.151	-.014	

Note. * significant at the .05 level

Most appropriate recommendations improved or remained stable after the simulation. Two recommendations showed minimal decline (<2%): correct answers for 'Limit all activity until the pain disappeared' decreased by 1.7%, and 'Refrain from participation until the pain improves' declined by 0.9% (see Table 5). However, the recommendation to "Perform only pain-free activities" showed a notable improvement from 56.6% pre-simulation to 67.8% post-simulation, which was statistically significant ($p = .035$). Additionally, the recommendation to "Rest in bed until pain improves substantially" increased from 84.3% to 93.0%, with the change also being statistically significant ($p = .041$).



Table 5
Clinical Vignette Contingency Table

Question	Pre(%)	Post(%)	p
Return to normal work	42(36.5)	42 (36.5)	1.00
Return to part-time or light duties	112 (97.4)	112 (79.0)	1.000
Be off work until pain has improved	88(76.5)	91(79)	.720
Be off work until pain has completely disappeared	113 (98.3)	114 (99.1)	1.000
Be off work for a further 2 weeks	96 (83.5)	97 (84.3)	1.000
Refrain from participating for a further 2 weeks	108 (93.9)	107 (93.0)	1.000
Refrain from participating until pain has improved	83 (72.2)	82 (71.3)	1.000
Refrain from participating in exercises until pain has completely disappeared	111 (96.5)	112 (97.4)	1.000
Return to normal exercises routine	18 (15.7)	22 (19.1)	.523
Return to light class participation	92 (80.0)	97 (84.3)	.458
Perform Usual Activities	22 (19.1)	27 (23.5)	.458
Perform activities within patient's tolerance	104(90.4)	105(91.3)	1.000
Perform only pain free activities	65(56.5)	78 (67.8)	.035*
Limit all physical activities until pain disappears	114(99.1)	112 (97.4)	.625
Avoid resting in bed entirely	19(16.5)	25 (21.1)	.327
Avoid resting in bed as much as possible	55(47.8)	67 (88.3)	.065
Rest in bed only when pain is severe	38(33.0)	42 (36.5)	.627
Rest in bed until pain improves substantially	97(84.3)	107 (93.0)	.041*
Rest in bed until pain disappears	109(94.8)	112 (97.4)	.508

Note. * significant at the .05 level

Qualitative

Four themes emerged from the data: (a) real-world but safe experience, (b) discomfort while embracing learning, (c) validation of the patient's pain experience, and (c) the value of metaphors and analogies.

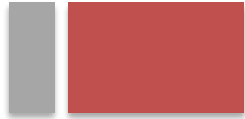
Main Theme 1: Real World, But Safe

This theme highlights students' experiences with telehealth physical therapy and simulated learning related to PNE and CLBP. Many students believed the simulation offered a safe space for real-world practice. They emphasized how the simulation helped them develop communication skills and deepen their understanding of critical concepts. Participants strongly appreciated the simulation, describing the patient scenario as highly valuable. Participants reported that completing the simulation made the concepts of pain neurophysiology clearer as they gained knowledge. They also emphasized how this experience would help them in future real-world interactions with patients.

"...it is a safe environment." (Sally-FG 2)

"So I think that's like just getting ready for that in practice, like navigating those conversations is the big thing." (Michael-FG 2)

"I think just to kind of get some of those kinks out of how you want to word" (Dan-FG 2)



"And through this experience, I feel like I actually understand pain science now." (Tim-FG 1)
"I think it was really good practice for, you know, the real world." (Michael-FG 2)

This simulation introduced many students to telehealth for the first time in the context of physical therapy and patient interactions. Students also recognized the importance of telehealth in physical therapy practice.

"...telehealth is getting more prominent" (Tim-FG 1)
"...educating them, telehealth is very valuable." (Sandra-FG 3)

Despite the benefits expressed, participants extensively discussed the challenges of telehealth. They highlighted its limitations, including communication difficulties and the impersonal nature of the interaction. Participants expressed strong emotional reactions to using telehealth, with most describing a sense of awkwardness when interacting through a screen rather than face-to-face.

"So the physical limitation of telehealth are definitely the biggest thing for me." (James-FG 3)
"It's always really hard to speak to someone and interact with them virtually versus being in person." (Kerry, FG 3)
"I didn't really like it so much because like it didn't feel very personable." (Jade-FG 2)
"Maybe at first it was initially kind of awkward just trying to talk through a screen and getting comfortable with that." (Erica-FG 3)

Main Theme 2: Discomfort While Embracing Learning

The simulation experience generally evoked strong emotions in participants. Most initially expressed negative feelings during the simulation.

"...always a little bit nervous." (Beth-FG 2)
"...nerve wracking, but it is a safe environment." (Sally-FG 2)

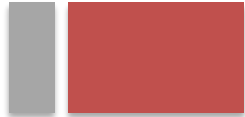
Yet, after their initial emotions settled, participants actively reflected on the experience and acknowledged their learning gains. Many expressed newfound confidence in educating actual patients about PNE, along with improved ability to communicate its concepts.

"...help(s) make you a lot more confident in moving forward." (Kyle-FG 3)
"I guess you don't really know until you have to do it." (Stephanie-FG 4)
"But I think in general it definitely increased my confidence and abilities to educate on chronic pain science." (Jill-FG 2)
"I think in addition to patient education, which seems like a lot of the basis on, I like being able to explain it, but there's that whole process of learning of like, OK, you can read it, you can like, say it out loud, but then being able to teach it to someone like we had learned all the information. (Tara-FG 1)

Main Theme 3: Validation of the Patient's Pain Experience

The simulation prompted a shift in participants' attitudes and beliefs. They expressed how their views on CLBP changed, emphasizing the importance of focusing on a patient's abilities rather than disabilities. Participants highlighted the need to validate a patient's pain experience and recognize the complexity of chronic pain. After interacting with the patient, this experience led them to adopt a more biopsychosocial and ability-centered perspective.

"But in terms of like, accepting it and kind of understanding it in terms of like a patient perspective, it just depends on them. But I think that what everybody else has said is, well, like their chronic pain patients have a very scientific and valid reason for their pain, and that's something that we should consider." (Jennifer-FG 1)



Main Theme 4: The Value of Metaphors and Analogies

While discussing PNE with an actual patient, participants found metaphors and analogies extremely helpful. Most emphasized their value, noting that they now have more "tools" for future patient interactions. They also highlighted the versatility of these tools and reflected on how they could have been helpful in past clinical experiences.

"I think the analogies are probably the most helpful because in real-life, we are explaining that to patients." (Dan-FG 2)

"...it gave more tools to kind of explain it to the patients a little better." (Jill-FG 2)

"I notice, like I didn't have those tools or those metaphors to tell my patients in the clinic what they were feeling." (Jennifer-FG 1)

"So I kind of took the alarm system and then put it into a different analogy that related more to him and his like activities and stuff." (Tim-FG 1)

Integration

Quantitative results revealed improved knowledge of pain neurophysiology, appropriate clinical recommendations, and a shift to a more biopsychosocial and positive attitude and belief system toward CLBP. Qualitative results indicated a greater understanding of pain science concepts among students, whereas their attitudes and beliefs shifted towards ability versus impairment and disability. Participants said the patient's pain was subjective, valid, and multifactorial, consistent with a biopsychosocial versus a biomedical perspective. Post-simulation, clinical recommendations for work, physical activity, exercise, and bed rest showed improvement. Qualitative data highlighted a shift in focus from patients' disability to their capabilities with CLBP, affirming the simulation's potential influence. High SET-M scores indicated confidence in knowledge transfer, while qualitative feedback confirmed the simulation as beneficial despite some discomfort during learning. Additionally, SET-M scores reflected self-confidence in applying knowledge to real-world contexts, and qualitative insights showed increased confidence in delivering PNE in future practice.

Integrating both sets of data expanded our understanding and provided deeper insights. Quantitative outcomes showed improvements in participants' knowledge of pain neurophysiology, along with shifts in attitudes, beliefs, and clinical recommendations. Qualitatively, this integration highlighted the significance of foundational knowledge, metaphors, and analogies.

"...definitely a better grasp and understanding of the concept." (Tim-FG 1)

"I always found it really hard to do, but I think that just like going through this experience helps me kind of better understand, like just the new analogies that I can use and hopefully make more sense to patients." (Beth-FG 2)

"...an organized place to start" (Jill-FG 2)

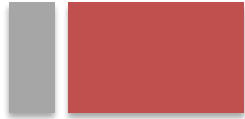
"...those metaphors made it really easy. And just like a good place to reference back to." (Stephanie-FG 4)

"...how much external factors really come into play with pain, their lifestyle or the stresses outside of that heavily influenced that it is very multifactorial." (Gretchen-FG 4)

Tim from FG 1 further expanded on the simulation and why knowledge alone may not suffice, saying:

"I feel like we learned a lot about pain science in school, but I don't think I necessarily recognized their relevance of the different components of science when we were learning them."

Quantitatively, attitudes and beliefs shifted towards a biopsychosocial perspective focused on ability, leading to more appropriate clinical recommendations. Qualitatively, Dan from FG 2 offered insight into this shift, emphasizing the focus on progress:



"...focusing more on what are you able to do more now than you were able to do yesterday?"

Qualitative data further elaborated on participants' high quantitative SET-M scores. Consistent with these scores, they reported a perceived increase in self-confidence. This boost in self-confidence extended to their communication skills and their ability to educate others about pain science concepts.

"...gave me even the confidence to be able to talk to someone so that I can be able to like verbalize better" (Kyle-FG 3)

Finally, SET-M measures participants' self-reflection on learning and ability to transfer knowledge to real-world situations. The simulation experience encouraged them to consider how they would apply PNE with actual patients in the future. Additionally, participants recognized the need to practice if they intended to incorporate PNE into their future practice.

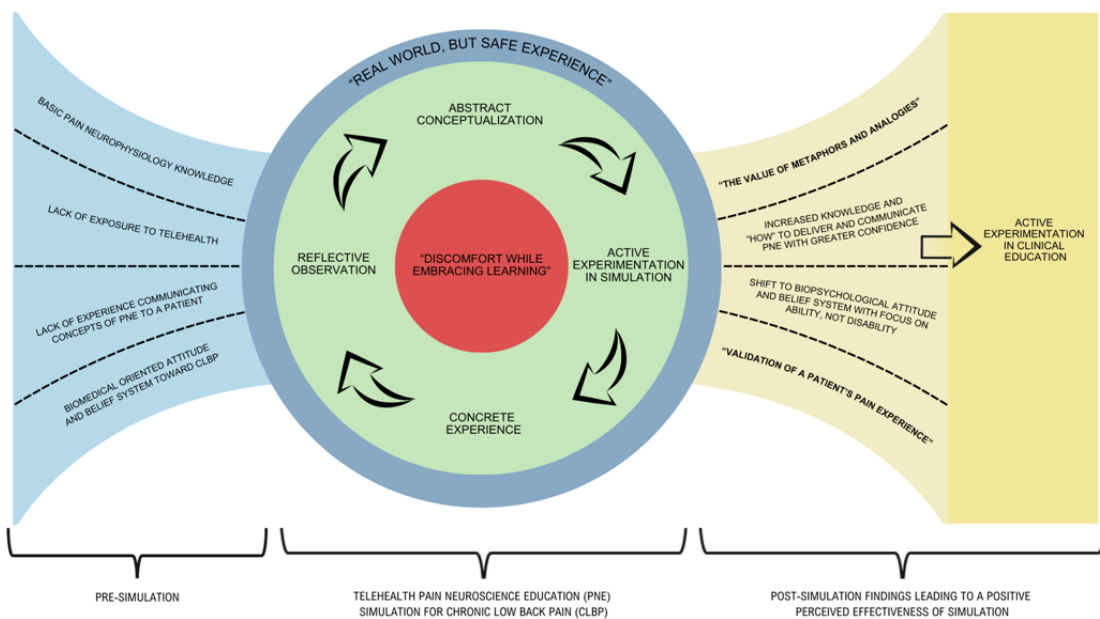
"...an eye opener for me to like practice."

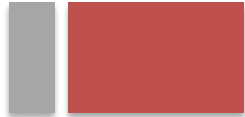
"...it was cool to like, see the whole scene unfold and just kind of the education be provided in a different way." (Tim, FG 1)

Meta Inference

A meta-inference is where overall conclusions are drawn by integrating insights from both quantitative and qualitative inferences (see Figure 2). Before the simulation, the participants received basic pain neurophysiology knowledge through the curriculum. Participants displayed an enhanced focus of a more biomedical perspective on CLBP based on the current curriculum design while also reporting a need for more experience with telehealth and communication of PNE concepts. They reported possessing the knowledge but needed to feel more confident communicating these concepts to an actual patient. Consistent with experiential learning, the telehealth PNE simulation for a patient with CLBP was a concrete experience for the participants, which they reported as a safe but realistic environment for learning. Despite this safety, participants reported discomfort through the process of the experience, reflective observation, and abstract conceptualization, which are all components consistent with Kolb's ELT (Kolb, 1984).

Figure 2
Meta Inference





Overall, participants reported that the simulation was effective and resulted in a high self-perception of learning and self-confidence, which then can be transferred to the context of the real-world via active experimentation. Post-simulation outcomes include both quantitative and qualitative aspects. For example, students gained knowledge in pain neurophysiology and how to confidently communicate these concepts to patients, noting that metaphors and analogies were beneficial tools. Participants conceptualized the importance of validating a patient's pain experience and the complexity of CLBP. A shift to a more biopsychosocial attitude and belief perspective can be a beneficial approach to focusing on the ability of an individual rather than disability and perhaps can impact the choice of interventions in future clinical practice.

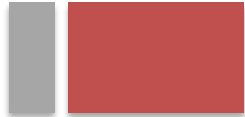
Discussion, Conclusion and Recommendations

Discussion

The overall mean of RNPQ scores, both pre-test (41%) and post-test (50%), were lower than those reported in physical therapy curricula outside the United States, yet similar to a study by Cox and Puentedura (2017) conducted within the United States (Adillón et al., 2015; Alodaibi et al., 2018; Marques et al., 2016). Overall, accreditation guidelines and varying approaches to integrating modern pain science into entry-level DPT curricula limit direct comparisons among programs. Gains on the RNPQ were statistically significant, but modest in effect size, suggesting minimal impact by the simulation itself. Due to prior curricular exposure, participants may have already been introduced to PNE concepts through previous coursework, limiting the degree of additional learning a single simulation exposure could provide. In other words, a ceiling effect may have influenced the results if students entered the simulation with relatively high baseline knowledge due to prior curricular exposure or preparatory activities, leaving limited room for measurable improvement and contributing to the small observed effect size. Finally, it is important to note that exclusion criteria related to prior exposure to PNE concepts outside the curriculum was based on self-report. While this approach was practical, it may have influenced the overall results.

