

VISUALIZING KNOWLEDGE: ENHANCING ESP STUDENTS' LEARNING THROUGH DIGITAL POSTER-BASED COLLABORATIVE LEARNING

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ABSTRACT

The integration of technical knowledge and oral communication remains a persistent challenge in English for Specific Purposes (ESP) classrooms, particularly in health-related disciplines where students are required to master complex subject matter while communicating it effectively in English. This study investigates the effectiveness of a digital poster-based collaborative learning model in enhancing both technical comprehension and oral communication skills among first-semester Speech Therapy students. The study aimed to examine how an integrated pedagogical approach combining digital tools, collaborative learning, and multimodal strategies influences students' learning outcomes in an ESP context. A Classroom Action Research design consisting of two cycles was implemented with 138 students in a health polytechnic institution. Data were collected through pre-test and post-test assessments, oral presentation rubrics, classroom observations, and semi-structured interviews. Quantitative data were analyzed using descriptive statistics and paired-samples t-tests, while qualitative data were analyzed thematically. Findings showed a significant improvement in students' performance, $t(137) = -47.88$, $p < .001$, with post-test scores ($M = 78.57$, $SD = 6.08$) exceeding pre-test scores ($M = 50.80$, $SD = 7.23$). Qualitative results indicated increased engagement, improved conceptual understanding, and greater communicative confidence. Digital posters supported information synthesis, while collaboration facilitated peer scaffolding and reduced speaking anxiety. Multimodal learning enhanced cognitive processing through the integration of visual, written, and oral modes. The study concludes that digital poster-based collaborative learning effectively improves technical and communicative competencies in ESP settings and offers a practical framework for integrating digital literacy, collaboration, and multimodal pedagogy in health education.

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INTRODUCTION

In an increasingly globalized healthcare environment, the ability to integrate specialized knowledge with effective communication is a critical competency for future professionals. During the foundational stages of speech therapy education, students face a significant pedagogical challenge: mastering complex technical content while articulating these concepts in English as a second language. This dual demand often leads to cognitive overload, where technical precision is compromised for linguistic fluency, or vice versa. Traditional instructional methods frequently treat content acquisition and language proficiency as separate domains, limiting students' readiness for integrated clinical practice (Mohr et al., 2022). Despite growing calls for innovative strategies to bridge this divide (Acevedo-Go & Butial, 2024; Eury & Hawk, 2023), current health education curricula lack a unified framework that simultaneously addresses technical comprehension and professional communication.

The integration of digital materials, collaborative learning, and multimodal strategies has been proposed as a potential solution (Fatihatussa'adah et al., 2024; Sabir et al., 2025). However, existing literature presents conflicting findings regarding their effectiveness when applied separately. While digital resources can significantly increase engagement (Gause et al., 2022a; Li & Chu, 2021), they may also lead to superficial learning without structured pedagogical guidance (A. Joubert, 2019; Budi et al., 2024). Similarly, collaborative learning promotes peer interaction and soft skills (Navila et al., 2023; Bjorn, 2024), yet it can result in unequal participation or linguistic dominance by high-achieving students (Männistö et al., 2020). These inconsistencies reveal an important empirical gap regarding how these strategies should be effectively integrated without allowing one skill to overshadow another.

Existing studies also tend to generalize findings from broader health or language education settings without sufficiently addressing the specific communicative demands of speech therapy training (Ben-Aharon, 2019). Accordingly, a clear research gap emerges: there is limited empirical exploration of integrated pedagogical models that simultaneously develop technical comprehension and oral communication in discipline-specific contexts such as speech therapy. Addressing this gap requires moving beyond isolated instructional strategies toward a cohesive framework integrating digital, collaborative, and multimodal elements.

To address these limitations, the present study implements an integrated pedagogical approach using digital poster presentations within collaborative learning activities. The model requires students to analyze digital materials, synthesize information, and present their understanding through multimodal representations. Grounded in social constructivism and multimodality, the study conceptualizes learning as an interactive and representational process. The following research questions guide the study: (1) How does the integration of digital poster presentations influence students' comprehension of technical speech therapy concepts? (2) To what extent do collaborative multimodal tasks enhance students' ability to articulate these concepts in English?

