



Fostering equitable collaboration: a study on Slido's impact on student engagement in higher education

Zoi Zoupanou¹

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Abstract

This mixed-methods study investigates how anonymous digital pedagogy impacts equitable participation within a diverse cohort of 39 undergraduate students. Grounded in the need for “meaningful and safe access” Dastyari & Jose, (*Alternative Law Journal*, 49(4) 282–287, 2024), the research utilized Slido's Q&A and polling features to remove traditional participation hierarchies that often silence marginalized students due to cultural differences or language anxieties (Amjad et al., (*European Journal of Education*, 2024) ; United Nations Office, (2022). Empirical results reveal a significant shift in engagement: the traditional verbal baseline of 15.38% rose to 54.54% during the digital intervention. Notably, 92.8% of contributions were anonymous, and all primary Q&A contributors were international students. Quantitative analysis confirmed a robust correlation between user experience and perceived content quality ($Rho = 0.659, p < .001$), supporting the “Personalization-Agency Loop” (Singh, 2025). Qualitative analysis identified a “critical dichotomy” in feedback. While 53.85% of responses were non-specific, unique contributions highlighted vital pathways for improvement. Key themes included the need for deeper pedagogical integration, inclusive design for neurodiversity (e.g., color-coding for dyslexia), and dynamic tools for real-time collaborative feedback. Ultimately, the findings suggest that anonymity is a fundamental requirement for inclusion, allowing students to engage with formative assessment without fear of judgment. However, sustainable success depends on empowering teachers with the digital fluency to transition technology from a simple polling tool into a holistic collaborative platform.

Keywords Equitable participation · Anonymous participation · Digital inclusion · Digital pedagogy · Slido · Student engagement

✉ Zoi Zoupanou
z.zoupanou@fashion.arts.ac.uk

¹ University of the Arts London, The Fashion Business School, London College of Fashion, UAL, 105 Carpenters Road, Stratford, London E20 2AR, United Kingdom

1 Introduction

The core mission of Higher Education is the cultivation of critical thinking, a skill fundamentally rooted in social practices and nurtured through collaborative, dialogue-based learning (Freire 1970; Vygotsky 1978a, b). However, the success of these models is increasingly contingent upon Digital Inclusion, which serves two vital functions. First, it ensures equitable access by empowering all learners, particularly those from marginalized or disadvantaged backgrounds, to navigate the digital sphere with security and purpose (United Nations Office, 2022). Second, it facilitates high-quality, balanced instruction by actively mitigating disparities in digital outcomes (Gottschalk & Weise, 2023). Achieving these objectives requires a multifaceted approach that addresses both the construction of robust digital infrastructure and the mastery of essential digital competencies (Marín & Castañeda, 2023).

Despite these goals, a significant “digital paradox” threatens the equity agenda. While social media (SM) collaboration via mobile learning has emerged as a primary mechanism for narrowing the academic equity gap (Amjad et al., 2024), the rise of Generative AI tools, such as ChatGPT, has introduced a notable disruption. Students are increasingly bypassing crucial SM-based peer exchanges in favor of AI-driven interactions (Amjad et al., 2024). This shift weakens the social dynamics that drive inclusion, potentially undermining equitable participation and the development of collaborative critical thinking. This paradox necessitates a safe, trusted digital environment; if students lack the security provided by anonymity and privacy protection, the collaborative engine of inclusion fails. Consequently, institutions must strategically manage AI integration to ensure conditions for secure expression are preserved, thereby safeguarding the integrity of the foundational equity agenda.

1.1 The equity gap in collaborative learning

While the theoretical benefits of collaborative learning are clear, a significant gap remains in the equitable distribution of these advantages. For instance, a landmark study by Loes and Pascarella (2017) revealed that gains in critical thinking through collaboration may disproportionately benefit white students—particularly those with lower initial academic preparation—compared to their racial and ethnic minority counterparts. Their research indicated that while collaborative learning boosted critical thinking across all demographics, the gains were statistically smaller for minority students.

This disparity is not an outlier. It is a call to action. It compels a direct inquiry into whether technology serves as a genuine equalizer or if, without intentional design, it inadvertently reinforces systemic inequalities. This study addresses this void by investigating whether a human-centered approach, specifically utilising anonymous digital participation, can dismantle the behavioral and systemic barriers that hinder truly equitable academic discourse.

2 Literature review: the Slido intervention

2.1 The foundational imperative of digital equity and inclusion

The successful integration of interactive Educational Technology (EdTech) is intrinsically linked to the foundational imperative of achieving digital inclusion and equity within Higher Education (HE). The efficacy of tools designed to facilitate anonymous participation remains contingent upon first bridging the “digital divide”, a gap characterized by profound disparities in device access, internet reliability, and technical proficiency (Dastyari & Jose, 2024).

