

Conditions Shaping AI Implementation in K–12 Schools: A Case Study of Khanmigo

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Abstract

Grounded in the Technology Acceptance Model (TAM), this qualitative case study examines how K–12 teachers and administrators perceive and implement Khanmigo, an artificial intelligence tool, within their instructional practice. Drawing on multiple data sources and thematic analysis, the study explores how perceived usefulness, ease of use, and organizational conditions shape adoption. Findings reveal that educators’ engagement with Khanmigo is driven by instructional alignment and efficiency, yet mediated by leadership guidance, professional learning, and policy clarity. This study contributes insight to emerging AI-in-K–12 scholarship and offers policy-relevant implications for district-level AI governance and implementation frameworks.

Keywords: Artificial intelligence, Khanmigo, K–12 education, Technology acceptance model, Qualitative case study, Educational policy

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Introduction

Artificial intelligence (AI) is increasingly shaping instructional practice and educational policy discussions, particularly through the promotion of AI-enabled tools such as intelligent tutoring systems, adaptive learning platforms, and virtual assistants. These tools are often positioned as solutions for instructional differentiation, teacher workload reduction, and student engagement, despite limited empirical evidence guiding their effective adoption (Holmes et al., 2019; Luckin et al., 2016). Prior research highlights persistent challenges related to AI integration including teacher readiness, the absence of implementation frameworks, and uncertainty regarding how AI tools align with established pedagogical practices (Zawacki-Richter et al., 2019). As a result, both researchers and policymakers lack clear guidance on the conditions under which AI contributes meaningfully to teaching and learning. Because districts increasingly function as key decision-makers for AI adoption in schools, understanding implementation in practice is essential for informing local policy design, guidance, and oversight.

Given these unresolved questions, there is a growing need for empirical, context-rich studies that examine how AI tools are implemented in real school systems. In particular, districts that have moved beyond isolated pilots to sustained, system-wide use provide valuable insight into the organizational, instructional, and human factors shaping AI adoption. In a Midwestern state, Lake Public Schools (pseudonym) has emerged as a national model for AI implementation through its partnership with Khan Academy, serving as a pilot site for the AI-powered personal tutor and teaching assistant, Khanmigo. The platform was introduced in Geometry, Algebra I, and Science classrooms just after the launch of Khanmigo in fall 2023.

After three years of Khanmigo integration, teachers reported that students' grades had improved, and the district announced an expansion of Khanmigo to all high school subjects and grade levels in fall 2025. While system-wide implementation of AI remains uncommon in K-12 settings, recent literature documents a range of challenges that often complicate effective integration, including teacher resistance, concerns about data privacy, ethical dilemmas surrounding AI's role in decision-making, and the potential for algorithmic bias (AlAlil & Wardat, 2024; Dilbert et al., 2024; Pavlik, 2023). Understanding how Lake Public Schools navigated these well-documented challenges during its integration of Khanmigo offers valuable insight into how educators perceive AI tools and respond to the practical, organizational, and policy-related demands of implementation. Examining these experiences may inform the development of sustainable, scalable models of AI integration in public education.

Because teacher and administrator perceptions play a critical role in shaping adoption, instructional practice, and student experiences, this study investigates the perspectives of educators involved in Khanmigo's implementation within Lake Public Schools, and the following research questions guided the inquiry.

Research Questions

1. How do teachers and administrators in Lake Public Schools perceive the usefulness and usability of Khanmigo in classroom instruction?
2. What instructional adaptations have emerged as a result of Khanmigo's implementation?
3. What barriers and supports have influenced the adoption and integration of Khanmigo in Lake Classrooms?
4. What are teacher perceptions regarding the influence of Khanmigo on student engagement and learning outcomes?

Theoretical Framework

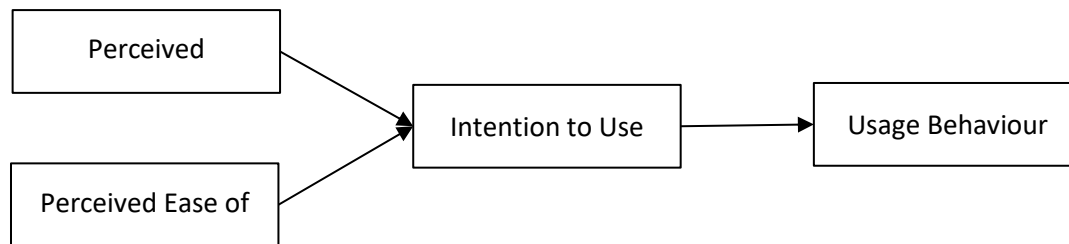
This study is grounded in the Technology Acceptance Model (TAM) (Davis, 1989), a foundational framework in technology adoption research that explains engagement with new technologies. Four constructs typify the TAM framework: perceived usefulness, perceived ease of use, intention to use and usage behavior (Davis, 1989). Perceived usefulness refers to the extent to which an individual believes that using a technology will enhance professional effectiveness or outcomes (Davis, 1989). In educational settings, this may include improving instructional efficiency, strengthening student learning, supporting differentiation, or expanding feedback capacity. Perceived ease of use reflects the degree to which a technology is experienced as understandable, navigable, and manageable within the constraints of daily practice (Davis, 1989). Technologies that require excessive time, technical expertise, or disruption to established routines are less likely to be sustained, even if their potential benefits are recognized. Within TAM, perceived ease of use also shapes perceived usefulness, as tools that are easier to integrate are more likely to be viewed as practically valuable.