These questions emerge from the theoretical and empirical limitations identified in previous studies. It is hypothesized that a structured, collaborative, and multimodal instructional approach can significantly improve both content understanding and oral communication skills. Furthermore, the study assumes that such an approach can enhance learner engagement and autonomy by positioning students as active participants in knowledge construction. Ultimately, this research aims to demonstrate that an integrated pedagogical model provides a theoretically grounded and context-sensitive framework for addressing the dual demands of content mastery and professional communication in health education.

RESEARCH METHOD

Research Design

This study employed a Classroom Action Research (CAR) design to investigate the effectiveness of a digital poster-based collaborative learning model in improving ESP students' technical comprehension and oral communication skills. The research was conducted in two iterative cycles, each consisting of the stages of planning, action, observation, and reflection. The first cycle focused on the implementation of digital poster creation in collaborative groups, while the second cycle emphasized instructional refinement through vocabulary scaffolding, structured peer feedback, presentation modeling, and reflective activities.

A mixed-methods approach was adopted to provide a comprehensive understanding of the intervention's impact. Quantitative data were collected through pre-test and post-test assessments to measure students' learning gains, while qualitative data were obtained from classroom observations and semi-structured interviews to explore students' learning experiences and engagement. The integration of both data types allowed for methodological triangulation and strengthened the validity of the findings.

Population and Sample

The population of this study consisted of first-semester students enrolled in the Speech Therapy program at the Health Polytechnic of Surakarta, Indonesia. From this population, 138 students were selected as the sample using purposive sampling. The participants were chosen based on their enrollment in a foundational English course that required the integration of technical knowledge and oral communication skills in an ESP context.

The sample included 112 female students and 26 male students, reflecting the natural gender distribution within the program. This demographic composition was considered relevant for examining collaborative learning dynamics and communication development in classroom action research settings. All participants were actively involved in the two-cycle instructional intervention, including group-based digital poster creation, presentations, peer feedback sessions, and reflective learning activities.

Table 1
Students gender distribution

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Female	112	81.2	81.2	81.2
Male	26	18.8	18.8	100.0
Total	138	100.0	100.0	-

Instruments

Multiple instruments were used to ensure data triangulation and methodological rigor. A pretest and post-test measured students' baseline technical understanding and learning

gains after the intervention. Students' oral presentations were evaluated using a structured rubric assessing content accuracy, vocabulary use, fluency, clarity, organization, and confidence. Classroom observations were conducted using a checklist to document engagement and interaction patterns across both cycles. In addition, semi-structured interviews with selected participants were carried out to explore students' perceptions and learning experiences. The combination of quantitative and qualitative instruments strengthened the validity and credibility of the findings.

Data Analysis

This study adopted a mixed-methods analytical approach, integrating quantitative and qualitative procedures to provide a comprehensive evaluation. Pretest and post-test scores were analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics (means and standard deviations) summarized overall performance. A paired-samples t test was conducted to determine whether differences between pretest and post-test scores were statistically significant. This inferential analysis provided empirical evidence of the intervention's effectiveness. Qualitative data from interviews, observation notes, and reflective documentation were analyzed using thematic analysis. The analysis followed systematic stages: data familiarization, coding, theme development, categorization, and interpretation. This approach enabled the identification of recurring patterns related to student engagement, vocabulary development, communicative confidence, and perceptions of digital and collaborative learning strategies. The qualitative findings provided contextual depth and explanatory support for the quantitative results.

RESEARCH FINDINGS AND DISCUSSION

Research Findings

Student's Profile

Participant gender distribution is crucial for subgroup analyses to determine whether the intervention had different impacts on male and female students, thereby revealing potential gender-related learning differences (Petrochko et al., 2024).

Based on Table 1, the study group is predominantly female, with 112 participants, accounting for a significant 81.2% of the total sample. In contrast, male students represent a much smaller minority, with only 26 participants (18.8% of the cohort). This pronounced gender skew is a critical characteristic of the research population. Given the study's objectives to enhance technical understanding and, particularly, oral communication proficiency through collaborative digital projects, the findings will predominantly reflect the experiences, learning patterns, and collaborative dynamics of female ESP students. The overwhelming majority of females in the sample is a key contextual factor that should be considered when interpreting the investigation's outcomes and generalizing its conclusions about the model's effectiveness.