More importantly, the primary objective of this simulation was to communicate and implement PNE, which may explain the modest gains on the RNPQ compared to previous studies. Although instructors ask students to recall and understand pain science concepts on exams, they only sometimes require them to actively communicate these topics with patients. Debriefing in a simulation is critical to improving reflective practice, in which knowledge is derived from grasping and transforming the experience (Kolb, 1984; Smith & Crocker, 2017). For example, Ohtake, Lazarus, Schillo, and Rosen (2013) compared knowledge gains after simulation, in-class debriefing, in-class discussions with a research essay, and in-class discussions only in the critical care environment. Simulation with debriefing resulted in the most effective mode for knowledge retention. Additionally, students reported increased confidence and communication ability after participating in experiential learning (Smith & Crocker, 2017). During debriefing, participants emphasized the significance of metaphors and analogies in delivering PNE to patients in an accessible manner. These metaphors can facilitate new avenues of understanding (Guilherme & Souza de Freitas, 2018). Therefore, these outcomes highlight the value of integrating qualitative data to provide deeper insight into the student learning experience.

As measured by the HC-PAIRS, attitudes and beliefs regarding CLBP significantly shifted toward a more biopsychosocial perspective, albeit modest in effect size. Participants' perspectives on CLBP may have been shaped by the broader curriculum, with the simulation providing an opportunity to apply and communicate pain neuroscience concepts. As with knowledge gains, changes in attitudes and beliefs may reflect cumulative educational exposure, rather than the simulation alone. However, qualitatively, participants expanded on attitudes and beliefs, stating the importance of validating a patient's pain and the complex and multidimensional nature of pain. The importance of this expansive conceptualization is that it reiterates what current literature has found about physical therapists struggling to address chronic MSK pain and following CPGs (Foster et al., 2018; Louw et al., 2017). Practicing physical therapists have reported feeling ill-prepared to provide the biopsychosocial aspects of PNE due to a lack of knowledge, confidence, and time constraints



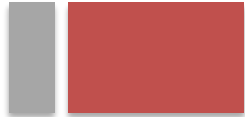
(Holopainen et al., 2020). However, these same clinicians reported increased confidence and improved communication skills after training (Holopainen et al., 2020). In DPT curricula, Helms, Mayhew, and Zimney (2021) explored active learning activities in a pain science curriculum. The researchers investigated its impact on practical outcomes, attitudes, beliefs, and confidence. The outcomes were measured pre- and post an 8-week curriculum. Similar to this study, improved morale and communication of concepts was found. Qualitative findings further highlighted how the simulation enhanced knowledge, application, and communication.

A weak positive correlation between the RNPQ and HC-PAIRS was found, indicating that greater knowledge of pain neurophysiology was linked to attitudes and beliefs about CLBP and disability, consistent with findings in first-year physiotherapy students (Springer et al., 2018). This simulation occurred before students completed two 12-week clinical experiences. Clinical practice, not just theoretical knowledge, is crucial for student learning, as real-world interactions expose them to diverse patient experiences. Clinical experiences also shape students' attitudes toward specific pathologies. For example, a two-week experience significantly improved the attitudes of medical interns specializing in psychiatry (Hemanthjumar et al., 2017). Similarly, Houben et al. (2005) found that physical therapy students improved biopsychosocial scores after clinical experiences. Therefore, the weak correlation may reflect the limitations of a single simulation experience, which might not fully capture participants' attitudes and beliefs following clinical experiences or over the long term.

Consistent with other quantitative findings, overall clinical vignette scores and most individual question outcomes improved post-simulation, though with modest effect sizes. Notably, two question outcomes declined. Improvements were primarily seen in recommending activities within the patient's tolerance. The modest effect sizes in clinical vignette improvements may reflect prior curricular exposure, limiting the simulation's additional impact. The decline in two question outcomes could stem from variability in student interpretation, cognitive overload during the simulation, or a shift in clinical reasoning that was not fully aligned with assessment criteria. Additionally, the simulation may have emphasized broader patient-centered communication, influencing certain recommendations more than others.

However, quantitative findings are consistent with Theme 4, which focused on ability rather than disability. This shift to "ability" is positive and consistent with CPGs for CLBP, including PNE as an intervention (George et al., 2021). Additionally, Leysen et al. (2021) reported that students recommended more guideline-adherent interventions in physical therapy as their beliefs shifted to a more biopsychosocial perspective. Further, the correlation between the RNPQ and overall clinical vignette scores was significant and positive, meaning as knowledge improved, the choice of appropriate recommendation improved. This finding is unsurprising, as PNE emphasizes the benefits of movement and exercise, which align with the clinical vignette and appropriate recommendations for CLBP (George et al., 2021; Moseley & Butler, 2015). Finally, questions in the clinical vignette are not solely knowledge-based but directed more toward application, which active learning, such as simulation, promotes. Simulation promotes content application and retention, which may have contributed to this finding (Pritchard et al., 2016).

In line with emerging work on simulation, participants had a high perception of effectiveness and improved self-confidence post-PNE simulation (Smith & Crocker, 2017). Both the replication of real-world processes and psychological fidelity contribute to overall satisfaction with the simulation, including the use of a standardized patient. However, simulations and the use of standardized patients have been shown to induce anxiety and stress, as reflected in Theme 1 (Pritchard et al., 2016). Yet, these emotions are common in experiential learning and lead to reflective observation and active experimentation (Kolb, 1984). Participants reflected on the need to practice communication with an actual patient, consistent with experiential learning and interacting with standardized patients. In a systematic review, Pritchard et al. (2016) stated students considered standardized simulation patients valuable for improving confidence and clinical skills. Participants in this study noted how beneficial it was to practice PNE and telehealth with a "real person" or in a "real world" scenario, which again expands upon the high SET-M scores. This outcome is consistent with research that suggests students desire more active or practice-based learning (Helms et al., 2021). Helms, Mayhew,



and Zimney (2021) reported the value of introducing active learning in a pain education curriculum from a qualitative perspective, stating, "It was good to practice speaking about topics without having to worry about messing it up in front of a real patient."

Finally, healthcare students report a shift in their perspectives on telehealth after participating in a simulation. They noted increased knowledge, improved attitudes, and recognized its value, particularly for patient check-ins. Exposure to this model generally boosts confidence and prepares students for patient communication and interactions (Randall et al., 2016; Serwe et al., 2020). Overall, active or experiential learning methods, such as simulation, effectively engage students and enhance their knowledge of pain neurophysiology, attitudes, beliefs, confidence, and communication skills.

Limitations

The sample size exceeded initial estimates, increasing the likelihood of detecting statistically significant results. While a larger sample from three campuses within the same institution enhances representation and generalizability, concerns of an overpowered study remain. Despite the small effect size, even modest improvements in complex educational settings can have meaningful cumulative impacts on learning. These findings support the feasibility of integrating this approach into DPT curricula and provide a foundation for future research.

Variability in faculty expertise, clinical experience, and curriculum delivery may have influenced participants' foundational knowledge of modern pain science concepts. Additionally, controlling exposure to general content, such as podcasts or discussions on PNE during DPT enrollment, is challenging and may have impacted outcomes. For most students, this simulation was their first telehealth experience with a standardized patient, potentially influencing results. Clinical vignettes served as a proxy for clinical behavior rather than the gold standard of direct observation in randomized controlled trials (RCTs). While RCTs typically include a control group, they are not always ideal for educational research as they fail to reflect real-world conditions, where the context and outcomes often involve complex, multifaceted variables that are difficult to standardize or control (Sullivan, 2011).

Outcome measures were collected in the short term after a single pedagogical intervention and at the curriculum's conclusion, potentially contributing to a ceiling effect on clinical vignette scores. Since data collection occurred during the final term of their didactic coursework and simulation preparatory activities, this timing may have further influenced the results. Longitudinal studies could offer deeper insights into sustained learning outcomes. Finally, while qualitative research is inherently interpretive, several steps were taken to enhance trustworthiness and rigor. However, the data were analyzed collaboratively rather than independently by two authors.

Conclusion and Recommendations

This study demonstrates that a single telehealth simulation focusing on PNE for CLBP has a possible and potential immediate but possible only a small influence on some areas of knowledge, attitudes, and beliefs, and supports appropriate clinical recommendations, though its longer-term usage, target participants, and impact needs further research. It serves as a viable and complementary pedagogical strategy within a DPT curriculum, fostering the communication skills essential for clinical practice and patient-centered care. However, although statistically significant improvements were observed, effect sizes were small, indicating that while the simulation contributed to changes in knowledge, attitudes, beliefs, and recommendations, the overall impact was modest. These findings highlight the greater value of qualitative insights, which offer a deeper understanding of how students engage with and process the learning experience and warrant further research.

Incorporating qualitative and integrative components in this study provided a richer perspective on the impact of simulation from the learner's viewpoint. Mixed-methods research offers a nuanced understanding of the



"how" and "why" behind simulation outcomes, revealing aspects of participant experiences that quantitative data alone cannot capture. These insights can shape and enhance educational practices for excellence in physical therapy education. Advancing learning sciences and educational research remains crucial for the profession, contributing to ongoing exploration in this critical area. This study also establishes a foundation for replicating the pedagogical approach while adhering to best practices for simulation.

Future research should explore implementation across diverse delivery models and curricula in DPT education to improve generalizability. Including a control group in future studies could further strengthen study design and provide a clearer understanding of the intervention's effectiveness. Additionally, comparing PNE delivered via telehealth versus in-person could offer valuable insights into the relative impact of different simulation formats. Examining longitudinal and long-term outcomes would help assess content retention, while developing a more specific clinical vignette for PNE research and simulations could enhance applicability and impact.

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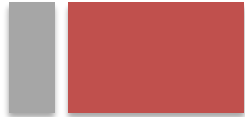
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Ethics Statement:

This study was approved by institutional review board (IRB) and all participants completed an informed consent for data release and participation in focus group interviews.

Conflict of Interest:

The authors declare that there is no conflict of interest regarding the publication of this article.



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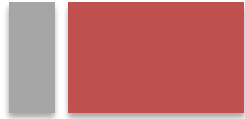
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The Digital Evolution of the Research Ecosystem: A Strategic Analysis of Ankara University's Research Capacity and Performance via Collaborative Networks

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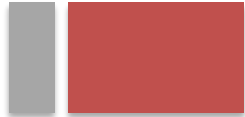
Abstract

Understanding how collaboration networks and digital infrastructures shape institutional research capacity has become a central concern in higher education research. Universities increasingly rely on integrated digital systems to enhance academic productivity, international visibility, and research performance within competitive global environments. In this context, the research capacity of Ankara University is examined through a multi-dimensional analytical framework incorporating collaboration platforms, bibliometric evaluation tools, laboratory management systems, and academic writing support mechanisms. Drawing on a descriptive and data-driven analytical approach, the study evaluates institutional performance using indicators related to publication output, citation impact, collaboration patterns, research infrastructure utilization, and project participation. The findings reveal a consistent increase in research performance, reflected in higher publication visibility, improved citation metrics, and expanded engagement in national and international funding programs. At the same time, the results indicate uneven adoption of digital systems and significant variation in research capacity across disciplines and academic units. The analysis further demonstrates that digital research infrastructures contribute to improved coordination, access to collaboration opportunities, and output quality; however, their effectiveness depends on institutional integration and user engagement. Structural constraints, including disparities in human resources and limited industry collaboration, continue to shape research outcomes and highlight gaps between knowledge production and its practical application. Overall, the findings suggest that strengthening institutional research capacity requires a holistic strategy that integrates technological systems, organizational practices, and collaboration networks. Enhancing user engagement, supporting balanced capacity development across academic units, and fostering stronger links between academia and industry are essential for achieving sustainable improvements in research performance and global competitiveness.

Keywords: *Research Capacity, Collaboration Networks, Academic Productivity, Digital Tools, Strategic Development*

Introduction

The research capacity of universities is now evaluated not solely through individual academic productivity, but also through the quality of collaboration networks among researchers, the effectiveness of digital research infrastructures, and the sustainability of institutional research ecosystems. The acceleration of digitalization, the increasingly data-driven nature of research processes, and the transformation of scientific problems into an interdisciplinary structure have moved higher education institutions away from the traditional individual research model and positioned network-based, collaborative research structures at the center of academic activity. Wuchty et al. (2007) and Abbasi et al. (2011) demonstrated that collaboration networks play a decisive role in research performance when solving large-scale research problems, while Petersen (2015) emphasized that a researcher's central position within a network enhances visibility and citation impact. Similarly, Hsieh et al. (2018) noted that collaboration networks strengthen academic productivity not only through direct partnerships but also through indirect connections within the network. With the proliferation of digital research platforms in recent years, research ecosystems have begun to be reshaped through interactions among researchers, universities, technological infrastructures, and data management systems (Neborsky, 2021; Zakirova, 2022). However, a significant portion of the existing literature focuses either on



global-scale research networks or on Western-centric university systems, leaving the structural and strategic dynamics of digital research ecosystems in large public universities in developing countries underexplored. This situation necessitates a holistic analysis of the research capacity of established and comprehensive higher education institutions such as Ankara University within the context of collaboration networks and digital transformation.

The Paradigm Shift from Individual Scholarship to Networked Science

A growing body of literature demonstrates that research performance is not solely an individual attribute but is profoundly shaped by structural, relational, and contextual factors. The shift towards big team science, the escalating complexity of contemporary research questions, and the substantial costs of advanced scientific infrastructure have rendered collaboration not merely beneficial but essential (Wuchty et al., 2007; Abbasi et al., 2011). As analysis of global academic systems becomes more sophisticated, collaboration networks function as essential analytical constructs for examining knowledge flow and the distribution of reputational advantage. The influence of these networks begins at the level of the individual researcher, where structural configuration significantly impacts publication visibility and citation performance. In this regard, Petersen (2015) introduced the concept of network-mediated reputation overflow, demonstrating that a researcher's centrality within a network facilitates increased citation impact. This enhanced visibility occurs through both direct association with influential collaborators and embeddedness within productive networks. Similarly, Abbasi et al. (2011) used correlation and regression analyses to demonstrate that co-authorship networks significantly affect productivity, particularly through the roles played by advisors and professional peers. Hsieh et al. (2018) further emphasized the presence of spillover effects, where the benefits of collaboration extend beyond direct partnerships to indirectly benefit all members within a connected cluster. Consequently, academic performance is not determined exclusively by individual merit but is co-constructed within interconnected, relational environments.

The Strategic Balance Between Local and International Collaborations

The strategic value of a university's collaborative portfolio depends critically on the balance between local and international partnerships. Local clusters can foster dense, trust-based relationships efficient for knowledge sharing, yet evidence suggests they may also lead to intellectual lock-in and reduced novelty. International collaborations, while more costly to coordinate, provide access to diverse knowledge bases, cutting-edge methodologies, and prestigious funding streams. In a detailed analysis of Indian biotechnology research, Mondal et al. (2021) found a predominance of local collaboration networks but simultaneously emphasized the necessity of expanding international ties to strengthen long-term scientific capacity. Complementing this view, Wang and Zhang (2019) argued that the impact of international collaborations on research quality can vary significantly across disciplines, suggesting that a one-size-fits-all strategy is ineffective. These findings collectively lead to a nuanced conclusion for an institution like Ankara University: it is not merely the extent of collaboration that matters, but the qualitative diversity of its overall collaborative portfolio.