TAM posits that individuals are more likely to integrate a tool into their professional practice when they believe it enhances performance (perceived usefulness) and when it can be used with minimal cognitive or operational difficulty (perceived ease of use). These perceptions influence behavioral intention, which in turn predicts actual use. Perceived usefulness is consistently identified as the strongest predictor of adoption, while perceived ease of use contributes both directly and indirectly by shaping beliefs about usefulness (Davis, 1989; Venkatesh &

Davis, 2000). Together, these constructs, illustrated in figure 1, explain how cognitive evaluations translate into sustained implementation rather than short-term experimentation.

Figure 1

Technology Acceptance Model (TAM) by Davis (1989)



Although TAM originated as an individual-level model of technology acceptance, subsequent scholarship has emphasized the influence of contextual and organizational factors on technology adoption. In educational environments, facilitating conditions, leadership support, professional development structures, time allocation, and social norms have been shown to influence educators' willingness and ability to integrate digital tools (Teo, 2011). In K-12 systems, teachers' cognitive evaluations of a technology are rarely formed in isolation; rather, they are shaped by institutional expectations, accountability pressures, instructional culture, and available support. As a result, perceptions of usefulness and ease of use are embedded within organizational conditions that either enable or constrain sustained implementation.

This contextual sensitivity is particularly relevant in the integration of artificial intelligence (AI) tools in schools. AI adoption involves instructional, ethical, and policy considerations that extend beyond basic usability. Educators must evaluate whether AI aligns with curricular goals, preserves pedagogical integrity, supports diverse learners, and adheres to appropriate safeguards for student data and responsible use. Administrators must consider system-wide consistency, professional learning alignment, and monitoring mechanisms. In this study, TAM provides a framework for examining how teachers' and administrators' perceptions of Khanmigo developed within these institutional conditions and how those perceptions influenced patterns of classroom use, instructional adaptation, and sustained engagement over time.

Methodology

This study employs a qualitative case study design to examine how the Khanmigo AI platform has been implemented in Lake Public Schools. Data sources include documents and resources gathered through AI in Education bi-monthly professional development sessions, transcripts of interviews with teachers who are utilizing Khanmigo, two focus groups, and on-campus classroom observations. The research team has engaged with teachers from Lake Public Schools across the past three years in online professional development sessions through the ECHO® platform, AI in Education ECHO sessions. The ECHO® platform provides hour-long professional learning approximately twice a month via Zoom. Educators who are using Khanmigo voluntarily come together to learn more about the platform and participate in collaborative problem solving. Hour-long sessions include a short didactic presentation by an AI expert (either a representative from Khan Academy or a professor whose research focus is AI). Following the didactic session, participants engage in collaborative problem solving where a challenge (or "case") is presented. Cases typically address a challenge that cuts across educational contexts. This professional development allows collaborative problem solving as teachers/administrators explain the challenges and opportunities they are encountering as they seek to implement AI in their classrooms. Aligning with ECHO®'s mantra of "all teach; all learn," (Egure, 2023, 2026) participants offer suggestions for addressing the problem that has been presented in the case. Transcripts of

these professional development sessions and all session documents and materials are used as sources of data for this study.

In addition to data collected through ECHO® professional development sessions, the research team has conducted over 12 hours of non-participatory classroom observations within Lake Public Schools, capturing detailed field notes on how Khanmigo is utilized during instruction. Two focus group discussions with educator-participants have been completed, allowing for the identification of shared experiences, attitudes, and perceptions of implementation opportunities and barriers. Semi-structured interviews were also conducted with nine participants including seven teachers and two administrators, to gain deeper insights into their perspectives, instructional adjustments, and perceived influence of AI on student learning. Documents include resources presented in ECHO® professional development sessions, Khan Academy professional development resources, and district guidance surrounding AI use (e.g., implementation expectations, acceptable-use guidance, communication materials, and safeguards for student use).