The Implementation of the Model

This study employed a two-cycle Classroom Action Research (CAR) design to improve students' technical understanding and oral communication skills through digital poster-based collaborative learning. The implementation process in each cycle is summarized in Table 2.

Table 2
Two-cycle CAR framework

Cycle	Phase	Action	Outcome
1	Plan→Act→Observe→Reflect	Implemented initial digital poster task	Identified gaps in language use, presentation skills, and group dynamics

2	Revise→Act→Observe→Reflect	Added vocabulary support, modelling, peer feedback, and reflection	Achieved significant improvements in comprehension, fluency, and engagement
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Cycle 1: Establishing the Foundation

The first cycle focused on introducing students to digital poster-based collaborative learning. During internal group discussions, students clarified concepts, exchanged ideas, and practiced discipline-specific vocabulary in English.

Phase 01: Creating Digital Posters in Groups (Digital + Collaborative)

Students were organized into heterogeneous groups of four to five members and assigned the task of investigating a specific speech therapy tool (e.g., the prompt technique, articulation apps, or nasometry devices). Each group accessed a curated set of digital materials, including clinical guidelines, instructional videos, peer-reviewed articles, and professional websites. Using tools such as Google Slides, Canva, or PowerPoint, students co-constructed digital posters that synthesized key information about the tool's purpose, mechanism, clinical application, and evidence base. This phase leveraged digital integration to expose students to authentic, discipline-specific resources, fostering early engagement with professional discourse. The collaborative nature of poster creation encouraged distributed cognition, students divided research tasks, debated interpretations, and negotiated meaning collectively. By engaging in multimodal design (combining text, diagrams, icons, and embedded media), learners processed complex technical information through multiple sensory channels, supporting deeper cognitive encoding and conceptual understanding.

Phase 02: Group Discussion (Collaborative + Reflective)

Following initial research and design, groups engaged in structured internal discussions to refine their understanding and finalize poster content. Guided by instructor-facilitated questions (e.g., "How does this tool support motor planning in children with apraxia?"), students clarified terminology, verified factual accuracy, and improved the logical flow of information. These discussions promoted peer-mediated learning, where students scaffolded each other's comprehension through dialogue. The social negotiation of meaning not only strengthened content mastery but also provided a low-pressure environment for practicing discipline-specific vocabulary in spoken English.

Phase 03: Presentation

In the presentation phase, each group delivered a five-minute oral presentation. Classroom observations revealed several challenges: many students relied heavily on reading slides, demonstrated limited use of technical terminology, and showed unequal participation within groups. These findings provided the empirical basis for instructional revisions in the second cycle.

Cycle 2: Refinement and Enhancement

The second cycle focused on improving students' communicative confidence and technical vocabulary usage. Instructional modifications included vocabulary scaffolding, presentation modelling, structured peer feedback, and self-reflection activities. During peer feedback sessions, students evaluated presentations using a standardized rubric covering content accuracy, visual organization, clarity of spoken English, and medical terminology. This activity encouraged active English communication and constructive critique.

Phase 04: Peer Feedback Session (Collaborative + Language-Sensitive)

A structured peer feedback session followed the presentations. Students used a standardized presentation rubric to evaluate peers across four domains: content accuracy,

visual organization, clarity of spoken English, and use of medical terminology. Feedback was required to be constructive and specific (e.g., “Adding a diagram of the vocal tract would help explain resonance disorders”). This phase transformed the classroom into a community of practice, where students learned to critique and improve professional communication. The act of giving and receiving feedback reinforced metalinguistic awareness and encouraged students to reflect on their own performance. Notably, peer interaction in English increased significantly during this phase, demonstrating the social dimension of language acquisition

Phase 05: Self-Reflection (Metacognitive + Learner Autonomy)

Students also completed reflective journals describing their learning experiences. Most reported that collaborative learning reduced presentation anxiety and improved conceptual clarity. Pre- and post-content comprehension tests showed an average 27% improvement. While gains were notable, thematic analysis of journals also highlighted instances of collaboration fatigue and varying comfort levels with peer evaluation, indicating that the model’s impact depended on individual student resilience and prior digital literacy.