Organizational, Socio-Psychological, and Technological Dynamics

Beyond structural positioning, research has moved toward understanding networks as lived, relational environments where socio-psychological dynamics exert measurable influence. Individuals occupying central positions within social networks tend to achieve higher academic outcomes, partly due to stronger emotional ties, trust, and reciprocity. Marqués-Sánchez et al. (2020) demonstrated that these relational dimensions introduce critical factors often overlooked in purely quantitative assessments of research capacity. The role of digital technologies in facilitating these dynamics has become increasingly prominent, as the COVID-19 pandemic radically altered collaboration patterns by forcing a rapid reliance on digital platforms. This global disruption accelerated the transition toward digitally mediated research ecosystems, where technological infrastructures play a central role in enabling sustained academic interaction and productivity (Damaševičius, 2023). From a policy perspective, international frameworks increasingly promote collaborative research as a



means to address complex scientific challenges, underscoring institutional responsibility to provide supportive environments including adequate funding and robust digital infrastructure (Toney & Flagg, 2021). Therefore, the development of collaboration networks must be a strategic priority, not an incidental outcome, for any university aiming to improve its global standing.

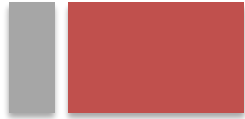
A Holistic, Network-Oriented Strategic Analysis

A critical gap remains despite the robust evidence correlating collaboration with performance. Most existing studies examine these dynamics at a global or disciplinary level, or within the context of well-established research universities in Western Europe and North America. There is a pressing need for in-depth, institution-specific strategic analyses that examine how these abstract network principles manifest in complex, resource-constrained environments, particularly in emerging economies. The concept of the digital ecosystem provides a valuable analytical framework for addressing this gap. As a digital counterpart to biological ecosystems, a university's digital ecosystem consists of multiple independent entities including individuals, organizations, services, and software that perform interrelated tasks focused on interaction and connectivity (Zakirova, 2022). Neborsky (2021) further structures this ecosystem into seven core components: digital environment including technical infrastructure, interaction participants or stakeholders, the system of connections between participants, participant engagement, digitally reflected university functions, ideas and values regarding digital technologies, and digital productivity and adequacy. When applied to research capacity, this framework reveals that performance cannot be reduced to individual productivity or physical infrastructure alone. Instead, research capacity depends on the quality of interaction among multiple actors including researchers, administrative units, technology parks, partner universities, and industry collaborators.

The effectiveness of digital platforms facilitating this interaction, the level of stakeholder commitment to digital processes, and the institution's data-driven decision-making mechanisms all play determinative roles (Rosak-Szyrocka, 2024; Zhao & Yang, 2024). The digital transformation of research ecosystems has been further accelerated by the emergence of advanced professional services. Research activities are becoming increasingly systematic and data-driven through digital software and platforms that support data collection, visualization, statistical analysis, and manuscript writing (Brunetti et al., 2023). While these tools significantly enhance measurable productivity and quality, they also introduce the risk of mass science, where standardized, algorithm-driven outputs may constrain scientific creativity and originality. Consequently, institutions must maintain a delicate strategic balance between technological automation and the preservation of genuine intellectual innovation.

The specific challenges facing universities in this transformation are multifaceted. Deficiencies in technological infrastructure, budget constraints, lack of strategic planning, and organizational misalignment constitute six major categories of barriers. From a human resource perspective, academic staff often exhibit fear of abandoning existing pedagogical habits and concerns about job security, creating powerful cultural barriers (Aditya et al., 2021). These obstacles are further complicated by regional disparities in hardware availability and insufficient coordination with external stakeholders. In this context, digital leadership emerges as a critical success factor. A growing body of research indicates that digital leaders play a vital role in building a digital culture, breaking resistance to change, and establishing a collaborative climate, going far beyond merely managing technological innovations (Onan, 2024; Anwar & Sarah, 2024). It has been widely acknowledged that without this leadership dimension, technological investments are unlikely to yield expected returns when institutional culture and human factors are neglected (Neborsky, 2021). These findings collectively suggest that successful digital transformation in higher education depends on both technical and human-centered leadership strategies.

The future evolution of higher education points toward University 5.0, a concept that moves beyond merely responding to Industry 4.0 dynamics. This new model centers on collective well-being and emotional intelligence, integrating open-source platforms and low-tech, environmentally friendly solutions as alternatives to capitalist data monopolies (Rosak-Szyrocka, 2024; Fitzpatrick et al., 2025). The philosophical challenge for universities is to build a smart education model that respects the planet's ecological limits while



upholding human dignity. Within this broader context, collaborative networks function as the operational infrastructure through which research capacity is built, sustained, and enhanced. However, institutional transformation of this magnitude requires more than technological investment; it demands strategic leadership, digital maturity, cultural change, and continuous learning. The interaction among multiple actors across university, industry, and government sectors must be elevated in quality, supported by effective digital platforms, and managed through strategic network positioning.

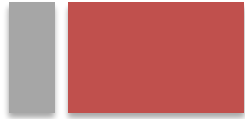
Given these theoretical and empirical considerations, the analysis of research capacity and the impact of collaboration networks on academic performance has emerged as a critical and increasingly complex domain within contemporary higher education research. The interaction between collaboration networks and academic output constitutes a foundational dimension for explaining how researchers and institutions can strategically enhance their visibility, impact, and overall research effectiveness. The present body of literature provides a comprehensive framework for interpreting how both structural and relational aspects of collaboration networks shape academic outcomes. Collaboration networks function as essential analytical constructs for examining the dynamics of academic productivity, offering insights into how knowledge flows, reputational advantages, and resource accessibility are distributed across scientific communities. The structural configuration of these networks significantly influences publication visibility and citation performance, yet the role of digitally mediated research management tools, the relative contribution of different network dimensions, and the specific institutional challenges facing large comprehensive universities remain underexplored.

Research Purpose and Questions

In light of the theoretical and empirical considerations outlined above, this study aims to address this gap by conducting a strategic analysis of a specific institution: Ankara University. The primary purpose of this research is to investigate the digital evolution of Ankara University's research ecosystem by analyzing the influence of its collaborative networks on its overall research capacity and academic performance. The study seeks to move beyond simple bibliometric counts to understand how structural, relational, and technological dimensions of collaboration interact to shape the university's scholarly output and international competitiveness.

To achieve this purpose and to provide a structured framework for investigation, the study is guided by the following research questions:

1. How do collaboration networks influence the research capacity and academic performance of Ankara University?
2. What is the role of digitally mediated research management tools in shaping collaboration patterns and research outputs?
3. To what extent do the structural, relational, and technological dimensions of collaboration networks contribute to institutional research performance?
4. What are the key challenges and limitations affecting the effective utilization of collaboration networks within the institutional context of Ankara University?
5. What strategic interventions can be developed to enhance sustainable research capacity and international competitiveness through collaboration networks?



Method

Research Design

This study employed a convergent parallel mixed-methods design (Creswell & Plano Clark, 2018), in which quantitative and qualitative data were collected concurrently, analyzed separately, and subsequently integrated during the interpretation phase. This design was selected to capture both the measurable dimensions of institutional research capacity (e.g., publication metrics, system usage rates) and the experiential, contextual factors (e.g., user perceptions, barriers, facilitators) that shape the effectiveness of digital research infrastructures.

Quantitative data were obtained from four primary sources: (a) SCIVAL bibliometric database, (b) LABSIS virtual laboratory management system, (c) Crowdhelix collaboration platform usage logs, and (d) institutional performance databases (TÜBİTAK project records, publication archives). Qualitative data were collected through semi-structured interviews (n = 12), one focus group discussion (n = 8), open-ended survey questions (n = 70), and document analysis (n = 17 documents). Integration of the two data strands was achieved using a joint display matrix (Guetterman et al., 2015), which allowed systematic comparison, identification of convergence/divergence, and generation of meta-inferences.

Materials and Data Collection Instruments

Quantitative Data Sources

SCIVAL (Elsevier). SCIVAL was used to retrieve Scopus-indexed publication data for Ankara University over a five-year period (2019–2023). Key performance indicators included Field-Weighted Citation Impact (FWCI), h-index, publication volume, and collaboration metrics (national vs. international co-authorships). Benchmarking analyses compared the university's performance with national and international peer institutions.

LABSIS. The LABSIS system provided automated logs on laboratory device usage, reservation frequency, user demographics (n = 169 unique users), equipment status, and financial tracking data across 10 registered laboratories and 276 devices.

Crowdhelix Platform. Crowdhelix usage metrics included number of registered users (n = 263), number of partner search announcements disseminated (n = 11), project applications submitted (n = 6), and partnership declarations (n = 6).

Institutional Databases. TÜBİTAK project records and postgraduate thesis completion data (n = 4,887 theses over five years) were obtained from Ankara University's Research Projects Support Office and Graduate School archives.

Qualitative Data Collection Instruments

Semi-Structured Interview Protocol (Crowdhelix). An interview guide was developed based on the theoretical framework of network-mediated reputation overflow (Petersen, 2015) and technology acceptance models (Davis, 1989). The guide included 12 open-ended questions exploring perceived barriers, facilitators, platform utility, and the role of digital collaboration tools in forming international research partnerships. Interviews lasted 35–50 minutes and were conducted via video conferencing.

Focus Group Protocol (LABSIS). A semi-structured focus group guide was designed to evaluate LABSIS usability, effect on collaborative workflows, and user satisfaction. The guide included six prompt questions addressing system strengths, limitations, training adequacy, and suggestions for improvement. The session lasted 90 minutes and was moderated by a researcher not involved in system administration.

Open-Ended Questionnaire (TRADOS Writing Support). A web-based questionnaire (Google Forms) was distributed to 70 researchers who had received language compliance certificates from the Scientific Writing and Article Support Unit. The questionnaire contained two core open-ended questions: (a) “How did the language support system affect your manuscript submission process?” and (b) “What improvements would you suggest?” Demographic information (faculty, academic position, number of submissions) was also collected.

Document Analysis Materials. Seventeen documents were analyzed, comprising 11 Horizon Europe partner search announcements and 6 partnership declarations submitted via CrowdHelix. These documents were examined to identify strategic collaboration priorities, thematic focus areas, and the nature of proposed partnerships.

Procedure

Data collection and analysis followed a concurrent timeline over a six-month period (January–June 2023).

Quantitative Data Collection. SCIVAL data were extracted using institutional subscription credentials, applying filters for Ankara University-affiliated publications (2019–2023). LABSIS and CrowdHelix logs were exported as CSV files from system dashboards. Institutional databases were accessed through the Rectorate’s Research Coordination Unit, with anonymized aggregate data provided for analysis.

Qualitative Data Collection. Semi-structured interviews (n = 12) were conducted with CrowdHelix users selected via maximum variation sampling based on publication performance (high/low FWCI) and platform engagement level (active/low). Participants were recruited through institutional email invitations. All interviews were audio-recorded with informed consent. The focus group (n = 8) included four principal investigators, two laboratory managers, and two PhD students who had used LABSIS for at least three months. The open-ended questionnaire was distributed via institutional email to all 70 researchers who had received a language compliance certificate in the preceding 12 months; 54 completed responses were returned (response rate: 77.1%). Document analysis was performed on publicly available partner search announcements archived within the CrowdHelix platform.

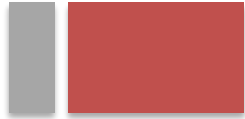
Data Analysis

Quantitative Data Analysis

Quantitative data were analyzed using descriptive statistics (frequencies, percentages, means) and comparative metrics (FWCI, h-index). SCIVAL data were processed using the platform’s built-in analytical modules. LABSIS and CrowdHelix logs were analyzed using Microsoft Excel and SPSS (version 26). Institutional publication and project data were analyzed to calculate publication conversion rates (thesis-to-publication ratio: 26.35%). Simulation-based ranking predictions were performed using linear regression to assess predictive validity.

Qualitative Data Analysis

Thematic Analysis (Interviews & Focus Group). Interview and focus group transcripts were analyzed using inductive thematic analysis (Braun & Clarke, 2006) with NVivo (version 14). The analysis followed six phases: (a) familiarization with data, (b) generating initial codes, (c) searching for themes, (d) reviewing themes, (e) defining and naming themes, and (f) producing the report. Two researchers independently coded 20% of the transcripts to calculate inter-coder reliability (Cohen’s $\kappa = 0.84$), indicating strong agreement.



Content Analysis (Open-Ended Questionnaire). Responses to open-ended questions were analyzed using conventional content analysis (Hsieh & Shannon, 2005). Two coders independently identified meaning units, condensed them, and assigned codes. Codes were then grouped into categories, and categories were abstracted into themes. Disagreements were resolved through consensus.

Document Analysis. The 17 partnership documents were analyzed using directed content analysis (Hsieh & Shannon, 2005), guided by predefined categories derived from the Horizon Europe work program themes (e.g., Cluster 6, Cancer Mission, Water4All, Sustainable Blue Economy). Each document was coded for thematic focus, partner types, and stated collaboration objectives.

Mixed-Methods Integration

Integration of quantitative and qualitative findings was achieved through a joint display matrix (Guetterman et al., 2015). Quantitative indicators (e.g., publication counts, FWCI, system usage rates) were placed alongside corresponding qualitative themes (e.g., user-perceived barriers, facilitators). The matrix allowed systematic comparison to identify:

- *Convergence:* where both data types supported the same conclusion;
- *Divergence:* where findings contradicted or complemented each other;
- *Complementarity:* where each data type provided unique insights into different aspects of the same phenomenon.

Meta-inferences were then generated by interpreting the integrated results within the theoretical framework of collaboration networks and digital research infrastructure.

Results

The findings of this study are organized according to the five research questions that guided the convergent parallel mixed-methods design. Quantitative findings from SCIVAL, LABSIS, Crowdhelix, and institutional databases are presented alongside qualitative themes derived from semi-structured interviews (n=12), focus group (n=8), open-ended questionnaires (n=70), and document analysis (n=17). Integration of quantitative and qualitative strands is presented through joint display matrices to identify convergence, divergence, and complementarity across data sources.

Research Question 1: How do collaboration networks influence the research capacity and academic performance of Ankara University?

Quantitative Findings

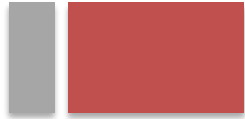
Findings related to Crowdhelix platform adoption and international collaboration network engagement are presented below in Table 1.

Table 1

Crowdhelix Platform Usage and International Collaboration Indicators

Indicator	Value
Registered users (institutional email)	263
Partner search announcements disseminated	11
Completed project outcomes shared	1

Table 1 continuee...



Indicator	Value
Horizon Europe Cluster 6 applications	1
Horizon Europe Cancer Mission applications	1
Strengthening ERA initiative applications	1
European Partnership applications (Water4All, SBEP)	2
Partnership declarations submitted	6

As shown in Table 1, a total of 263 researchers from Ankara University registered on the CrowdHelix platform using institutional email addresses. This number indicates a moderate level of initial adoption within the academic community. However, only 11 partner search announcements were disseminated and only 6 partnership declarations were submitted. This finding suggests that active platform utilization for collaboration purposes remains limited relative to the number of registered users. Specifically, while 263 individuals created accounts, the average number of collaboration actions per user was 0.07, indicating that registration alone does not translate into active engagement. Furthermore, five project applications were submitted across various Horizon Europe calls, all of which remained under consortium-level evaluation at the time of analysis. These quantitative indicators suggest that while the platform successfully lowered the barrier to initial registration, it has not yet been fully integrated into researchers' regular collaboration workflows.