Data Analysis

Data analysis followed Merriam's (2019) constant comparative method and was guided by the study's research questions. Interviews, focus group transcripts, AI in Education ECHO® session recordings, and classroom observation field notes were collected collaboratively by the research team. The first author organized all data within a shared digital repository to ensure accessibility across the research team and initiated the analytic process. Open coding began with close examination of transcripts and field notes to identify discrete segments representing distinct perceptions, instructional practices, or implementation experiences related to Khanmigo's integration. Codes documented participants' language in order to preserve contextual meaning and avoid premature abstraction. Examples of early codes included phrases such as "didn't like it at first," "3 before me," "too busy... not user-friendly," "pressure from mandate," "built independence," "students ask the chat," and "monitoring email alerts."

Through axial coding, relationships among open codes were examined and organized into broader analytic categories. For example, codes related to early student frustration and expectations for direct answers were grouped under a category representing initial resistance to AI-supported learning. Codes describing routines such as "10 minutes at the beginning of class" and "3 before me" were clustered under restructured help-seeking practices. Usability-related codes referencing difficulty logging in or navigating the interface were grouped under educator-centered usability challenges. Additional categories reflected leadership advocacy, professional learning supports, mandated expectations, peer tutoring behaviors, and teacher-reported academic shifts. As new data were collected, earlier transcripts and observation notes were revisited to ensure that emerging categories remained grounded across multiple participants and contexts.

Co-authors joined the analytic process as coding progressed, contributing to the refinement of categories and the development of narrative themes. The research team met multiple times to discuss emerging patterns and clarify interpretations. These analytic conversations served to challenge assumptions, collapse redundancies, and ensure coherence between data segments and the themes ultimately reported in the findings. Categories were synthesized into themes aligned directly with the four research questions, and these themes continued to be refined as additional data were analyzed. Triangulation across interviews, focus groups, classroom observations, and professional learning artifacts enabled comparison between reported perceptions and observed practices, strengthening analytic credibility.

Researcher Positionality and Trustworthiness

The research team occupied a dual role in this study as both investigators and facilitators of the AI in Education ECHO® professional development sessions. As such, we were not external observers but participants within the broader implementation context. This positioning provided sustained access to educators' evolving perceptions and allowed us to observe how conversations about Khanmigo shifted over time. At the same time, we recognize that our presence and professional roles may have influenced how participants discussed successes, challenges, or uncertainties during interviews and group sessions. However, triangulation of data minimized the influence of this limitation.

Rather than attempting to separate ourselves from this context, we addressed positionality through transparency and triangulation. Interpretations were grounded in direct participant quotations and recurring patterns across multiple data types rather than isolated comments. Member checking occurred through follow-up engagement with participants, including a subsequent interview with one educator and opportunities during later AI in Education ECHO® sessions for participants to revisit and elaborate upon earlier statements. Classroom observations were conducted across multiple points in time rather than as single visits, allowing early impressions to be compared with later instructional practices and providing an additional layer of confirmation. These strategies strengthened credibility by ensuring that findings reflected consistent patterns across participants and settings.

Findings

Findings revealed four interrelated themes: (1) Perceived Usefulness and Usability of Khanmigo, (2) Instructional Changes and Adaptations with Khanmigo, (3) Barriers and Supports for Khanmigo Implementation, and (4) Impact on Student Engagement and Learning Outcomes. Collectively, these findings portray implementation as a developmental process rather than a fixed or uniform initiative. Teachers and administrators described learning to work with Khanmigo over time, adjusting expectations, routines, and instructional practices as they encountered both constraints and opportunities. Across data sources, participants did not present Khanmigo as a transformative solution in isolation, but as a tool, whose value emerged through sustained classroom use, applied professional judgment, and organizational support. The details that follow elaborate on each theme, illustrating how educators navigated the introduction of AI within existing instructional contexts and how its impact became visible through everyday practice.

Perceived Usefulness and Usability of Khanmigo

Teachers and administrators consistently framed Khanmigo as a valuable supplement to teacher expertise rather than a replacement for instruction. This framing appeared repeatedly across interviews, classroom observations, and AI in Education ECHO® session transcripts. Educators described Khanmigo as functioning alongside the teaching process, supporting students when teachers were unavailable, reinforcing concepts already introduced, and encouraging persistence rather than providing answers outright. In this way, Khanmigo was positioned not as an instructional shortcut but as a tool that extended instructional capacity while preserving the central role of the teacher. Specifically, Khanmigo provided virtual, individualized tutoring to support student learning needs, supplementing the role of the teacher in the learning process.