Without meeting the essential requirement of “equitable, meaningful, and safe access,” disadvantaged students remain unable to navigate the complexities of online platforms or utilize features like anonymity effectively. Consequently, the technology risks widening, rather than closing, the educational gap (Dastyari & Jose, 2024). Furthermore, the promise of emerging EdTech, such as Generative AI (e.g., ChatGPT), may exacerbate existing inequalities if students lack the critical digital literacy necessary for its effective use. This highlights the necessity of making inclusion the cornerstone of any institutional technology strategy (Amjad et al., 2024; Dastyari & Jose, 2024).

2.2 The platform paradox: business objectives versus pedagogical autonomy

The design of modern online education platforms introduces features that fundamentally reshape the relationship between students, content, and institutions. However, these designs are often driven more by commercial business objectives than by pure pedagogical intent (Khreiche, 2025). While modularisation refers to structuring content into discrete units and provides students with clarity, Khreiche (2025) argues that it primarily serves institutional control. By making courses easily replicable and simplifying content reuse, modularization potentially renders faculty more “replaceable.” Multimodality features that offer varied communication (e.g., video, chat, and digital notes) are utilized by platforms like Class and Engageli to create environments optimized for maximum data collection. This aligns with the logic of platform capitalism, where participation is tracked and monetized (Khreiche, 2025).

Ultimately, this system imposes a significant trade-off on teaching staff. While constant platform “nudges” increase academic workload by demanding perpetual interaction, they simultaneously erode academic freedom and diminish autonomy over core pedagogical decisions (Khreiche, 2025).

2.3 Anonymous EdTech as a strategy for equitable participation

A practical and theoretically grounded approach to addressing equity concerns, specifically by lowering psychological barriers, is the strategic implementation of interactive tools that facilitate anonymity. The literature on engaged pedagogy (Peters & Mathias, 2018; Vespone, 2023) and collaborative learning (Castle, 2014; Johnson et al., 1991) provides the essential framework for the effective deployment of anonymous platforms such as Student Response Tools (SRTs) and Slido (2021).

Rooted in constructivist and critical theory, this pedagogical approach emphasizes transforming the classroom into a shared space for collaborative knowledge construction, a process proven to boost academic success (Greenwood-Hau, 2024; Kolb & Kolb, 2005). Within this framework, anonymity is a critical catalyst for digital inclusion; it mitigates psychological deterrents such as the fear of peer judgment or the risk of microaggressions, which disproportionately affect marginalized or introverted students (Hashim et al., 2021; Johnson et al., 2020).

Real-time tools like Slido (2023) enhance overall engagement and cultivate a more inclusive learning environment (Crooks et al., 2012; Aslan et al., 2019; Muthmainnah, 2019; Fonseca & García-Peñalvo, 2019; Onyema et al., 2019). By providing a platform for students who are otherwise hesitant to speak (Crooks et al., 2012; Ningsih, 2023), these tools validate the utility of Slido as a primary focus for this inquiry into digital collaboration and equity in HE.

The choice of Slido is further supported by Piaget's theory of disequilibrium (1950), which suggests that anonymous features can trigger the socio-cognitive conflict necessary for deep learning. Anonymity allows for honest, uninhibited peer interaction that challenges existing schemas without the social risk of "being wrong" in public. By investigating this mechanism, this study directly addresses the central research question: How can technology ensure all students—particularly those from under-resourced backgrounds—collaborate effectively to develop critical thinking, solve complex problems, and advocate for fairness?

2.4 Empirical evidence and the requirement for redagogical shift

Empirical evidence consistently demonstrates how anonymous features actively advance digital equity. The implementation of Student Response Tools (SRTs), such as the Acady application in large-enrolment courses, has been shown to facilitate real-time participation while successfully promoting inclusion. By empowering students to share their perspectives without the traditional barriers of the physical classroom, these tools bypass the social anxieties that often silence marginalized groups (Matteson, 2024).

This core functionality proves particularly transformative for students whose insights "normally remain unspoken in a class setting" (Matteson, 2024). Beyond simple participation, SRTs are instrumental in establishing a dialogical feedback culture. The "overwhelming amount of feedback" generated in real-time serves to validate student contributions, subsequently boosting self-esteem and intrinsic motivation (Matteson, 2024; Hattie & Timperley, 2007; Ferguson, 2011; Boud & Molloy, 2013).

Similarly, platforms like Kahoot, when integrated into structured group activities, enhance engagement by repositioning students as "co-developers" of their own learning experience. Through collaborative quiz creation and peer-to-peer competition, students shift from passive recipients to active contributors (Bawa, 2019; Plump & LaRosa, 2017; Holbrey, 2020; Viswanathan & Radhakrishnan, 2018).