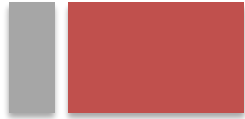
Findings related to SCIVAL-based bibliometric indicators of institutional research performance over a five-year period are presented below in Table 2.

Table 2

Five-Year Research Performance Indicators (2019–2023)

Indicator	Value
Total postgraduate theses completed	4,887
Publication conversion rate (thesis to publication)	26.35%
TÜBİTAK 1001 project ranking (2023) – Overall	3rd
TÜBİTAK 1001 project ranking (2023) – State universities	2nd
Predicted ranking range (simulation)	11–13
Actual ranking	9th

As presented in Table 2, the simulation-based predicted ranking range of 11–13 aligned closely with the actual institutional ranking of 9th. This finding demonstrates strong predictive accuracy of the data-driven institutional evaluation model, with an error margin of only two positions. The narrow gap between predicted and actual rankings (ranging from 0 to 4 positions) suggests that the simulation model



captured the key performance drivers effectively. Additionally, Ankara University ranked 3rd overall and 2nd among state universities in TÜBİTAK 1001 projects in 2023, indicating strong national research competitiveness. However, the overall publication conversion rate from postgraduate theses was 26.35%, meaning that approximately one in four theses resulted in a peer-reviewed publication. While this rate is comparable to national averages, it also points to substantial untapped research output potential.

Qualitative Findings

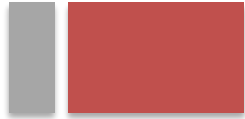
Findings related to user perceptions of collaboration networks, derived from thematic analysis of semi-structured interviews (n=12) with Crowdhelix users, are presented below in Table 3.

Table 3

Thematic Analysis Results: User Perceptions of Collaboration Networks

Theme	Description	Representative Quotation
Awareness and onboarding	Insufficient initial training and guidance	"I registered but never received guidance on how to find partners" (Interview, User 4)
Matching accuracy	Algorithm utility with niche limitations	"The suggested partners are often not aligned with my specific research niche" (Interview, User 7)
Sustained engagement	Declining usage without institutional reminders	"Without regular reminders from the university, I forgot the platform existed" (Interview, User 9)
Perceived value of international networks	Positive but underutilized resource	"When I found a partner, the quality was high, but finding them took too long" (Interview, User 11)

As shown in Table 3, four main themes emerged from the interview data. The first theme, "awareness and onboarding," revealed that many researchers registered on the platform but did not receive sufficient initial training or guidance on how to effectively use its features. This finding helps explain the quantitative observation of high registration but low active use. The second theme, "matching accuracy," indicated that while the platform's algorithmic partner suggestions were considered useful in principle, they often failed to align with researchers' highly specific disciplinary niches. Third, "sustained engagement" emerged as a critical barrier; participants consistently reported that without regular institutional reminders or integration into existing workflows, their usage declined rapidly after initial registration. Fourth, "perceived value of international networks" reflected a paradox: researchers acknowledged the potential value of international collaboration but found the process of identifying suitable partners too time-consuming relative to the perceived benefit. Collectively, these qualitative themes provide explanatory depth to the quantitative finding of moderate adoption but limited active engagement.



Research Question 2: What is the role of digitally mediated research management tools in shaping collaboration patterns and research outputs?

Quantitative Findings

Findings related to the utilization of the TRADOS-based academic writing and translation support system are presented below in Table 4.

Table 4

Academic Writing Support System Utilization and Publication Outcomes

Indicator	Value
Manuscripts undergoing grammatical revision	142
Successfully published manuscripts	68
Manuscripts under evaluation	74
Language compliance certificates issued	70
Response rate for open-ended questionnaire	77.1% (54/70)

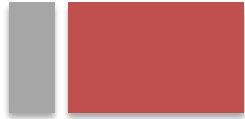
As presented in Table 4, a total of 142 manuscripts underwent grammatical revision through the TRADOS-based system. Of these, 68 (47.9%) were successfully published, while 74 (52.1%) remained under evaluation at the time of analysis. This relatively balanced distribution suggests that while the language support system contributes positively to the publication process, manuscript acceptance is not guaranteed and depends on factors beyond linguistic quality, such as scientific novelty, methodological rigor, and journal fit. Additionally, 70 language compliance certificates were issued upon request. The high response rate to the open-ended questionnaire (77.1%) indicates strong user engagement and willingness to provide feedback, reflecting the perceived relevance of the service among researchers who had utilized it.

Findings related to the distribution of writing support service utilization across academic units are presented below in Table 5.

Table 5

Concentration of Service Utilization by Faculty

Faculty	Level of Utilization
Faculty of Veterinary Medicine	High
Faculty of Pharmacy	High
Faculty of Dentistry	High
Other faculties	Low to Moderate



As shown in Table 5, service utilization is heavily concentrated within three specific faculties: Veterinary Medicine, Pharmacy, and Dentistry. These three faculties accounted for the majority of manuscript submissions to the writing support unit. In contrast, faculties in the social sciences, humanities, and educational sciences demonstrated substantially lower utilization rates. This disciplinary variation suggests that publication practices, particularly the pressure to publish in international indexed journals, differ significantly across fields. It may also indicate uneven awareness of the service across the university or differences in the perceived value of language support depending on disciplinary publication norms. This finding highlights the need for broader institutional integration and targeted outreach to low-utilization units.

Findings related to LABSIS virtual central laboratory utilization are presented below in Table 6.

Table 6

LABSIS Virtual Central Laboratory Utilization Indicators

Indicator	Value
Registered research laboratories	10
Integrated laboratory devices	276
Unique users (device reservation and service utilization)	169

As presented in Table 6, the LABSIS system integrated 276 laboratory devices across 10 registered research laboratories. A total of 169 unique users actively engaged with the system for device reservation and service utilization. This finding indicates initial operational adoption and demonstrates substantial technical infrastructure deployment. However, when compared to the total number of potential laboratory users across the university, 169 unique users represent a moderate penetration rate. The ratio of devices to users (approximately 1.6 devices per user) suggests that while a broad range of equipment is available, the user base has not yet reached full institutional scale. This quantitative pattern points to the need for continued user recruitment and onboarding efforts.

Qualitative Findings

Findings related to LABSIS usability and collaborative workflows, derived from thematic analysis of the focus group discussion (n=8), are presented below in Table 7.

Table 7

Thematic Analysis Results: LABSIS Usability and Collaborative Workflows

Theme	Description	Representative Quotation
Transparency and coordination	Real-time device availability reduces wasted time	"I no longer waste time checking lab availability in person" (Focus group, PI 2)
Learning curve	Initial complexity for multi-step procedures	"Booking a sequence of devices took me several attempts to figure out" (Focus group, PhD Student 1)



Table 7 continuee...

Uneven coverage	Only 10 of 20 eligible laboratories registered	"My main equipment is not in the system, so I still use paper booking" (Focus group, Lab Manager 1)
Financial tracking	Automated fee calculations valued	"The billing is clear, but I wish I could get monthly usage reports" (Focus group, PI 3)

As shown in Table 7, four themes emerged from the focus group analysis. The first theme, "transparency and coordination," revealed that users highly valued real-time visibility into device availability, which eliminated the need for in-person checks and reduced scheduling conflicts. This finding aligns with the quantitative observation that 169 users actively engaged with the system, suggesting that those who adopted it found clear operational benefits. The second theme, "learning curve," indicated that while the system was functional, users "particularly PhD students" found multi-step booking procedures initially difficult to navigate. Third, "uneven coverage" emerged as a major limitation: only 10 of approximately 20 eligible laboratories were registered in the system, meaning that researchers who needed equipment from non-registered labs could not benefit from the digital workflow. Fourth, "financial tracking" was positively received, with users appreciating automated fee calculations, although some requested more detailed usage reports. Collectively, these themes indicate that while LABSIS improves operational efficiency for registered users, its institutional impact remains constrained by incomplete laboratory coverage and usability barriers for complex tasks.

Findings related to researcher perceptions of the TRADOS writing support system, derived from content analysis of the open-ended questionnaire (n=54), are presented below in Table 8.

Table 8

Content Analysis Results: Researcher Perceptions of Writing Support System

Category	Frequency	Representative Quotation
Reduced journal	82%	"After receiving the language certificate, my manuscript
Lack of full	31%	"The system corrects grammar but does not help with
Expedited editorial	67%	"Journals processed my manuscript faster when I attached
Need for discipline-	24%	"The editor corrected grammar but changed technical

As presented in Table 8, the majority of respondents (82%) reported that the language support system reduced journal rejection rates due to language-related issues. This finding suggests that the system successfully addresses one of the primary barriers to international publication. Additionally, 67% of respondents indicated that obtaining a language compliance certificate expedited editorial processing, implying that journals perceive the certificate as a credible signal of linguistic quality. However, 31% of respondents expressed concerns about the lack of full translation services, noting that while grammatical errors were corrected, conceptual translation from Turkish to English—particularly for field-specific terminology—remained a challenge. Furthermore, 24% of respondents called for discipline-specific editors, reporting instances where generic language corrections inadvertently altered technical meanings. These qualitative findings provide important context for the quantitative observation that 74 manuscripts remained under evaluation; language support alone may not be sufficient when deeper conceptual or translational issues persist.



Research Question 3: To what extent do structural, relational, and technological dimensions of collaboration networks contribute to institutional research performance?

Joint Display Matrix (Integration of Quantitative and Qualitative Findings)

Findings related to the integration of quantitative and qualitative data across structural, relational, and technological dimensions are presented below in Table 9. This joint display matrix allows systematic comparison between data strands.

Table 9

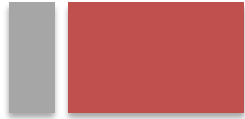
Joint Display Matrix: Structural, Relational, and Technological Dimensions

Dimension	Quantitative	Qualitative Theme	Integration
Structural	Publication	"Doctoral students produce more	Complementarity
	263 Crowdhelix	"I registered but never used it	Divergence
Relational	68 published / 142	"The language certificate helped,	Convergence
	Top 3 in	"Our successful projects come	Divergence
Technological	169 LABSIS	"LABSIS is good for scheduling,	Convergence
	70 language	"I received a certificate but still	Divergence

As shown in Table 9, the joint display reveals three types of integration across dimensions. *Complementarity* is observed in the structural dimension: the quantitative finding of a 26.35% publication conversion rate is complemented by qualitative explanations regarding differential productivity between doctoral and master's students, as well as supervision workload constraints. This complementarity allows researchers to understand not only the rate but also the mechanisms behind it.

Divergence is observed in multiple instances. First, while 263 researchers registered on Crowdhelix, qualitative data revealed that many registered but never used the platform due to lack of training, explaining the divergence between registration numbers and active engagement. Second, despite Ankara University's top-3 ranking in TÜBİTAK 1001 projects, interview data indicated that this success was driven by existing personal networks rather than platform-mediated matching, suggesting that quantitative performance does not necessarily reflect effective use of digital collaboration tools. Third, while 70 language certificates were issued, qualitative responses indicated that certificates did not eliminate the need for external translation services, revealing a gap between service output and user expectations.

Convergence is observed in the relational and technological dimensions regarding manuscript publication and LABSIS adoption. Both quantitative and qualitative data indicated that language support improves publication outcomes but does not fully resolve quality issues. Similarly, both data strands confirmed that LABSIS improves scheduling efficiency but suffers from incomplete institutional coverage. This convergence strengthens the validity of these findings, as they are supported by multiple independent data sources.



Research Question 4: What are the key challenges and limitations affecting the effective utilization of collaboration networks within the institutional context?

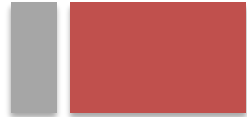
Findings related to the key challenges and limitations identified across both quantitative and qualitative data sources are presented below in Table 10.

Table 10

Challenges and Limitations in Collaboration Network Utilization

Challenge	Evidence Source	Specific Finding
Uneven disciplinary adoption	Quantitative (Table 5)	Three faculties (Veterinary Medicine, Pharmacy, Dentistry) account for majority of writing support usage
Incomplete system coverage	Qualitative (Table 7)	Only 10 of approximately 20 eligible laboratories registered in LABSIS
Training and onboarding gaps	Qualitative (Table 3)	"I registered but never received guidance on how to find partners" (Interview, User 4)
Limited industry collaboration	Quantitative	Proportion of industry-collaborative publications remains low relative to total output
Human resource constraints	Quantitative	Vocational schools and certain faculties lack sufficient doctoral-level academic staff
Translation service gap	Qualitative (Table 8)	31% of survey respondents cited lack of full translation services as a limitation
Low sustained engagement	Qualitative (Table 3)	Platform usage declines without regular institutional reminders

As presented in Table 10, the most frequently identified challenges cluster into three categories: adoption and coverage (uneven disciplinary adoption, incomplete laboratory coverage), training and support (onboarding gaps, low sustained engagement), and structural constraints (limited industry collaboration, human resource limitations, translation service gaps). Notably, the challenge of uneven disciplinary adoption was observed quantitatively (service utilization concentrated in three faculties) and was not contradicted by any qualitative finding. Similarly, incomplete LABSIS coverage was reported by multiple focus group participants, indicating that this is a widely experienced limitation rather than an isolated perception. The human resource constraint—limited doctoral-level staff in vocational schools—represents a structural factor that cannot be resolved through technological interventions alone, as research capacity is fundamentally dependent on qualified personnel. Taken together, these challenges suggest that effective utilization of collaboration networks requires not only technological infrastructure but also organizational support, training, and human capital development.



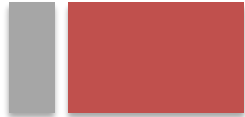
Research Question 5: What strategic interventions can be developed to enhance sustainable research capacity and international competitiveness through collaboration networks?

Findings related to strategic intervention recommendations, derived exclusively from qualitative data (interviews, focus group, and open-ended questionnaire responses), are presented below in Table 11. These recommendations represent user-generated suggestions for institutional improvement.