Classroom observations illustrated perceived usefulness in practice. In one Algebra I classroom observed during the spring semester of 2025, students rotated between solving equations independently at their desks and consulting Khanmigo when they encountered difficulty. Students referred to the tool as “Bob the Blob,” a nickname that reflected familiarity and reflected a sense of reduced intimidation. During a subsequent interview, the teacher explained that Khanmigo “goes through the assignment step by step... and it is encouraging,” allowing students to work through confusion until they could say, “Never mind, I’ve got it.” Field notes documented students quietly checking the chatbot before approaching the teacher, suggesting that Khanmigo supported help-seeking in ways that were accessible and non-disruptive. Across interviews, educators consistently emphasized Khanmigo’s usefulness in scaffolding problem-solving and individualizing feedback, noting that it “makes it easy for students to do assigned work, and it feels good while they’re doing it.”

Educators further described Khanmigo as useful in contexts where students entered their classrooms with uneven prior knowledge. Teachers explained that, before Khanmigo implementation, when students lacked foundational skills, they often “froze” during independent work. Khanmigo was perceived as useful because it allowed those students to access explanations independently rather than disengaging as their level of discomfort with the material increased. One teacher described supporting students who were “really low,” asking, “how did they get here?” while emphasizing that Khanmigo enabled students to work through confusion without immediately signaling difficulty to peers or the teacher. Another teacher noted that the platform made it possible to adjust instructional pacing, such as deciding when to “rewind... all the way back”, based on the learning needs that she identified in student responses. In these accounts, usefulness was tied to Khanmigo’s capacity to provide

responsive support without altering classroom expectations or drawing attention to individual learning differences.

Perceptions of usefulness were closely intertwined with educators' experiences of usability. Teachers emphasized that Khanmigo was easiest to use when it fit naturally within existing classroom routines. During ECHO® professional learning sessions, participants noted that Khanmigo was most usable when embedded into familiar structures such as bell ringers, warm-ups, or formative practice. One educator explained that when AI use was treated as optional, students were less likely to take it seriously; however, when it was part of the regular rhythm of class, it was perceived as a legitimate learning resource. Despite this perception, usability was not experienced uniformly. Teachers who were already familiar with blended learning platforms described daily, seamless use, while others encountered friction. One teacher described the interface as "too busy... not user-friendly," explaining that some students struggled to log in or locate assignments. Another reflected, "I'm old school... we did shorthand... I didn't have computers in the '80s," adding, "I can't even log in." These accounts highlight that usability depended not only on platform design, but also on educators' prior experience and confidence with technology.

Concerns about AI "thinking for the students" also shaped early perceptions of both usefulness and usability. Several educators recalled initial skepticism, with one teacher stating, "AI kind of worried me... I didn't know how that's going to work." Over time, however, teachers and administrators described growing trust in Khanmigo's design that utilizes Socratic questioning to prompt student learning. Teachers and administrators pointed to the platform's built-in "guardrails" as features that guided appropriate use and required students to engage cognitively. During ECHO® sessions, an administrator described Khanmigo's education-specific constraints as tools that "keep students inside the lane," while teachers noted that Khanmigo "doesn't just give the answer." Instead, it prompts students to explain their thinking and persist in their efforts to learn the material.

Across the dataset, perceptions of usefulness and usability converged around a shared understanding: Khanmigo was perceived as useful when it extended teacher capacity without replacing instructional judgment, and it was usable when it aligned with existing classroom routines and educator familiarity. In this way, usefulness and usability were not inherent properties of the tool itself, but emerged through educators' interactions with Khanmigo in everyday classroom contexts.

Instructional Changes and Adaptations with Khanmigo

The introduction of Khanmigo prompted educators to make incremental adjustments to how they structured instructional time, organized learning activities, and supported students during lessons. Teachers described an ongoing process of experimentation in which Khanmigo was gradually incorporated into existing classroom practices as teachers assessed where and how the tool could fit. Across interviews, classroom observations, and professional learning sessions, it was evident that these teachers were able to modify their familiar routines to include AI-supported work while maintaining established instructional goals and expectations.

One of the most common early instructional adaptations involved the development of structured routines. Teachers described intentionally setting aside short, predictable periods, often at the beginning of class, for students to interact with Khanmigo. A teacher referenced allocating "10 minutes at the beginning of each class" for Khanmigo use as a warm-up or bell ringer. In some classrooms, teachers further adapted these routines by encouraging informal naming of the tool; students referred to Khanmigo as "Bob the Blob," a practice teachers described as making the tool feel more approachable and easing integration for new students and English language learners. These adaptations reflected teachers' efforts to integrate Khanmigo into both the procedural and social fabric of the classroom.