Phase 06: Evaluation and Data Synthesis

To ensure methodological rigor, the normality of the data distribution was assessed using Skewness and Kurtosis tests (Table 3), confirming that the data met the assumptions for parametric testing. Pre- and post-content comprehension tests showed an average 27% improvement. While these gains are noteworthy, they must be interpreted with caution. Thematic analysis of student journals, while generally positive, also highlighted instances of “collaboration fatigue” and anxiety regarding peer evaluation, suggesting the model’s success varied depending on individual student resilience and prior digital literacy.

Students’ Pretest and Post-test Analysis

To examine intervention effectiveness, pre-test and post-test scores were analyzed using descriptive statistics and paired-samples *t*-tests (Table 3).

Table 3
Students’ pre-test and post-test scores

Score	N	Mean	Std. Deviation	Std. Error Mean	Min	Max	Skweness	Kurtosis
Pre-Test	138	50.80	7.23	0.62	38	65	-0.1	0.63
Post-Test	138	78.57	6.08	0.52	70	92	0.82	0.81

The analysis revealed a significant positive change ($p < .001$, $t = -47.88$). The calculated Cohen’s *d* was 4.16, indicating a very large effect size. However, the dramatic shift where the post-test minimum (70) exceeded the pre-test maximum (65) warrants critical scrutiny. While this suggests a strong instructional impact, it may also reflect a “teaching-to-the-test” effect or the inherent nature of the assessment instruments, which were closely aligned with the intervention’s specific terminology. Furthermore, the “novelty effect” of using new digital tools may have temporarily inflated engagement levels.

Table 4
Descriptive statistics of pre-test and post-test scores

	Mean Difference	Std. Deviation of Difference	Std. Error of Difference	t	df	sig. (2-tailed)
Pre-test, Post-test	-27.77	6.74	0.58	-47.88	137	0

The post-test mean score ($M = 78.57$, $SD = 6.08$) was substantially higher than the pre-test Mean ($M = 50.80$, $SD = 7.23$). Notably, the post-test minimum score (70) exceeded the pre-test maximum (65), indicating a comprehensive upward shift in cohort performance. The paired-samples t-test confirmed a statistically significant difference, $t(137) = -47.88$, $p < .001$, with a very large effect size (Cohen's $d = 4.16$). These findings suggest that the digital poster-based collaborative learning intervention effectively improved students' technical understanding and oral communication skills.

Students' Skills Utilization

The intervention involved multiple language skills, with engagement distributed as follows: Reading (41.8%), Speaking (28.9%), Writing (19.9%), and Listening (9.4%). Reading dominated the initial research and material synthesis phases. Speaking was primarily utilized during group discussions and final presentations. Writing supported poster development and note organization, while listening occurred mainly during peer presentations and classroom discussions. These results indicate that the intervention supported multimodal learning by integrating receptive and productive skills throughout the instructional process.

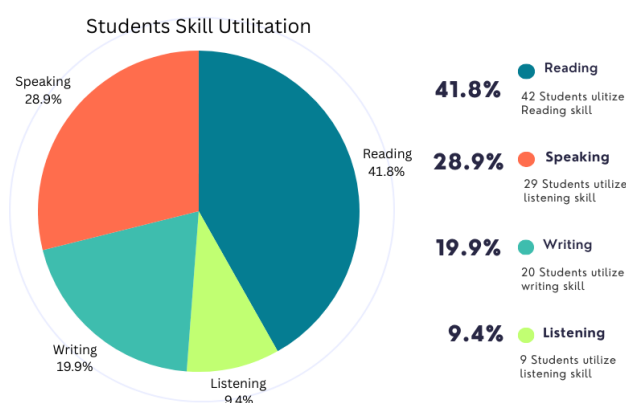


Figure 3. Student's skill utilization

The data reveal that Reading was the primary skill utilized, accounting for 41.8% of student engagement. This high proportion is analytically significant as it underscores the “input-heavy” nature of the initial research phase. Students were required to navigate complex clinical guidelines, peer-reviewed articles, and technical specifications of speech therapy tools. This suggests that the model effectively fostered digital literacy and academic decoding, though it also implies that a substantial portion of student effort was spent on individual or group-mediated comprehension rather than active production.