Table 11
Qualitatively Derived Strategic Interventions

Intervention Area	Suggested Action	Source
Training and onboarding	Regular workshops, personalized onboarding sessions, and video tutorials	Interview, User 4; Focus group, PI 2
Platform integration	Embed collaboration platforms into existing institutional workflows with automated reminders	Interview, User 9
System expansion	Register all eligible laboratories into LABSIS; prioritize high-demand equipment	Focus group, Lab Manager 1
Translation support	Add full translation services or establish formal partnerships with external translation providers	Respondent 45
Cross-disciplinary promotion	Targeted outreach to low-utilization faculties (social sciences, humanities, education)	Quantitative (Table 5) + Interview, User 6
Industry-academia linkage	Structured programs for joint publications, applied research grants, and industry-seconded positions	Quantitative (low industry collaboration) + Interview, User 10
Recognition and incentives	Acknowledge platform engagement and collaboration activities in annual performance reviews	Focus group, PI 3

As shown in Table 11, strategic interventions proposed by participants cluster around seven areas. The most frequently mentioned intervention was training and onboarding, with multiple participants emphasizing that initial registration alone is insufficient; sustained engagement requires structured guidance. Platform integration was the second most common suggestion, with researchers recommending that collaboration platforms be embedded into existing workflows (e.g., project reporting systems, email reminders) rather than functioning as standalone tools. System expansion—particularly registering all eligible laboratories into LABSIS—was highlighted by focus group participants as a necessary step to ensure equitable access to research infrastructure. Translation support emerged as a gap in the current writing support system, with respondents calling for either in-house full translation services or formal partnerships with external providers. Cross-disciplinary promotion was recommended to address the uneven utilization patterns observed quantitatively, with targeted outreach to low-utilization faculties. Industry-academia linkage was identified as a critical area for improvement, given the low proportion of industry-collaborative publications; suggestions included structured programs for



joint publications and applied research grants. Finally, recognition and incentives were proposed to motivate sustained engagement, including acknowledging platform activities in annual performance reviews. Collectively, these qualitative findings provide actionable recommendations that complement the quantitative performance indicators and address the challenges identified in Table 10.

Summary of Integrated Findings

Findings related to the overall integration of quantitative and qualitative data across all five research questions are presented below in Table 12.

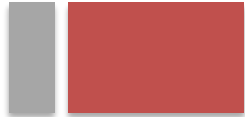
Table 12

Summary of Mixed-Methods Integration by Research Question

Research Question	Convergence	Divergence	Complementarity
RQ1: Collaboration networks influence	Moderate	High registration vs. low active use explained by lack of training	Qualitative explains mechanisms behind quantitative patterns
RQ2: Digital tools role	High	Certificate issuance vs. unmet translation needs	Quantitative shows service utilization; qualitative reveals expectation gaps
RQ3: Structural/relational/technological	Moderate	TÜBİTAK success not platform-mediated; personal networks drive performance	Quantitative rates + qualitative mechanisms provide fuller explanation
RQ4: Challenges	High (all sources align)	None identified	Both data types independently confirm same challenges
RQ5: Strategic interventions	Qualitative only (no quantitative comparison)	N/A	Qualitative provides unique, actionable recommendations not available from quantitative data alone

As presented in Table 12, the highest level of convergence across quantitative and qualitative findings was observed for Research Question 4 (challenges and limitations), where both data strands independently identified the same set of barriers. This convergence strengthens the validity of these findings and suggests that the identified challenges are robust across different measurement approaches. Research Question 2 (digital tools) also demonstrated high convergence, with both data types indicating that while digital tools provide benefits, they do not fully meet all user needs.

Divergence was most pronounced for Research Question 1 (collaboration networks) and Research Question 3 (structural/relational/technological dimensions). In both cases, qualitative data explained why quantitative indicators (high registration numbers, strong TÜBİTAK rankings) did not translate into expected outcomes (active platform use, platform-mediated collaboration success). These



divergences are not methodological weaknesses but rather analytical strengths of the mixed-methods design, as they reveal important nuances that would remain hidden if only one data type were used.

Complementarity was observed across all research questions, but most notably for Research Questions 1 and 3, where qualitative data provided explanatory mechanisms for quantitative patterns. For Research Question 5, qualitative data made a unique contribution by generating actionable strategic interventions, demonstrating that mixed-methods designs are particularly valuable when research aims to inform institutional policy and practice.

Discussion, Conclusion and Recommendation

Discussion

This study was designed to examine how collaboration networks and digital infrastructures shape institutional research capacity at Ankara University, employing a convergent parallel mixed-methods design that integrated quantitative bibliometric and system usage data with qualitative interviews, focus group discussions, open-ended questionnaires, and document analysis. The most striking findings reveal three critical patterns. First, while 263 researchers registered on the Crowdhelix collaboration platform, only 11 partner search announcements were disseminated, indicating a substantial gap between registration and active engagement. Second, academic writing support services were heavily concentrated in three faculties (Veterinary Medicine, Pharmacy, and Dentistry), suggesting uneven disciplinary adoption. Third, despite strong national rankings in TÜBİTAK 1001 projects (3rd overall, 2nd among state universities), the proportion of industry-collaborative publications remained low, pointing to persistent academia-industry disconnects.

The Gap Between Network Position and Active Engagement

A researcher's central position within a collaboration network significantly influences publication visibility and citation performance. Earlier research introduced the concept of network-mediated reputation overflow, demonstrating that centrality facilitates increased citation impact through enhanced visibility and association with influential collaborators (Petersen, 2015). Further evidence from correlation and regression analyses showed that co-authorship networks affect academic productivity particularly through the roles played by advisors and professional peers (Abbasi et al., 2011). However, the findings of the present study qualify these claims by revealing that network centrality alone is insufficient without active engagement strategies. At Ankara University, improved citation metrics were observed alongside growing international collaboration, yet qualitative interviews indicated that many researchers registered on platforms but never actively participated due to lack of training and onboarding support. It is therefore important to recognize that structural network position must be complemented by institutional mechanisms that convert passive membership into active collaboration. This finding aligns with the broader digital transformation literature, which emphasizes that technology adoption metrics are poor proxies for genuine organizational change (Fernández et al., 2023). These results highlight the need for a more nuanced understanding of how network positions translate into measurable academic outcomes.

The Complex Interplay Between Local and International Collaboration

The distinction between local and international collaboration plays a decisive role in shaping research outcomes, yet this relationship is more complex than previously acknowledged. Research on Indian biotechnology highlighted the predominance of local collaboration networks while simultaneously emphasizing the necessity of expanding international collaborations to strengthen scientific capacity (Mondal et al., 2021). Complementary evidence argues that international collaborations enable access to diverse knowledge bases but vary in impact across disciplines and contexts (Wang & Zhang, 2019). The present study found that successful TÜBİTAK 1001 project outcomes at Ankara University were qualitatively attributed to existing personal networks rather than platform-mediated matching. This

suggests that local and personal networks remain primary drivers of research success even as international collaborations expand. This pattern parallels the Indian context described by Mondal et al. (2021) while extending it by demonstrating that digital platforms have not yet replaced traditional network mechanisms. The implication for institutional strategy is clear: universities must invest in strengthening local networks while simultaneously reducing barriers to international engagement.

Social, Organizational, and Relational Dynamics of Collaboration

The social and organizational dimensions of collaboration extend beyond structural connectivity to include spillover effects and relational quality. Previous research emphasized the presence of spillover effects within co-authorship networks, where the benefits of collaboration extend beyond direct partnerships and contribute to the broader academic ecosystem (Hsieh et al., 2018). Further evidence demonstrated that individuals occupying central positions within social networks tend to achieve higher academic outcomes, partly due to stronger emotional and relational ties within collaborative environments (Marqués-Sánchez et al., 2020). In the present study, focus group discussions revealed that trust and relational quality were frequently cited as prerequisites for effective collaboration, particularly in laboratory settings where shared equipment requires coordination. Participants who reported positive emotional ties with their collaborators also reported higher satisfaction with digital tools such as LABSIS. It is therefore important to recognize that technological systems are more effectively utilized when embedded within trusting relational environments. This finding aligns with the socio-technical perspective advanced in the digital transformation literature, which argues that technology and social structures co-evolve and cannot be treated separately (Neborsky, 2021). These results underscore the necessity of fostering relational trust alongside technological infrastructure.

The Limits of Technology-Driven Transformation

The role of digital technologies in transforming collaboration networks has become increasingly prominent, yet technology adoption alone does not guarantee transformation. Research on pandemic-era collaboration highlighted significant changes in collaboration and publication dynamics, emphasizing the growing reliance on digital platforms to sustain academic interaction and productivity (Damaševičius, 2023). The present study both supports and qualifies this observation. On one hand, the adoption of Crowdhelix, LABSIS, and TRADOS demonstrates that digital platforms have become integral to research management at Ankara University. On the other hand, the gap between registration and active engagement, with 263 registered users versus only 11 partner search announcements, suggests that digital transformation is not yet complete. International policy frameworks increasingly promote collaborative research, underscoring the responsibility of institutions to provide supportive environments including adequate funding, infrastructure, and networking opportunities (Toney & Flagg, 2021). A key finding of the present study is that institutional support mechanisms, particularly training, onboarding, and workflow integration, require further development before digital platforms can achieve their intended impact. This finding aligns with the broader observation that most universities remain in the early stages of digital maturity, with only one in four having a comprehensive digital strategy (Fernández et al., 2023). These results collectively indicate that successful digital transformation depends on both technological infrastructure and sustained institutional investment.

Systemic Challenges Beyond Technological Investment

Systemic challenges in research capacity strengthening cannot be resolved through technological investment alone. A realist synthesis of health research capacity strengthening initiatives in African universities found that systemic challenges including lack of funding, ineffective research policy environments, and weak institutional support must be addressed for collaborative interventions to achieve sustained impact (Mutua et al., 2025). The present study confirms this observation at Ankara University, where the uneven distribution of doctoral-level staff across academic units, the low proportion of industry-collaborative publications, and the concentration of writing support utilization in

only three faculties all point to systemic challenges that require coordinated policy responses rather than isolated technological solutions. It is worth noting that these findings are consistent with the barriers literature, which identifies technological infrastructure deficiencies, budget constraints, lack of strategic planning, and organizational misalignment as six major categories of obstacles facing higher education institutions (Aditya et al., 2021). These results underscore the necessity of adopting a systemic and policy-driven approach to research capacity strengthening.

The Persistent Academia-Industry Gap

The persistent gap between academic research and industry application reflects a broader global challenge documented across multiple contexts. Bibliometric analyses mapping the conceptual structure of university-industry collaboration research have identified technology transfer, knowledge transfer, and academic entrepreneurship as dominant clusters in the literature (Ballesteros-Ballesteros & Zárate-Torres, 2025). Complementary research has found that collaboration barriers, challenges, and sustainability have emerged as distinct research themes (Guofang et al., 2024). Despite increases in patent activity and project funding at Ankara University, the proportion of industry-collaborative publications remained low, placing the institution within this broader global pattern. This suggests that while the importance of university-industry collaboration is widely recognized, the mechanisms for achieving it remain poorly understood and inconsistently applied across institutional contexts. The implication is that bridging this gap requires moving beyond individual researcher incentives to structural changes in how academic work is organized, valued, and funded.

Implications for Policy and Practice

Several concrete implications for institutional policy and practice emerge from the integration of theoretical frameworks and empirical findings. First, universities must move beyond platform-centric approaches to research collaboration. Collaboration outcomes are determined not merely by network access but by network position and engagement (Petersen, 2015; Abbasi et al., 2011). The finding that 263 researchers registered on Crowdhelix but only 11 partner search announcements were disseminated suggests that platform adoption metrics are poor proxies for active engagement. Institutions should develop structured onboarding programs, regular training workshops, and integration of collaboration platforms into existing research workflows.

Second, the uneven distribution of research capacity across academic units calls for targeted, differentiated interventions. The impact of international collaboration varies across disciplines and contexts (Wang & Zhang, 2019), a finding confirmed by the present study's observation that Particle Physics and Oncology demonstrate stronger international impact than Veterinary Sciences and Surgery. Policy interventions should include targeted recruitment of doctoral-level staff for low-performing units, mentorship programs pairing less research-intensive units with high-performing faculties, and differentiated funding mechanisms that recognize structural constraints.

Third, bridging the academia-industry gap requires structural changes beyond individual researcher incentives. Persistent barriers between academia and industry have been well documented in the global literature (Ballesteros-Ballesteros & Zárate-Torres, 2025; Guofang et al., 2024). The finding of low industry-collaborative publication rates at Ankara University reflects this broader pattern. It is therefore recommended that policy interventions include formal mechanisms for industry secondments, joint funding schemes requiring industry co-investment, and recognition of industry-collaborative outputs in promotion and tenure criteria. A growing body of research indicates that institutions have a responsibility to provide supportive environments including adequate funding and infrastructure for collaborative research (Toney & Flagg, 2021). These results highlight the need for systemic reforms that align academic incentives with industry engagement

Fourth, digital transformation initiatives must be accompanied by organizational change management. Despite the growing reliance on digital platforms highlighted in the literature (Damaševičius, 2023), the present study found that adoption alone is insufficient. It is therefore recommended that policy initiatives include dedicating resources to user training and support, establishing user feedback mechanisms for continuous system improvement, and integrating digital tool usage into institutional performance metrics. A growing body of research indicates that digital leadership plays a vital role in this process, as leaders are responsible for building a digital culture, breaking resistance to change, and establishing a collaborative climate (Onan, 2024; Anwar & Sarah, 2024). These findings underscore the necessity of aligning technological investments with human-centered change management strategies.

Fifth, institutional support for academic writing and language services should be expanded and distributed more evenly across disciplines. The concentration of writing support utilization in three faculties (Veterinary Medicine, Pharmacy, Dentistry) suggests that researchers in other disciplines either lack awareness of the service or perceive it as less relevant to their publication practices. Given that language barriers are a well-documented obstacle to international publication, institutions should actively promote these services across all disciplines and consider discipline-specific editorial support.

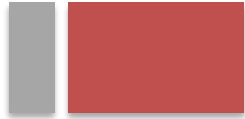
Limitations

Several limitations of this study should be acknowledged. First, while the convergent parallel mixed-methods design enabled triangulation of findings across quantitative and qualitative data sources, the generalizability of findings beyond Ankara University remains uncertain. Institutional contexts vary significantly in terms of research culture, available resources, governance structures, and strategic priorities. As noted in the literature, the impact of collaboration networks on research performance is shaped by context-specific factors (Wang & Zhang, 2019), and the present findings are best understood as offering transferable insights rather than universally applicable conclusions.

Second, the cross-sectional nature of the data collection limits causal inference. While associations between digital tool adoption and research performance indicators were observed, causal direction cannot be definitively established. It has been widely acknowledged that longitudinal co-authorship network analysis has demonstrated that collaboration structures evolve over time, and longitudinal data are necessary to establish temporal precedence (Ye et al., 2011). This finding underscores the need for future research employing longitudinal designs.

Third, the qualitative sample, while adequate for thematic saturation, may not fully represent the diversity of experiences across all academic units. The focus group included only eight participants, and interviews were conducted with 12 Crowdhelix users. Researchers from low-utilization faculties or those who chose not to engage with digital platforms may have different perspectives that were not captured.

Fourth, the study period coincided with the post-COVID-19 period, during which digital tool adoption may have been temporarily elevated due to pandemic-related remote work requirements. Significant changes in collaboration and publication dynamics occurred during the pandemic (Damaševičius, 2023). It is therefore important to recognize that the sustainability of observed adoption patterns beyond this exceptional period remains to be seen. Fifth, the reliance on SCIVAL and Scopus-indexed publications as performance indicators privileges English-language, internationally visible research outputs. A growing body of research indicates that this may systematically underestimate research contributions in local languages, discipline-specific outlets, or practice-oriented publications. As research on local collaboration networks has shown, such networks play an important role that may not be fully captured by international bibliometric databases (Mondal et al., 2021). These limitations highlight the need for future research employing more diverse data sources and extended timeframes.