Instructional change was also evident in how teachers restructured help-seeking and redistributed instructional attention. In some classrooms, teachers embedded Khanmigo into established help-seeking protocols, most notably through "3 before me" routines, which required students to consult their notes, peers, and then Khanmigo before asking the teacher for assistance. Observation field notes captured teachers circulating quietly during these periods, redirecting students back to Khanmigo's prompts rather than providing immediate answers. One teacher explained that this routine "built independence and reduced the line of hands in the air," allowing her to allocate instructional attention more strategically. These changes represent an adaptation in

instructional practice, as teachers altered the flow of assistance in the classroom while retaining responsibility for instructional decisions.

Teachers also described adapting instruction in response to class size, pacing demands, and instructional continuity challenges. In classrooms with large enrollments, educators noted that providing individual support to every student during independent work was not feasible. Khanmigo was incorporated as an additional instructional presence during work time, allowing students to continue progressing while the teacher rotated among individuals or small groups. Educators also described adapting Khanmigo use during disruptions such as substitute coverage. When students were reluctant to ask substitutes for academic help, particularly when substitutes were unfamiliar with course content, teachers relied on Khanmigo to maintain instructional expectations. As one teacher explained, students “don’t really like to ask the sub,” but “they’ll ask the chat,” allowing instructional routines to continue under non-ideal conditions without altering curricular goals.

Instructional adaptations extended into feedback, differentiation, and planning practices, particularly in English language classrooms. A teacher described using Khanmigo to support drafting, revising, and refining student work, emphasizing that providing individualized feedback to all students in real time was impractical. One teacher stated, “You can’t do that for 30 students in real time,” describing how Khanmigo allowed students to engage in revision while she focused on higher-level instructional support. In one writing-focused classroom, the teacher required all students to complete an initial draft before using Khanmigo for revising and refining their work. Rather than circulating continuously, she described monitoring, on the back end, the amount of time each student spent revising, which allowed her to identify who was engaging deeply with feedback and who required additional support. This visibility into students’ revision processes created opportunities for more targeted, individualized teacher feedback during class time. Teachers also described using Khanmigo to differentiate instruction without creating visibly different tasks, noting that “everybody has a different set” even when assignments appeared similar. Additional adaptations included multilingual support, with teachers reporting that students could “speak to Khanmigo in Spanish,” and instructional planning practices in which educators used Khanmigo to generate lesson ideas that they then revised. As one teacher explained, “I use it like my students; get ideas, then critique it back to how I want.” Across these accounts, instructional adaptation was marked by teachers’ ongoing adjustments to routines, feedback processes, and planning practices.

Barriers and Supports for Khanmigo Implementation

Educators described the implementation of Khanmigo as shaped by a combination of enabling supports and persistent constraints, rather than by a single facilitating or inhibiting factor. Across interviews, classroom observations, and professional learning sessions, participants emphasized that implementation occurred within an already crowded instructional environment. Barriers and supports were often discussed together, as teachers navigated competing instructional demands while determining how, and how much, to incorporate Khanmigo into their practice. Importantly, educators did not frame barriers as resistance to AI itself; instead, they described structural, temporal, and organizational conditions that influenced the depth and consistency of implementation.

One of the most frequently cited constraints was limited time, both for learning the Khanmigo platform and for integrating it into daily instruction. Teachers described balancing large course loads, grading demands, extracurricular responsibilities, and mandated district initiatives. Some teachers noted that even when they saw potential in Khanmigo, finding uninterrupted instructional time to experiment with the tool was difficult. During a focus group session, teachers described how AI-supported activities were sometimes postponed or deprioritized during testing windows or when other required district initiatives took precedence. These accounts highlight that time constraints were not unique to Khanmigo, but reflected broader structural pressures that shaped instructional decision-making.

Variation in teacher confidence and comfort with technology also emerged as a significant barrier. While professional learning opportunities were available, educators described uneven engagement with these supports. Some teachers reported feeling confident navigating new tools, while others described steep learning curves. For some educators, particularly those who identified as less technologically confident, the expectation to begin using Khanmigo was experienced as pressure rather than encouragement. Although school leadership framed Khanmigo as an opportunity for experimentation with no performance expectations, teachers reported

that its use was also mandated. Participants described this mandate as a district expectation intended to ensure consistent implementation, but one that interacted with teacher workload and readiness in ways that varied across classrooms and educators. This finding highlights how implementation mandates, when introduced without protected time or differentiated support, can simultaneously promote consistency and constrain instructional experimentation. A few educators described feeling overwhelmed by the requirement to adopt Khanmigo alongside other instructional responsibilities, suggesting that the mandate itself functioned as a barrier under these conditions.