Speaking constituted 28.9% of the engagement, primarily driven by the “social negotiation of meaning” during group discussions and the final oral presentations. The shift from reading to speaking indicates a successful transition from receptive to productive language use. However, while significant, the 19.9% allocated to Writing highlights a potential limitation of the digital poster format. The multimodal nature of the task encouraged concise, bulleted text and visual icons over extended syntactical composition. While this mirrors modern professional communication, it may result in fewer opportunities for students to develop formal academic writing stamina.

Most notably, Listening was the least utilized skill at 9.4%. From a critical perspective, this discrepancy reveals a “reception gap” in the peer-feedback cycle. While students were highly active in presenting (Speaking) and researching (Reading), their engagement with the oral output of their peers was significantly lower. This low percentage suggests that the

“Community of Practice” was somewhat asymmetrical, focusing more on individual group output than on collective auditory processing. This finding serves as a vital point for future pedagogical adjustment, indicating a need for more rigorous, listening-dependent tasks (e.g., peer interviews or live synthesis of peer presentations) to ensure a more balanced development of communicative competence.

The Collective Impact: Synergy of Digital, Collaborative, and Multimodal Strategies

Semi-structured interviews revealed positive perceptions categorized into three themes: digital strategy, collaborative strategy, and multimodal strategy (Table 5).

Table 5
Students interview feedback

Main Theme	Sub Theme	Students Opinion
Digital Strategy	Increased Motivation & Engagement	“It felt like a creative project, not just a normal assignment.” “It was honestly fun... it felt more like a creative project. It made me want to make it look good”
	Deeper Information Synthesis	“The limited space forced us to choose the most important ideas.” “The poster has limited space. We couldn’t just copy-paste... It forced us to summarize and really understand”
Collaborative Strategy	Peer Scaffolding & Shared Knowledge	“I finally understood when my friend explained it in a simpler way” “When my friend explained it using a simple analogy for our poster, it finally clicked. It’s easier than from a lecturer.”
	Development of Communication Skills	“We had to use English for real discussion and debate.” “We had to use English to discuss everything... It was real practice, not just a classroom exercise.”
Multimodal Strategy	Holistic & Deeper Understanding	“I learned it in three ways: writing it, visualizing it, and speaking it.” “By the time we presented, I knew the topic inside and out because I had processed it in three different ways: writing it, visualizing it, and speaking it”
	Catering to Diverse Strengths	“The visual poster was my guide when I felt nervous in presenting.” “The presentation was the most challenging part for me. But I felt more confident explaining it. The poster was like my guide”

The analysis of student feedback indicates that the digital strategy functioned as a dual-purpose catalyst. Students initially perceived the task as a “creative project” rather than a conventional assignment, suggesting a shift toward greater intrinsic engagement. The use of digital tools such as Canva and Google Slides introduced natural design constraints that required students to prioritize and organize information more carefully. This limitation encouraged more selective processing of content, as students needed to identify and synthesize the most relevant speech therapy concepts. This contributed to the development of higher-order thinking skills, particularly synthesis and evaluation, as reflected in the interview data presented in Table 5.

The collaborative dimension fostered a supportive learning environment where peer explanations played an important role in understanding complex material. Students reported that explanations from classmates were often clearer than those from the lecturer, indicating effective peer-mediated scaffolding. Within this process, learners helped each other simplify technical clinical terminology and negotiate meaning through English communication. This interaction created more opportunities for meaningful language use beyond rehearsal

activities, which in turn increased students' confidence in speaking during group discussions and presentations.

The multimodal aspect of the project contributed to what students described as a more holistic understanding of the material. This can be explained through Dual Coding Theory, which suggests that combining visual and verbal information enhances cognitive processing and recall. Students also reported that the digital poster served as a practical guide during presentations, helping them organize ideas and reduce cognitive load. By integrating writing, visual representation, and oral explanation, students engaged in multiple forms of processing that supported deeper understanding of the subject matter.

The interview findings in Table 5 show that digital learning activities increased student motivation and engagement. Collaborative interaction supported clearer conceptual understanding through peer explanation, while multimodal representation improved confidence and clarity in communication. These findings collectively suggest that the integration of digital, collaborative, and multimodal strategies contributed positively to both technical comprehension and oral communication skills in ESP learning contexts.