Recommendations for Future Research

Building on the findings and limitations of this study, several directions for future research emerge. First, longitudinal studies are needed to examine the temporal dynamics of digital tool adoption and research performance. The value of longitudinal co-authorship network analysis in understanding how collaboration structures evolve over time has been well established (Ye et al., 2011). Such studies could employ panel data designs to disentangle causal direction and identify critical periods for intervention. Second, comparative case studies across multiple universities would help identify which findings are specific to Ankara University and which reflect broader patterns in higher education research capacity development. Comparisons could be structured around variation in key contextual factors such as institutional age, size, research intensity, and national research policy environments.

Third, intervention studies are needed to test the effectiveness of specific strategies for enhancing digital tool adoption and research collaboration. The value of regression and correlation analyses in identifying network effects has been demonstrated (Abbasi et al., 2011), but experimental or quasi-experimental designs would provide stronger evidence for causal claims. Randomized controlled trials could evaluate the impact of structured onboarding programs, financial incentives, or workflow integration on platform engagement and subsequent research outcomes.

Fourth, future research should examine the role of leadership and governance in shaping digital transformation in higher education research. The present findings suggest that organizational factors are critical determinants of digital tool adoption, but leadership practices, decision-making structures, and resource allocation processes were not systematically investigated. Institutional support environments are critical for collaborative research success (Toney & Flagg, 2021), and research is needed on how leadership can effectively foster these conditions.

Fifth, given the persistent gap between academia and industry observed in the present findings and documented in the global literature (Ballesteros-Ballesteros & Zárate-Torres, 2025; Guofang et al., 2024), future research should investigate the specific barriers and facilitators of industry-collaborative publications. It is therefore recommended that such research employ realist evaluation methods to identify what works, for whom, and under what conditions in promoting university-industry knowledge transfer, following the methodological model provided by Mutua et al. (2025). These results underscore the necessity of context-sensitive approaches to bridging the academia-industry divide.

Conclusion

This study examined how collaboration networks and digital infrastructures shape institutional research capacity at Ankara University using a convergent parallel mixed-methods design that integrated quantitative bibliometric and system usage data with qualitative interviews, focus group discussions, open-ended questionnaires, and document analysis. The findings demonstrate that Ankara University has made substantial progress in research performance, evidenced by improved publication metrics, increased participation in international funding programs, and strong national rankings in TÜBİTAK projects. However, this progress is unevenly distributed across academic units, and significant gaps remain between platform adoption and active engagement, between certificate issuance and unmet user needs, and between research output and industry application.

The study confirms that collaboration networks influence academic performance through multiple mechanisms: structural positioning, geographical scope, social and organizational dimensions, emotional and relational ties, temporal evolution, digital mediation, and policy environments (Petersen, 2015; Abbasi et al., 2011; Mondal et al., 2021; Wang & Zhang, 2019; Hsieh et al., 2018; Marqués-Sánchez et al., 2020; Ye et al., 2011; Damaševičius, 2023; Toney & Flagg, 2021). The mixed-methods design proved essential for uncovering how these mechanisms operate in concert. Quantitative data alone would have suggested moderate success based on registration numbers and publication counts.

Qualitative data alone would have identified barriers and user concerns but without a sense of their prevalence or magnitude. The integration of both data strands through joint display matrices revealed critical divergences: high registration numbers did not translate into active platform use, and strong TÜBİTAK rankings were driven by personal networks rather than platform-mediated collaboration.

The study contributes to the literature on digital transformation in higher education research by providing empirical evidence that technology adoption is fundamentally a socio-technical challenge. Consistent with findings from cloud migration studies, digital access research, and university-industry collaboration bibliometric analyses, the results demonstrate that successful digital transformation requires alignment of technological, organizational, and human dimensions (Munot, 2024; Ojulong, 2025; Mutua et al., 2025; Ballesteros-Ballesteros & Zárate-Torres, 2025; Guofang et al., 2024). Investments in digital platforms, laboratory management systems, and writing support tools are necessary but insufficient; their impact depends on complementary investments in training, workflow integration, user support, and organizational change management.

The study also contributes to the literature on university-industry collaboration by documenting persistent gaps between academic research and its applied translation. This finding aligns with bibliometric evidence suggesting that despite decades of policy attention to technology transfer and knowledge exchange, the structural barriers between academia and industry remain substantial. Addressing these gaps requires moving beyond individual researcher incentives to institutional and systemic reforms, including formal partnership mechanisms, joint funding schemes, and recognition systems that value applied and collaborative outputs alongside traditional publications.

In conclusion, while Ankara University has made significant progress in enhancing its research capacity, sustaining and advancing this trajectory requires coordinated efforts that integrate technological, organizational, and strategic dimensions. The effective alignment of digital infrastructures, human capital, and collaboration networks will be central to achieving long-term improvements in research performance and global competitiveness. For policymakers and university administrators, digital transformation in research is not primarily about technology. It is about people, processes, and the organizational conditions that enable researchers to collaborate effectively across disciplinary, institutional, and national boundaries. Academic success is co-constructed within networked environments, and building those environments requires sustained, holistic, and context-sensitive institutional strategies.

Fundings and Competing Interests

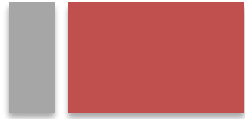
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Conflict of Interest Statement

No potential conflict of interest was reported by the authors.

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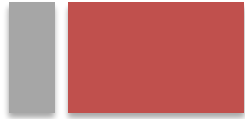


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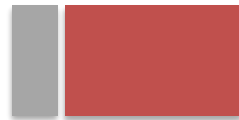
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Creative Methods and Learning with Justice-Centered Mixed Methods Research: Decolonizing Systemic Inequities with Land Acknowledgments

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Abstract

The purpose of this article is two-fold, offering both a methodological and socially meaningful direction in justice-centered research integrating the arts and texting. First, we invite readers into a narrative, creative approach centering social justice, environmental justice, and economic justice as justice-centered mixed methods in an effort towards decolonizing systemic inequities and issues of power. We highlight an arts-based response integrating poetry, photos, and texting as a response to the call to action from Onwuegbuzie and Abrams (2024) for “integrative, transformative approaches to research” that are “socially meaningful and transformative” (p. 218). Second, in this article, we guide readers through the methodological and practical process of developing, expanding, and adapting a land acknowledgment for the Sámi - Indigenous people with territory spanning Sweden, Norway, Finland, and Russia. Our methods weave together feminist collaborative processes with collaborative autoethnography in data generation, bringing together visual arts through asynchronous research processes, quantizing narrative, Wordcloud, and identification of learning contexts. Findings highlight the relevance of the arts and informal learning within justice-centered mixed methods (including an Appendix with toolkit), noting the need for further research continuing decolonial processes furthering social, environmental, and economic justice and research praxis for Indigenous peoples of the Sámi territory of Sápmi.

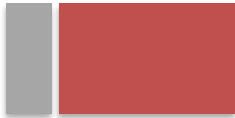
Keywords: *Justice-centered mixed methods research, SIDES, arts-based research, informal learning, Saami/Sámi/Sápmi land acknowledgment*

Creative Methods and Learning with Justice-Centered Mixed Methods Research: Decolonizing Systemic Inequities with Land Acknowledgments

Introduction

In this article, we bring together justice mixed methods research with arts-based methods to address a topic of systemic inequities and consider practical steps to move forward through the purposeful use of a Sámi land acknowledgment. We incorporate justice-centered mixed methods research (CohenMiller & Grace, 2026) with the SIDES of CDP 2.0 - social justice, inclusion, diversity, equity, and social responsibility (Onwuegbuzie & Abrams, 2024). Through these lenses, we journey into the topic of land acknowledgements, and how people and organizations (e.g., universities, large-scale events) can incorporate them in teaching (and offering informal learning) to acknowledge systems of power and privilege, racism, and colonialization, and take one small step towards positive change through spreading awareness. A goal in this work is to answer Onwuegbuzie and Abrams’s (2024) call to action to push mixed methods forward for justice-centered aims, in particular as relating to systemic inequities and power imbalances. We do this through the weaving together of methodology and practical application.

We expand upon autoethnography and poetry with mixed methods research (Onwuegbuzie, Abrams, S., Abrams, M., CohenMiller, & Bambrola, 2024), weaving visual arts together with informal learning,

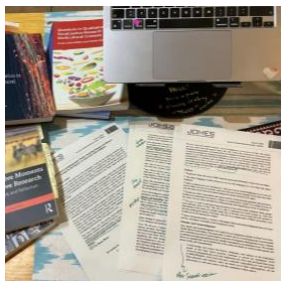


ending with a toolkit for practical use. In the following poem, we introduce the idea of a land acknowledgement for the Sámi people, in a poetic collage developed through found poetry, cultivating words from an article I (Anna) co-wrote for this same journal about the development of a land acknowledgement for the Sámi people at our university (CohenMiller, Ness, & Martin, 2024).

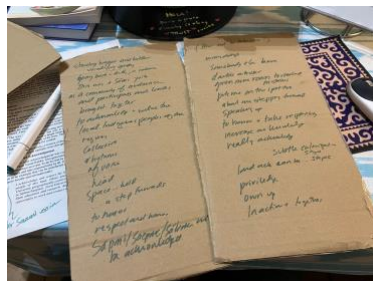
Land acknowledgements are not common practice in Sápmi, although the Office for Contemporary Art Norway (n.d.), which is funded by the country, offers a recognition¹. Within Sápmi, there are differences, with variances in the breadth and depth of acceptance of ownership and historical presence across Sweden, Norway, Finland, and Russia. Sápmi, the name for the Sámi People’s traditional territory, also describes as a transnational Indigenous homeland that crosses the Arctic Circle, including substantial areas of the Kola Peninsula in Russia and the northern parts of Norway, Sweden and Finland (Koivurova, 2015). Despite the formal recognition as an Indigenous People, there are still voids between the formal recognition and the realization of rights (The Saami Council, 2025).

As Lynn Butler-Kisber (2019) explains, found poetry is a type of poetic inequity in which the words of participants are drawn out of the transcript into poetic form. I used the words of the article as the participant “voice,” drawing forth words and phrases, adding in my own connecting words and interpretations in parentheses. The process started identifying words and phrasing from the article (CohenMiller, Ness, & Martin, 2024), rewriting, and then rereading and further reducing (Figure 1).

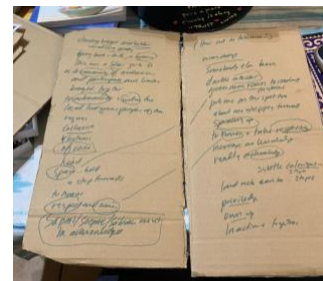
Figure 1
Found Poetry Step-By-Step



Article notes



Reducing ideas and writing down key words and phrases

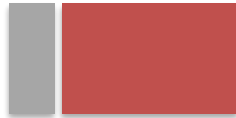


Further reducing the ideas and connecting concepts

*(I hear the) cadence (in) the Sámi yoik.
Community participants; acknowledge and value
(Are the Sámi acknowledged and valued?)
a collective voice, (trying to give) space
respect(ing) and honor(ing) – Sápmi/Saepme/Sabme
(Yet, and, also, we’re) double outsider(s)...
Speaking up (for others). (A chance to take) responsibility
acknowledge (our) privilege
own up, (stand up)
Together (with and for one another)*

In that article, we (Anna, Tove, and Rose from the 2024 article) used mixed methods autoethnographic

¹ “OCA acknowledges the Sámi as one people, and as the Indigenous people of the Fennoscandian region. On the land of this region, Sápmi, the Sámi people have lived since time immemorial, respectfully harvesting from nature by fishing, farming, hunting and following reindeer, amongst other activities. We pay respect to the deep knowledge of land and water, as well as to the spiritual principles and world perspectives that have and continue to inspire Sápmi across all of its communities.” (Office for Contemporary Art Norway, n.d.)



theater. We integrated critical self-reflection to address social justice issues (CohenMiller & Boivin, 2021) along with evocative autoethnography (Bochner & Ellis, 2016). We note that while we aren't Indigenous, we felt (and feel) a responsibility and need to take responsibility, acknowledge our privilege, and offer some type of awareness to colonialization (with which racism and discrimination come hand-in-hand). Sápmi (the land where Sámi have lived for centuries) includes land where our university resides in Bodø, Norway, and spreads across northern Scandinavia and into the Kola Peninsula in Russia. We ended our article with a practical direction, a sample land acknowledgement developed by a Sámi scholar and PhD student at our university, Sandra Rahka. The idea was to offer a tool that others could use and implement as fitting for their contexts. And in this article, we (Anna, Charlotta, and Nayr, of this article) - continue this work, spurred on from the use of the land acknowledgment at TEDxBodø.

Research Questions

The following three questions guided our overall study:

1. Why do we care about land acknowledgments?
2. Who needs to learn about them and why?
3. What feelings / images come up when thinking about land acknowledgments?

How these questions developed in a collaborative process and how it led to determining our data collection methods is discussed later in the article.

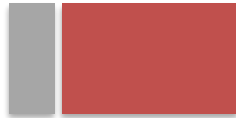
Method

As part of our process we base our work upon a decolonial lens drawing from CohenMiller and Grace's (2026) justice-centered mixed methods research, to purposefully center and actively advocate for social, environmental, and economic justice. We aim to integrate mixed methods autoethnography to offer greater nuance and understanding, whereby "The goal of integrated mixed methods autoethnography is to integrate the elements in such a way that they complement and enrich each other, leading to a deeper understanding of the research topic" (Onwuegbuzie Abrams, S., Abrams, M., CohenMiller, & Bambrola, 2024, p. 169).

We embed critical self-reflection throughout our processes, asking reflexive questions as a form of the 3As of research (Author, 2024c) to better understand ourselves through awareness, acceptance of one another, with an ultimate goal to affect positive action. Such an approach considers our critical reflection as a form of contemplative inquiry which can enhance our research and ourselves (Janesick, 2016). Critical self-reflection can be seen as echoing the work of emancipatory pedagogue, Paolo Freire who notes that "Critical reflection is also action" (p. 128).

Emphasizing CDP 2.0 and the four SIDES of social justice, inclusion, diversity, equity, and social responsibility (Onwuegbuzie & Abrams, 2024), we aim here to answer the call to action. As set forth by Onwuegbuzie and Abrams (2024), they call for transformative mixed methods research that seeks to "push the boundaries of what mixed methods research can achieve, particularly in terms of addressing issues of equity, diversity, and inclusion" (p. 218).

Moreover, we recognize the importance of vulnerability in our process, such as "sharing about one's limitations in research and/or practice for the purposes of growth and learning for the individual or greater good" (CohenMiller, 2024, p. 5). Therefore, we work to include the "messiness" of research, seeing how "doubting" comes into critical thinking (Belenky, Clinchy, Goldberger, & Tarule, 1973) as we consider the ways we navigated through our processes of learning individually and together. These steps of embedding vulnerability can also be seen as drawing from evocative autoethnography (Bochner & Ellis, 2016), where we seek to engage with specific details along with feelings and emotions.