At the same time, educators described several institutional and relational supports that facilitated implementation over time. During professional development sessions observed through the AI in Education ECHO® platform, one district leader emerged as a visible champion, encouraging teachers to experiment with the AI tool. Teachers credited this visible enthusiasm as legitimizing the use of the platform. One participant explained, “He believes in it, and so he wants us to believe in it... it starts at the top and works its way down.” This leadership stance fostered peer-to-peer mentoring, as early adopters modeled classroom use (both successes and challenges) for colleagues. Professional learning further supported implementation. Teachers and administrators had access to more than ten virtual professional development sessions addressing both technical navigation and classroom integration, as well as two in-person sessions that brought together educators from multiple districts. Participants described these opportunities as encouraging and eye-opening, emphasizing that they were “all in the same boat.” In addition, two Khan Academy specialists remained available for ongoing guidance, answering questions and troubleshooting challenges. As the school’s attention shifted toward additional initiatives and explicit expectations regarding Khanmigo use were reduced, one teacher who had initially experienced the mandate as pressure described feeling more willing to explore the tool independently. This shift suggests that early mandates, potentially linked to organizational accountability for district-supported resources, interacted with teacher workload in ways that limited experimentation, while reduced pressure later created space for more voluntary and sustained engagement.

Built-in monitoring and safety features in the Khanmigo platform functioned as district-supported policy mechanisms that addressed concerns about student misuse and data responsibility. Teachers described receiving automated alerts when students used inappropriate language, which allowed them to address behavior without constant surveillance. One educator recalled receiving an email when a student became “aggressive” with the tool, describing this visibility as reassuring rather than punitive. These features helped teachers feel more comfortable to allow students to work independently with Khanmigo, knowing that safeguards were in place. Educators framed these features as supports that enabled responsible use rather than mechanisms of control.

Taken together, these findings show that barriers and supports for Khanmigo implementation were contextual. Time limitations and uneven technological confidence constrained how fully teachers could integrate the tool. At the same time, leadership advocacy, peer modeling, sustained professional learning and built-in safeguards supported gradual adoption.

Impact on Student Engagement and Learning Outcomes

Educators described the impact of Khanmigo on student engagement and learning as gradual, becoming increasingly visible over time. One of the most frequently discussed effects involved student persistence and task completion; though educators emphasized that initial student resistance preceded these changes. Several teachers described students expressing frustration early on, particularly when Khanmigo did not provide immediate answers. Students who were accustomed to AI tools producing solutions reacted negatively when Khanmigo instead prompted them to explain their thinking, revise responses, or try again. One teacher explained that students “didn’t like it at first” because “it wasn’t just giving them the answer.” This resistance was most evident early in implementation. Over time, however, especially in classrooms where teachers consistently integrated Khanmigo into daily routines, educators observed a shift in student behavior. Students became more willing to engage with the tool, persisted through prompts, and began using feedback to continue working rather than disengaging. Teachers described this change as gradual, noting that persistence emerged as students adjusted their expectations about what academic support from the tool looked like. As persistence increased, teachers also reported higher levels of task completion, including fewer unfinished assignments and consistent submission of work.

Educators also described changes in academic performance indicators. In one class, a teacher provided a particularly vivid example, reporting that her course failure rate dropped from 12–15 students to just two. She stated, “I had so many more students pass this year... I only had two fail.” She attributed this change to students’ increased willingness to persist, the immediacy of feedback, and the self-paced nature of assignments, explaining that “they don’t feel overwhelmed... they like that those assignments are short.” Other teachers similarly reported observing improvements in grades for some students, particularly those who had previously struggled to complete or submit work. Educators consistently emphasized that these changes unfolded over time and alongside other instructional supports, situating academic gains within a broader instructional context.

Teachers also reported the emergence of peer tutoring behaviors, which they viewed as a meaningful shift in classroom engagement. Students began mirroring Khanmigo’s Socratic questioning style when working with classmates, asking one another, “What did the blob tell you to try next?” Educators described this peer modeling as extending the instructional reach of the tool, fostering a classroom culture of collaborative inquiry rather than dependence on direct teacher correction. These interactions were not formally structured but emerged organically as students became more familiar with Khanmigo’s prompts and language.

Equally significant were the affective and motivational effects educators observed. Teachers consistently described Khanmigo’s nonjudgmental tone as creating a sense of safety for students who were embarrassed to ask for help publicly. One teacher reflected that the tool “helps those who are the most hesitant to ask for assistance,” adding that this comfort “motivated a student to engage further with the platform, even though he was hesitant at first.” Another teacher described quieter students leaning closer to their screens, visibly relaxed as they typed questions for Khanmigo. Teachers also noted fewer behavioral disruptions during independent work periods, describing calmer classrooms and reduced expressions of frustration as students were able to access help privately.

Taken together, these findings indicate that educators observed meaningful shifts in student engagement and learning behaviors associated with the use of Khanmigo, particularly increased persistence, task completion, peer interaction, and changes in academic indicators such as grades and course failure rates. Educators emphasized that student engagement was not an immediate response to the tool itself, but a learned behavior shaped over time as students adjusted to new norms for academic support, effort, and persistence.