Discussion

The findings of this study demonstrate that the implementation of the two-cycle pedagogical model successfully shifted students from passive content consumption to active, multimodal knowledge construction. Although the cohort was predominantly female ($n = 112$), the consistent improvement in performance suggests that the model's effectiveness was not limited by gender-related learning preferences but rather supported broader cognitive and social scaffolding processes. This aligns with previous research indicating that multimodal activities, such as digital poster creation, can enhance engagement across diverse student populations (Cipta et al., 2025; Imansyah & Utama, 2023; Sabir et al., 2025).

The first cycle functioned as an introductory phase that facilitated peer interaction, vocabulary practice, and information synthesis. This supports social constructivist principles, which emphasize collaborative knowledge construction (Fatihatussa'adah et al., 2024; Yang & Wilson, 2011). The use of digital posters enabled students to organize and communicate technical information more effectively, consistent with findings by Männistö et al. (2020) on multimodal comprehension. Visual elements in the posters acted as cognitive support during oral presentations, helping students explain technical concepts with greater confidence.

The second cycle significantly improved communication performance and learner autonomy. The inclusion of peer feedback and self-reflection shifted the focus from final products to continuous learning processes. Peer feedback encouraged collaborative evaluation of content accuracy, language use, and presentation quality, aligning with research on the role of peer interaction in promoting communication skills (Al-Mutrafi, 2020; Tschirhart & Pratt-Adams, 2019). Reflective activities further supported learner autonomy, as students became more aware of their strengths and areas for improvement (Marantika, 2021). The iterative nature of the model supports continuous improvement in task-based learning.

Quantitative findings revealed a substantial improvement in test scores, with the post-test minimum exceeding the pre-test maximum. Reading (41.8%) and speaking (28.9%) were the most utilized skills, reflecting a strong emphasis on active communication and collaborative interaction. Although listening accounted for a smaller percentage (9.4%), this distribution highlights the model's focus on production and multimodal synthesis rather than passive reception. The digital poster format also encouraged students to summarize and organize information, reflecting higher-order thinking skills associated with Bloom's Taxonomy (Kim, 2020; Yousef et al., 2025).

Qualitative findings further support these results, indicating that digital activities increased motivation, peer scaffolding facilitated understanding, and multimodal processing

strengthened retention. Students reported that using English during group discussions provided authentic communication practice beyond conventional exercises.

Despite these strengths, several limitations should be acknowledged. The predominance of female participants may limit generalizability to different educational settings. Additionally, listening activities were less dominant, suggesting that future iterations should incorporate more listening-oriented tasks to support balanced language skill development. Overall, the study demonstrates that digital poster-based collaborative learning can create a more active, reflective, and communicative ESP learning environment.

CONCLUSION

This study demonstrated that digital poster-based collaborative learning effectively improved students' technical understanding and oral communication skills in an ESP classroom context. The integration of digital, collaborative, and multimodal strategies encouraged active participation, peer interaction, and deeper comprehension of speech therapy concepts. The two-cycle CAR model further supported learner autonomy and communicative confidence through structured peer feedback and reflective activities.

The findings highlight the role of digital multimodal learning as a cognitive scaffold that helps students organize, synthesize, and communicate technical information more effectively. However, the results should be interpreted cautiously due to the short intervention period, the gender imbalance in the sample, and the limited focus on listening activities. Future studies are recommended to investigate the long-term impact of this model, involve more diverse participant groups, and incorporate balanced language-skill activities across different ESP learning contexts.

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INFORMED CONSENT STATEMENT

Participation in this study was voluntary. Prior to participation, all participants were provided with clear information regarding the study's objectives, procedures, potential risks, and anticipated benefits. Participants were assured of the confidentiality of their personal information and informed that all data collected would be used solely for research purposes. They were also informed of their right to withdraw from the study at any time without penalty. Informed consent was obtained from all participants prior to data collection.

DATA AVAILABILITY STATEMENT

The data generated and analyzed in this study are not publicly available because they contain information that could compromise participant privacy and confidentiality. Restricting public access ensures compliance with ethical research principles and applicable data protection regulations. Nevertheless, the dataset may be made available to qualified researchers upon reasonable request for verification or further analysis. Any such request will be reviewed on a case-by-case basis and will require prior approval from the appropriate institutional ethics authority.

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