Development of Research Questions and Feminist Collaborative Practices

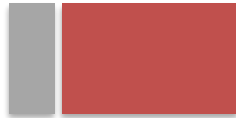
The three of us came together and were each profoundly impacted by the development and use of a land acknowledgment at our university. But why? What was it about the land acknowledgement that touched us? Thus, we found ourselves with ideas to explore that led to specific guiding questions for each of us. Using a text message group, Anna shared a few suggested research questions and ideas. As guided by participatory methods, the aim was to work collectively and cooperatively with one another to determine our questions and processes. I (Anna) started a WhatsApp group with the three of us, after first checking in with Charlotta and Nayr individually so as not to assume they wanted to take part and not to pressure them into joining. These ideas are grounded in justice-centered research practices, such as those seen in the feminist research collaborations I've been a part of and led (e.g., CohenMiller, Dresscher-Lambertus, & Samuels, 2026; Hinton-Smith, 2022).

Uncovering our Positionality: Our Roles and How We've Used a Land Acknowledgment

We are three transnational women in higher education who have become friends and critical colleagues over the last three years while working at the same university in northern Norway. We are all double outsiders, neither Indigenous nor from Norway. And yet the insider-outsider concept is not as clear-cut as a black and white dichotomy, but instead can incorporate an in-between "space between" (Dwyer & Buckle, 2009) and also a movement between status roles, shifting along a "spectrum of insider-outsiderness" (CohenMiller & Boivin, 2021). For example, Charlotta and Nayr are in the process of creating a children's trilingual book where a Sámi language, a Maōri language, and Norwegian are side by side. Nayr includes multilingual, decolonial and Indigenous perspectives in her teaching and research of children's literature for Grades 1-7 (Ibrahim, 2020, 2022, 2025, *forthcoming*; Lau, Ibrahim & Destroismaisons, 2025). As such, she has used a multilingual/translanguaging approach to integrating or fusing dual language picture books, where one language is an Indigenous, in this case, northern Sámi, thus meeting the curriculum requirements for addressing Indigenous perspectives and the university's role in supporting the teaching and learning of two Sámi languages. Anna integrates Indigenous and decolonial paradigms and research into her research and writing (e.g., CohenMiller, 2023a, b; 2024a, b; CohenMiller & Boivin, 2021; CohenMiller & Dikanchieva, 2024; CohenMiller & Grace, 2026). We agree with Sonya Corbin Dwyer and Jennifer Buckle (2009) when stated, "I do not think being an insider makes me a better or worse researcher; it just makes me a different type of researcher" (p. 56).

While in different roles (a professor in a center for teaching and learning, an associate professor in the department of education, and a lead administrator in the department of education), we found a connection through our deep commitment to working with students, faculty and communities to address systemic inequities at a local and global level. For Anna, she added the Sámi land acknowledgment to her signature after writing the previous article (CohenMiller, Menten-Ness, & Martin, 2024) and she began incorporating into the programs she leads, talks and workshops. For example, at the kick-off for an inclusive master's program for top students to learn more about research and become a part of the academic community, she incorporates the land acknowledgment as part of the welcome (Aaaneland, 2025; CohenMiller, 2025). As a part of that work, both Charlotta and Nayr have become integral partners in presenting and leading workshops, joining in with the land acknowledgement. Inspired by Anna's sharing of the land acknowledgement, Nayr added the land acknowledgement to her signature, shared it with her networks, for example, in the Association for Researchers on Children's Literature in English in Norway (ARCLLEN), and will introduce it to her classes as a lead-in to the literature courses.

The land acknowledgment became a part of all our work. For example, in Charlotta's role, she both added the land acknowledgement to her email signature and likewise integrated it into events she led. For example, in opening the Summer School (Nord University, 2025), she began with the Sámi land acknowledgement.



Uncovering a Process: The Sámi Land Acknowledgement at TEDxBodø

After a year of working together to develop TEDxBodø, on October 24, 2025, we (Anna and Charlotta) led the welcome to the event at the public library in Bodø, Norway (Figure 2, 3). We had developed a PowerPoint to guide us through the event, collaborating, acting as master of ceremonies, literally and figuratively sharing the stage with one another and others. As part of that process, we made decisions about the layout of the PowerPoint slides, how we were going to introduce each speaker, and how to thank our sponsors, partners and audience. One decision we made was automatic; we included the Sámi land acknowledgment. It was actually one of the first slides we created, as we considered its inclusion as a central aspect to working in the area and showing respect for the Indigenous peoples. Moreover, when we had first chosen the date for the TEDx event, we purposefully chose Sámi Language Week Giellavahkku – Giellavahkko (The Sámi Parliament, n.d.), to help draw attention to the important social, environmental and economic justice issues.

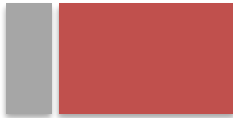
Figure 2

Anna and Charlotta Introducing the Sámi Land Acknowledgment at TEDxBodø (Fagerbakk, 2025)



As we began our introduction, we could look out and see Nayr in the audience, poised to offer her TEDx talk. Within the first minute of walking onstage, we invited the audience as participants to join, together, to read the Sámi land acknowledgment (Figure 3):

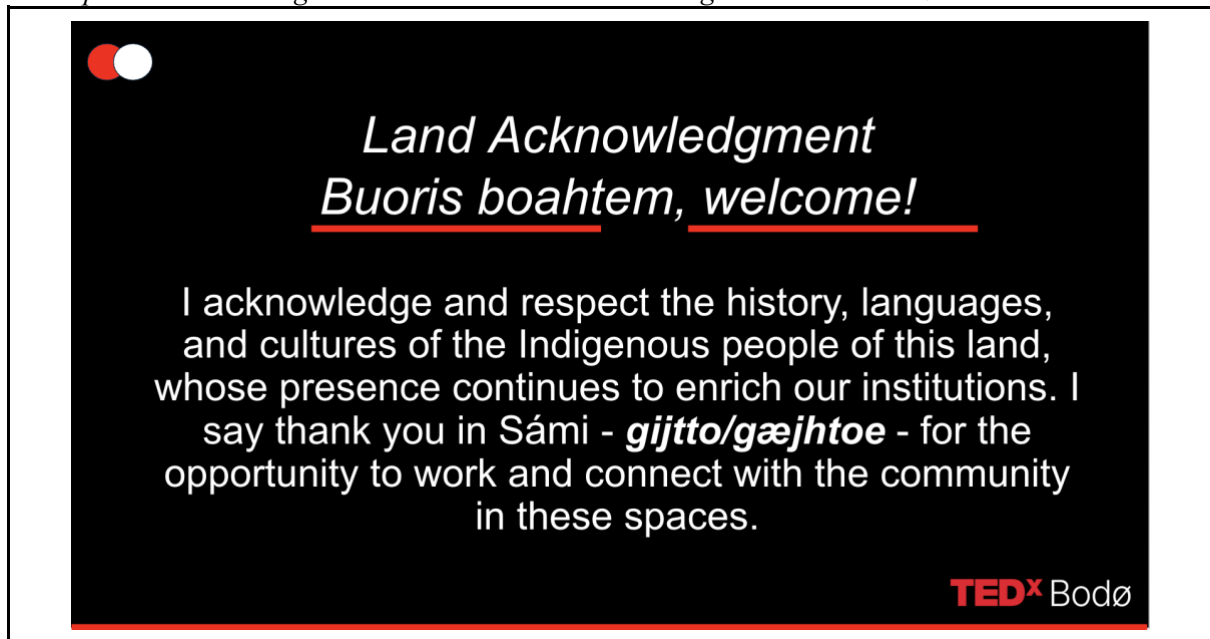
...today we will start us off with a land acknowledgment, and this is an opportunity and respect where we are in our space and places and recognize our privilege to be here together today to learn with one another. Please follow along with the words on the screen that Charlotta will



lead us in

Figure 3

Powerpoint Slide Inviting all to Read The Land Acknowledgment at TEDxBodø



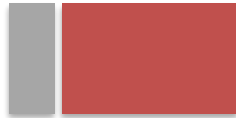
Seeing a Praxis: Informal Learning and the Land Acknowledgment at TEDxBodø

Although we (Anna and Charlotta) had been using the land acknowledgment since 2024. At this point, it was unique to invite an entire audience to read with us. Likewise, bringing it to a context outside of the university extended the visibility of the attention to Sámi peoples, and an extension of informal learning in another context. We hadn't initially planned to have the audience read along with us, instead we had many conversations around who was the "right" person to read it. What would be signalling to others by our choice? If we had someone identifying as a white Norwegian man read it, what would that say about colonialization? If we had a Sámi student read it, would that signal that only someone who is of an Indigenous background could read the land acknowledgment? In the end, it turned out that all our choices of people weren't available. Thus, the result was audience participation, which appeared to offer a chance to move away from what Goffman (1959) refers to as "audience segregation". Reflecting back, we now consider this approach to be the ideal symbolic statement to make with others, to draw in awareness and show how we are all affected and part of the space we are embodying.

These types of questions of who is involved in the reading of the land acknowledgment relate to the field of adult education and nonformal and informal learning. Sharan Merriam and Lisa Baumgardner (2020) explain of the three types of learning traditionally classified in adult education, that while formal education takes place typically in higher education for credit, nonformal and informal learning occur in other spaces:

Nonformal learning refers to organized activities outside educational institutions, such as those found in community organizations, cultural institutions such as museums and libraries, and voluntary associations. Informal learning refers to the experiences of everyday living from which we learn something. (p. 24)

Thus, the use of the Sámi land acknowledgement as part of an event taking place at a university institution, lies at the intersection of formal, nonformal and informal learning. The intent of the inclusion of the land acknowledgement is not the specific learning that is being taught, however as it is within a learning context, its inclusion can be seen as formal learning. Whereas when the land acknowledgement



is used within a learning environment outside of higher education, such as at the TEDx event, where the purpose is to convey “ideas worth sharing” (TED.com, n.d.), its inclusion could be seen as nonformal or informal learning for audiences. When an event or organization has as specific purpose to share information with the intent for audiences to learn, we can see the space as a site of informal learning, one that effects our sense of gendered identities (CohenMiller, Koo, Collins, & Lewis, 2020) as well as racialized positioning. And as a purpose of a TED event is to share information and learning, we can look at a site of informal learning. Thus, what audiences and participants saw (a PowerPoint slide with the land acknowledgment written on it), what we hear (the acknowledgment read aloud), and exposed to (participating in read it), influence our understanding of the world around us and our own belonging.

Unpacking Reactions

Responses to the land acknowledgment from the organizing team. When we had developed the PowerPoint draft, we shared it with our full organizing team. However, with everyone’s busy schedule, many hadn’t noticed the land acknowledgment until we invited the audience to read it with us. This point was jokingly noted in a debriefing meeting we had with our full team of six. Someone in the group noted how I (Anna) managed to lead the team in a “flat” manner - where everyone was brought in to make decisions together. This person laughed and said that sometimes on the team texting thread, I would write and say, “what do you all think?” And he would get worried thinking, “oh no, this will never be resolved!” but then it would be sorted out. Yet, there was one point he noted that was different. And it was the inclusion of the land acknowledgment; he said I hadn’t asked others about it being added.

So, why didn’t I ask others about that? If I critically self-reflect on it, I was advocating for its use, standing up for its inclusion, and unintentionally finding a back door to embed it within the event.

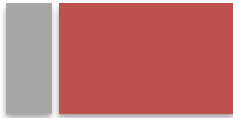
I find myself wondering about this comment now. In the team of six of us, two of us identify as women. Considering how social inequalities including gendered inequities exist in all societies would the inclusion of the land acknowledgment have felt differently or have been received differently if we (Anna and Charlotta) identified as men? The inclusion of the land acknowledgement was a purposeful step towards justice-centered practice, what Onwuegbuzie and Abrams would explain of critical dialectical pluralism, which “addresses local practical needs, particularly in culturally progressive ways that engage with and support marginalized, oppressed, underserved, and/or silenced communities to bring about social change and to foster social justice” (p. 208).

Reactions from the audience. Multiple audience members came up to us (Anna and Charlotta) after the event to thank us, and many emphasized how interesting it was that we had included the land acknowledgment. They suggested they appreciated it, noting that it was new for them. Later that day, our organizing team was directed to a Facebook post from a local celebrity, Rick Kirkman. He included a couple photos of the event, a video from his own TEDx talk a few years before, and one other video - of our welcome and land acknowledgement. The attention to posting the communally spoken land acknowledgement suggested its impact, and potential value to the community.

The combination of these reactions from our team members and audience is what led to the idea for this article. I (Anna) contacted editor in chief of JOMES to see of their interest for a potential follow-up to the original article about the development of the Sámi land acknowledgment, and we were given an encouraging response.

Texting as Research Practice

Our team primarily collaborated with one another via text message, forming a WhatsApp group to share our thoughts, feelings, and images. Texting for researchers and participants is a direction to work with limited time and access to other ways to engage. Text messages as part of research are a growing area,



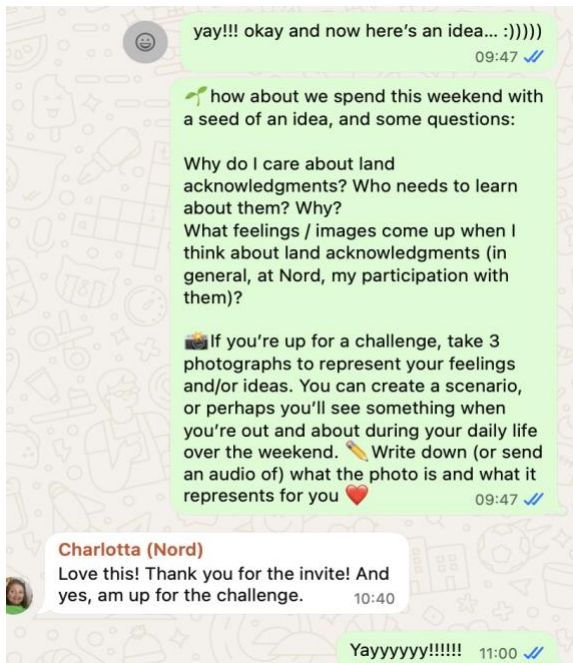
such as a means to facilitate voice and access for participants to communicate with researchers (CohenMiller, Schnackenberg, & Demers, 2020) or as a means for data mining (Nordstrom, Maheshwari, Quenneville, & Shen-Tu, 2025). For us, choosing to use a texting group meant that we weren't tied to the timeframe that emailing typically takes place, and could use an asynchronous flexible process – a “rigid flexibility” (CohenMiller, Schnackenberg, & Demers, 2020). Not being bound to office hours meant we could explore these ideas and feelings when we were out walking, when we were with our family, and in town. Working beyond office hours can conflict with typical Norwegian separation of work and personal spheres, however as each of us are *from* different cultural contexts and have lived across regions spanning Europe, USA, Africa, South America, and Central Asia, the idea of working from our phone even on a weekend was agreed upon for all.