Discussion

The narratives from educators in this study can be explained by core elements of the Technology Acceptance Model (TAM) (Davis, 1989; Venkatesh & Davis, 2000). Teachers’ reports of higher assignment completion, increased student independence, and multilingual scaffolding for English language learners exemplify perceived usefulness, that is, the belief that Khanmigo enhances teaching and learning outcomes. Simultaneously, the friction a teacher described such as login issues, navigation challenges, and limited planning time correspond to lower perceived ease of use. TAM explains that when usability is low, adoption tends to stall (Davis, 1989). Yet, in classroom contexts, adoption is shaped not only by these perceptions but also by the realities of school life, which include teachers’ comfort with digital tools, the pace and structure of lessons, the diversity of student needs, and the alignment between AI functions and everyday teaching routines. In this sense, while TAM’s classic constructs remain relevant, they must be contextualized for education, where human expertise, social support, and pedagogical fit determine how usefulness and ease of use are actually experienced.

Adaptations and Productive Struggle

Implementation of Khanmigo in classrooms appears to require more than mere availability of the tool; it demands a shift in teacher practice, student norms, and task design. In our study, teachers instituted daily routines such as “10 minutes at the beginning of class” and “3 before me... ask the assistant.” These routines seemed to normalize AI use and shifted student expectations. Such routines align with research showing that predictable integration helps embed technology into classroom culture rather than treat it as a novelty (Kim, 2025).

An important finding of this study was that productive struggle was evident in student interactions with Khanmigo. Because of the Socratic questioning framework of Khanmigo, students were challenged to engage with the learning material as they asked questions that moved them toward the solution to their queries. Teachers observed that students initially sought immediate answers, but they gradually learned to engage with prompts, revise their responses, and say, “Never mind, I’ve got it” after being guided by Khanmigo. This finding is important because of concerns that AI will replace, rather than support, learning. Neuroeducational research indicates that, when a learner grapples with cognitively challenging material, the prefrontal cortex activates, dopamine is released in learning-relevant circuits, and myelination may improve, whereas immediate answer-giving bypasses these mechanisms (Edutopia, 2020; Puig, et al., 2014). In this light, AI-scaffolding that resists full answer-giving and instead prompts prior knowledge (such as the question “What do you already know?”) aligns with neuroscience of learning and supports deeper cognitive processing. Findings of this study indicate that Khanmigo’s Socratic questioning method resists full answer-giving and, instead, prompts the use of prior knowledge. Thus, teachers’ observations of increased student persistence and independence suggest that Khanmigo supported productive struggle.

Barriers and Enablers in Whole-School AI Implementation

Findings reveal enablers that catalyze adoption of Khanmigo and barriers that inhibit it. On the enabler side, visible leadership advocacy such as a principal “champion”, peer modelling, embedded and ongoing professional development, and clear guardrails (e.g., alerting when students enter inappropriate queries) were cited by participants as vital enabling conditions. These conditions align with wider literature on AI in K–12 education that emphasizes institutional readiness, policy alignment, teacher professional development, and ethical/human-centered frameworks for successful implementation (Alalil & Wardat, 2024; Lin & Tan, 2025; Education and Information Technologies special issue, 2025).

Conversely, barriers included time scarcity, teacher digital-fluency gaps, large class sizes, and lack of protected planning/pilot time. For example, one teacher described the initial training as a “30-minute overview in August” which left her feeling unsupported and unable to navigate the platform. She stated, “I can’t even log in.” Survey results from Cengage Group (2025) corroborate this finding; while about 63 % of K–12 teachers reported some GenAI classroom use in 2025, about 83 % still expressed moderate to severe concerns about data privacy, training, and academic integrity (Cengage Group, 2025). Our findings suggest that the gap between tool availability and meaningful classroom integration was present in this district, particularly in classrooms with teachers who possessed lower digital or technological literacy.

Student Growth through Supportive Systems

The study’s findings indicated evidence of positive student outcomes when AI was integrated with fidelity and under supportive conditions. Teachers in math contexts reported marked improvements in pass-rates. For example, one teacher explained, “so many more students pass[ed]... only two failed.” The platform also led to an increase in peer tutoring behaviors. Affective gains, such as students who were less afraid to ask questions, demonstrating increased independence and stronger engagement, also surfaced. These outcomes reflect findings in recent K–12 AI literatures that link teacher perception of usefulness to both student engagement and self-regulated learning (Alfarwan, 2025; Kim, 2025). Yet, the variation across contexts signals caution. For example, in this district, academic disciplines such as science did not seem to reap the same benefits as courses such as math and writing. The promise of AI to support ELL/IEP learners through multilingual, differentiated interfaces was also evident, but our findings suggest that this promise is met when teachers are provided with allocated time, access, training, and supportive infrastructure. These findings suggest that, without those factors, AI may amplify rather than reduce inequities across classrooms (Joshi, 2025).