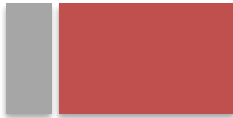
Starting off the first text message to the group was an invitation about how we might proceed:

Hi lovelies! Here's our new group for working on the land acknowledgment article with a culmination at TEDxBodø. the idea here is not to add *more (stress/deadlines), but instead to go with the flow of the feelings and explore our thoughts throughout the last year or so hearing, being a part of, and implementing the use of a land acknowledgement at Nord/Bodø. To open a space in our minds and hearts individually and together.

Considering my background in the arts-based research (CohenMiller, 2018, 2022, 2025), I immediately thought about ways we could incorporate visual arts to help us better understand our own experiences, thoughts and ideas, as well as help one another connect in understanding each other's ideas. Thus, I proposed the following questions (Table 1). The questions along with photographs were a means for us to start thinking and feeling and seeing through a lens of embodied learning (Tobin & Tisdell, 2015) and embodied inquiry (CohenMiller, 2025; Leigh & Brown, 2021).

Table 1
Research Invitation to Participate in Collaborative Research

Questions	Text Message Screenshot
<p>Why do I care about land acknowledgments? Who needs to learn about them? Why?</p>	
<p>What feelings / images come up when I think about land acknowledgments (in general, at the university, my participation with them)?</p>	
<p>📷 If you're up for a challenge, take 3 photographs to represent your feelings and/or ideas. You can create a scenario, or perhaps you'll see something when you're out and about during your daily life over the weekend. ✍️ Write down (or send an audio of) what the photo is and what it represents for you ❤️</p>	



Data Generation as Collaborative Process

Part of our process of collaboration can be seen in how the data was generated. Here we purposefully use the term “data generation” instead of data collection. In data collection, there can be a misconception that data exists “out there,” to be collected by the researcher. Yet all data is “generated” or “created” by the researchers, by participants, and in this case, by us as participant-researchers. This shift to the use of the term data generation aligns with justice-centered mixed methods practices, pointing to “the relational aspect of working with data” (CohenMiller & Grace, 2026), echoing the emphasis in CDP mixed methods research (Onwuegbuzie & Abrams, 2024). The first set of data generation came from Charlotta. She shared the following responses via our texting group followed by a photo of her family from that day on November 10th, 2025, (Figure 4):

Figure 4
Charlotta Offers Her Thoughts

On Saturday, I walked from Bodøsjøen to City Nord. As always, I paused at a certain point on the road to take in the soil, the sun, the mountains, and the sea—except when the darkness feels too heavy. “What do they mean to me?” I asked myself. An inner voice answered: belonging and roots.

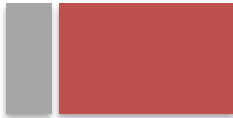
A few minutes later, I felt a hand on my shoulder. One of my sons had quietly cycled after me. Soon, another joined us. In that moment, I thought: they are my belonging and roots in human connection. I took a photo—two of my three sons, and the place where I feel I belong. Of course, I’m a guest here. It’s not my land. But I’m allowed and welcome to be part of it.

During the first break at TEDxBodø someone asked: “Charlotta, that land text—what was that about?” I tried to give a short answer but struggled to capture its depth. I gave (some kind of) answer - and the person said: “So it’s a sign of respect?”. “Yes,” I replied. “It’s a sign of respect.”

Why do I care about land acknowledgements? Because they are part of a healing process. Indigenous people here have faced discrimination and persecution. It’s everyone’s responsibility to help heal. A few weeks ago, we held a thematic day for our MAGLU students. One speaker—a mother of a boy with severe autism—shared how much her son loved soccer and had volunteered at Aspmyra, FK Bodø/Glimt’s home field. He welcomed people, even though speaking was hard for him. On of these occasions, a grown man looked at him and asked: “Are you Saami or what?” Imagine that—from an adult, in Bodø, in Sápmi.



We know how attitudes form early, often passed down like social genes. If we really care about justice, we must give it a voice—even through something as “simple” as a land acknowledgement (which isn’t simple, it’s profound). I would love to see Nord University lead this process in Bodø and



Nordland. Could we get a reporter to write about it? If not, maybe we write the piece ourselves. Who needs to learn about land acknowledgements?

Just free-wheeling here... 😊 These are just spontaneous thoughts. Here are the photos from Bodøsjøen with my sons.

As part of a collaborative and cooperative collective online space, we engaged in some conversation and reaction to one another's texts. For example, a response to Charlotta's photo with a response by Anna (Figure 5):

Figure 5

Cooperative Space through Text Response



Anna was the next to share about her data generation related to the prompts. While Charlotta punctuated her words with a photo at the end, Anna began with photos, expanding upon the initially suggested three photos. She included a short explanation to a few days after on Tuesday, November 11th, 2025, followed by further explanation and narrative the following day (Figure 6).

Figure 6

Anna Offers Her Thoughts

Here are my photos, from today as over the weekend I couldn't get myself settled into the questions *enough. The words will come later but for now when I thought of a land acknowledgment and what it meant to me, I saw patterns and shapes and colors and contrast





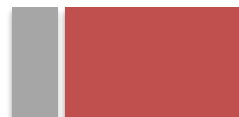
Okay, here are some thoughts that are coming to mind this morning.

I don't yet feel comfortable in saying and using the land acknowledgment even though I've been using now for almost two years at events and presentations. But something was different at TEDxBodø and I think it was because I was doing it with you, @Charlotta Knowing that I wasn't alone in trying to show an important direction to be inclusive, and like you said @Nayr, to be respectful.

It reminds me a bit of taking a pause, in general. A secular prayer of sorts of recognition and thanks. I remember going to a conference once led at a religious institution. When we went to eat, everyone paused, lowered their heads and...paused. Nothing said outloud, likely to not separate any of us from one another. And that pause felt so profound, so different too.

As I think more about the land acknowledgements in Canada and New Zealand that I know of, they are deeply meaningful as well to note the privilege and move towards action to doing something to make up for being on others' lands/ spaces, colonizing with language and bodies.

So I wonder, is the land acknowledgement *enough?



No. But it is something and starting somewhere is important.

Which then makes me think about the power of showing a presence, like the linguistic landscape @Nayr. For more than a couple decades I've been interested in how popular culture influences us...and language is a part of our popular life, in signs, in signatures, in meetings. So, maybe it is *enough for now.

After Anna texted the set of photos, Nayr shared that same day focusing on just words. She linked many ideas from her time at the university and in the city, as well as related to her earlier experiences traveling:

Hei... no photos from this weekend but I was asked to write about the linguistic landscape of Bodø early on when I arrived (2019) and I was surprised how little Saami I saw in the landscape... I suddenly realized that it's still rather hidden to the naked eye - you need to make an effort to find it - of course there's the university and I have added Saami to my email signature (thanks to you Anna)!

I first experienced the land acknowledgment in Canada at Queens university on the project Canope - it was an interesting experience and I wondered why we didn't have one in Norway - now we do! But I always feel rather uncomfortable - imposter syndrome, I guess! I'm not Sámi or indigenous - I don't have that experience or background or pain. In actually a descendant of a colonizing country - so how legitimate am I? Double non-belonging - I'm not Norwegian either - but recognition, respect is key!²

Results

Unfolding: How the Land Acknowledgement Has Been Used

When we first started thinking of the next steps for the Sámi land acknowledgment and our research, the first step was to identify how it has been used. Through a reflective process, we sat down to try identifying details of how we have used the land acknowledgment, such as the type of event, the date, who read it each time, and the other people involved. Although we aren't able to articulate most of the details from the events we were involved in, there is one case where we don't have all the information about the people involved. Likewise, it's possible that the land acknowledgement has been used in another instance that we're not aware of. Part of the purpose of itemizing these details is to consider the influence of audience members and/or participants in the space being exposed to the practice of reading and/or seeing/listening to it (Table 2).

In June 2024, the land acknowledgement was published as a sample use (CohenMiller Ness, & Martin, 2024). During that year, it was used four times and read by different people each time. I (Anna) invited various people to read it, starting with the coordinator of a Sámi research center, followed by other coordinators of the program I was leading. Once I read it at the beginning of a talk I gave at an online event. In 2025, the Sámi land acknowledgement was read seven times, including expanding its use beyond events I led, into the welcoming for another university event (which included international students as well), by another faculty members, and for the first time at a public community event. We can estimate that approximately 340 people, including students from our university and others, faculty members, staff members and community members locally have heard the Saami land acknowledgement. One particularly salient feature was a faculty member (from a Canadian context who is used to land acknowledgments) who heard it at a teaching event and thanked us for developing it and asked to use it in her lecture about Saami health.

Table 2
Sámi Land Acknowledgement Learning Contexts

Date (reverse chronological order)	Event	In person	Online	Who read the land acknowledgment	People in the audience/ participants (approx. no.)	Student	Faculty members	Staff members	Community members
Oct 2025	TEDxBodø	x		Charlotta, invitation to full audience to read along	100	x	x	x	x
June 2025	Summer School opening	x		Charlotta (asked Anna to use it after seeing her use it elsewhere)	50	x	x	x	
May 2025	Lecture for nursing students		x	Faculty member lead.	20	x			
May 2025	Ed. Prof. development		x	Anna	40		x	x	
April 2025	Master's Program Research Seminar III	x		Nayr	10	x	x	x	
Feb 2025	Master's Program Welcome	x		Coordinator	15	x	x	x	
Oct 2024	Master's Program graduation	x		Coordinator	15	x	x	x	
Aug 2024	Master's Program Research Seminar III	x		Coordinator	15	x	x	x	
April 2024	Teaching conference workshop		x	Anna	50	x	x		
Jan 2024	Master's Program welcome	x		Lead for the university Sámi research center	25	x	x	x	
Learning: 340 people									

Figure 7

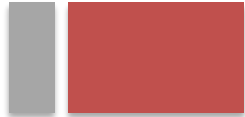
Wordcloud And Table Of The 30 Most Frequently Used Words In Our Texting Narratives

Word	Length	Count	Weighted Percentage	Similar Words
land	4	15	2,98%	land, lands
acknowledgment	14	11	2,19%	acknowledgement, acknowledgements, ackn...
feel	4	7	1,39%	feel, feelings, feels
nord	4	7	1,39%	nord
bodø	4	5	0,99%	bodø
part	4	5	0,99%	part
paused	6	5	0,99%	pause, paused
photos	6	5	0,99%	photo, photos
something	9	5	0,99%	something
belonging	9	4	0,80%	belong, belonging
like	4	4	0,80%	like, likely
respect	7	4	0,80%	respect, respectful
sons	4	4	0,80%	son, sons
thoughts	8	4	0,80%	thought, thoughts
write	5	4	0,80%	write, write
asked	5	4	0,80%	asked
love	4	4	0,80%	love, loved, lovelies
now	3	4	0,80%	now
one	3	4	0,80%	one
think	5	4	0,80%	think
weekend	7	4	0,80%	weekend
care	4	3	0,60%	care
enough	6	3	0,60%	enough
even	4	3	0,60%	even
landscape	9	3	0,60%	landscape
landscape	9	3	0,60%	landscape
saami	5	3	0,60%	saami
tedxbodø	8	3	0,60%	tedxbodø
university	10	3	0,60%	university
answer	6	3	0,60%	answer, answered
come	4	3	0,60%	come, coming

As part of any data interpretation are decisions. This is particularly important when we think about the ways we can embed justice-centered decision making into mixed methods research (CohenMiller & Grace, 2026). One such decision was in our transcription of the text in the WhatsApp group. While retaining the exact words spoken or written can be a means to allow voice of participant-researchers to come through, it can also diminish the voice through distracting and removing power from the content. The decisions in translation in research practices emphasize how to embed and consider such justice-centered decisions (see Eng’s Insight from Practice, in CohenMiller & Grace, 2026). As such, in the text messages, we made minor edits for clarity, including removing emoji’s that did not transfer to the Word document and a correction of spelling.

What notes are emphasized? Which ideas? *Paused. Belonging. Respect.* Those words jump out. Almost as if they are speaking to us, *what is important about a land acknowledgement?* A chance to pause. A coming together of belonging. An opportunity to show respect. So, what can that mean in looking through, reading, taking in our narratives, the set of dates and people included in reading with and for the land acknowledgment? It means a consideration of what is said, and what is included, and what is not there.

And lastly, but perhaps most importantly, we are left with questions that need to remain open. *Whose voices are missing? What perspectives are still needed? What are the next steps for moving forward to decolonize spaces and places and how, if any, can a land acknowledgment take a role to affect this change?* It’s not a “neat” ending, it’s messy, as people are, and research. And it’s a continuing unfolding process of justice-centered praxis – of research and informal learning.



Discussion, Conclusion and Recommendation

*...how can we become more critically self-reflective
to support these practices and ultimately empower others
and ourselves to do the important work needed to
make our societies and world more just?*

- emphasis in original, CohenMiller, 2023, p. 46

In conclusion, the integration of justice-centered mixed methods research with the weaving together of texting and arts-based methods with particular attention to CDP offers a powerful direction for unpacking systemic inequities through informal learning practices. Through our autoethnographic narratives and photos, we have seen ways to continue the SIDES of CDP to embed social justice, inclusion, diversity, equity, and social responsibility into the topic of Indigenous land acknowledgments.

The implications of this study provide significant potential for justice-centered mixed methods research and the arts to better understand societal injustices and determine potential steps to influence positive change. Such research practice brings together theoretical frameworks with real-world applications that can guide work with communities.

At the heart of our work in this article is twofold, a texting, arts-based response to the call to action from Onwuegbuzie and Abrams (2024) for “integrative, transformative approaches to research” that are “socially meaningful and transformative” (p. 218). And with this response, further research is needed to further understand questions around how best to honor and respect the Indigenous peoples and lands as individuals, as higher education institutions, and as society, while recognizing such differences as generational, geographic, and linguistic practices. And secondly, this article offers a practical set of tools (and toolkit in the Appendix) for all committed to re-envisioning spaces and seeking to decolonize higher education and beyond to offer awareness, respect, and honor in a land acknowledgment as the first step towards meaningful change.

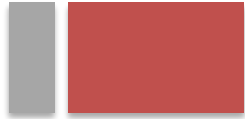
Appendix

Toolkit for Using a Land Acknowledgment

We have developed this short toolkit for others interested in developing a land acknowledgment for themselves and/or their related institutions.

1. Put together a team of interested individuals.
2. Research the topic locally to confirm that a land acknowledgment hasn't already been created for the area.
3. Reach out to the local Indigenous communities to assess their interest to connect and collaborate and join the team.
4. Draft a land acknowledgement and share with team members and others who would have diverse perspectives and insight into the cultural contexts. (See below for a sample land acknowledgement.)
5. Determine which languages the land acknowledgement should be translated into, and which to use in which contexts.
6. Include the land acknowledgement in written spaces (e.g., email signatures, websites).
7. Determine who will speak the land acknowledgement (e.g., events, workshops) recognizing that each choice of person highlights a particular perspective and can appear to devalue others. Consider having everyone read aloud together.

Sample Land Acknowledgement



I acknowledge and respect the history, languages, and cultures of the Indigenous people of this land, whose presence continues to enrich our institutions. I say thank you in [the local language - _____ -] for the opportunity to work and connect with the community in these spaces.

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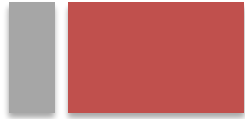


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