District Policy Conditions and AI Implementation in Practice

From a policy and practice standpoint, our findings illustrate how district policy conditions shaped AI implementation as a whole-district effort rather than an isolated experiment. To support teacher capacity for AI integration, the district established clear expectations for classroom use while simultaneously preserving teacher autonomy in how those expectations were enacted. To create an environment where teachers had the latitude

to implement Khanmigo as they saw fit, the district provided access to sustained professional learning, leadership messaging that legitimized experimentation, and safeguards designed to support responsible student use. This approach aligns with research emphasizing the importance of coherent systems and professional learning in supporting instructional change (Darling-Hammond et al., 2017) and reflects the kind of capacity-building conditions described by Fullan (2016). The findings also highlight that simply giving students access to an AI tool is not enough. Teachers explained that real learning happens when students are encouraged to work through challenges instead of rushing to get the right answer. When teachers used well-designed tasks, guiding questions, and consistent routines, students stayed in that “productive struggle” zone, where the work felt challenging but still achievable, and that is where the deepest learning occurred. This mirrors prior work on the role of productive struggle in learning, where understanding deepens through effortful engagement with challenging tasks (Hiebert & Grouws, 2007). Together, these findings suggest that district policy conditions do not merely authorize AI use but actively shape how educators engage with AI tools, determining whether implementation feels supportive, manageable, and instructionally meaningful.

Implications and Conclusion

Findings from this case study illuminate several important implications for schools with similar contexts seeking to implement AI tools in ways that are pedagogically sound, ethically responsible, and sustainable over time. First, successful integration in this district required coordinated systems of support rather than isolated training events or one-time rollouts. In Lake Public Schools, teachers benefited when leadership framed AI as a shared innovation, when professional development emphasized real classroom application, and when expert guidance remained accessible throughout the school year. These structures fostered teacher confidence and allowed instructional routines to evolve gradually. Districts with similar contexts that are hoping to replicate this work may consider investing in ongoing coaching, protected time for teachers to experiment, and opportunities for cross-district collaboration that reduce the sense of isolation often associated with new technologies. At the district level, key actions included clarifying expectations for classroom use, establishing privacy and acceptable-use guidance, and creating feedback loops to monitor implementation variability across schools and subjects.

Second, findings suggest that AI tools such as Khanmigo hold particular instructional promise when they reinforce, rather than replace, core principles of teaching and learning. The platform’s Socratic scaffolding helped students persist, revise, and engage in productive struggle, signaling that AI can support deeper learning when designed and used intentionally. At the same time, inconsistent integration across subjects and teacher comfort levels in this district underscores that AI’s benefits depended heavily on pedagogical alignment and teacher digital fluency. Policies for implementation in this district provided differentiated training pathways that recognized the varied starting points of teachers and prioritized tiered and personalized access to instructional support.

Third, this study raises important considerations about equity and access. Although many students experienced increased independence, confidence, and homework completion, those without stable technology or those in classrooms where AI use was less consistent may not have benefitted to the same degree. These disparities echo national concerns that AI may widen gaps if not paired with infrastructure, culturally responsive instruction, and intentional monitoring of engagement. Our findings align with literature suggesting that equitable AI implementation depends not only on access to devices and connectivity, but also on students’ readiness to engage with AI-mediated feedback in ways that support learning and well-being (U.S. Department of Education, 2024).

Overall, the integration of Khanmigo in Lake Public Schools demonstrates that meaningful AI adoption emerged in this district through iterative, human-centered processes rather than rapid technological shifts. Teachers and administrators learned their way into AI together, adapting routines, modifying expectations, and calibrating their use of the tool in response to student needs. The experience of this district suggests that AI is most powerful when embedded within supportive professional cultures, when aligned with established instructional goals, and when grounded in ethical guardrails that protect both students and teachers.

In conclusion, this case study contributes to growing research on AI in K-12 education by offering a contextually grounded example of how a public school district moved beyond early experimentation toward more mature, pedagogically integrated use of AI. While the findings are not generalizable, they provide transferable insights

for districts with similar contexts that are exploring how to implement AI tools responsibly. The study reaffirms that technology alone does not improve learning; rather, improvement arises from thoughtful design, collaborative professional learning, and ongoing reflection on how AI intersects with the realities of classroom and home life. As schools continue to navigate the expanding role of AI in education, the experiences of Lake Public Schools illustrate that purposeful, supported, and ethically guided implementation strengthened instruction and expanded opportunities for students, while keeping educators at the center of the work.

Disclosure Statement

No potential conflict of interest was reported by the author.

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