Ultimately, the success of these EdTech interventions highlights that technology alone is not a panacea. True equity requires a strategic pedagogical shift. Faculty must be willing to adapt their teaching methods and relinquish a degree of tradi-

tional classroom control to amplify student voices. Simply “bolting on” a tool to a standard lecture format is insufficient for achieving meaningful collaboration (Mateson, 2024). Future efforts must ensure that EdTech serves as a catalyst for inclusive dialogue and social learning, rather than a sterile replacement for human interaction (Amjad et al., 2024).

2.5 Participatory action research for equity

The present study is situated within a Participatory Action Research (PAR) framework (McNiff & Whitehead, 2009; Lenette, 2023; see Fig. 1). This methodological choice is intrinsically aligned with the study’s overarching goal of achieving educational equity, as PAR actively involves those directly affected by the research in a cyclical process of planning, acting, observing, and reflecting.

By adopting this collaborative approach, the design and implementation of EdTech interventions, specifically the use of Slido, are not merely imposed top-down. Instead, they are iteratively refined to maximize benefits for all students, with a particular focus on empowering those whose voices and resources have been traditionally marginalized. Ultimately, this framework provides a practical, responsive roadmap for addressing the critical objectives and complexities defined in the central research question.

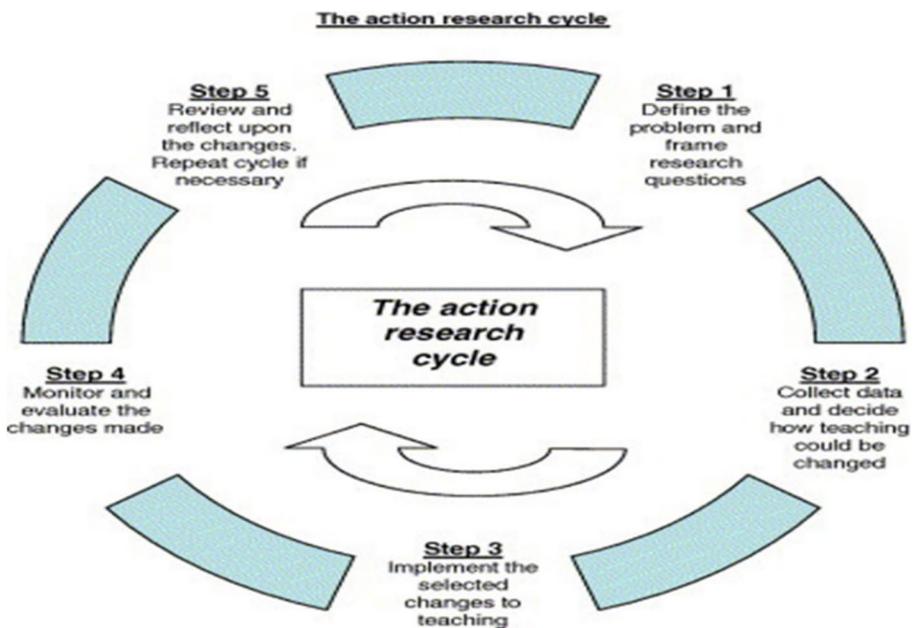


Fig. 1 Action research cycle (McNiff & Whitehead, 2009)

3 Method

3.1 Slido intervention and procedure

This study investigated the impact of the interactive digital platform Slido on student participation and engagement. Three specific features, Q&A, Open Text, and Emoji Rating, were integrated into a PowerPoint presentation for an undergraduate psychology lesson focused on using NVivo software for interview analysis.

The intervention began with a practical exercise on qualitative coding using NVivo's "colored stripes" feature. After a 10-minute application task, Slido was deployed as a real-time measurement tool. Students used an Emoji Rating scale, ranging from "sad" (low confidence/strong disagreement) to "happy" (high confidence/strong agreement), to indicate their self-efficacy in using the tool. This provided an immediate, quantifiable assessment of student confidence. Slido's Polls for emojis and a Word Cloud feature, each lasting ten minutes, served as visual cues displayed in the classroom to guide engagement.

The second activity required students to perform a five-minute NVivo matrix coding task, analyzing the relationship between thematic codes and participant demographics. Immediately following the task, a Slido emoji poll asked: "How confident are you in your ability to complete the matrix coding task?" The Poll Insights feature was displayed for ten minutes, providing a visual distribution of confidence levels. This instant visualization allowed the author to pinpoint areas of ease, highlight widespread agreement, and guide a targeted classroom discussion that addressed the technical convenience of the matrix coding table while empowering student voices.

The final segment utilized Slido for a structured Questions and Answers (Q&A) session. Students used a join code to submit online queries regarding the matrix task and software installation. They were also required to view and respond to peer submissions. The session concluded with an in-class discussion centered on the most frequent queries identified via the Slido Word Cloud, allowing the author to address recurring technical themes.

Furthermore, a ten-minute Open Text prompt asked students to articulate specific challenges faced when "classifying cases" (e.g., creating categories and assigning variables). The resulting Word Cloud aggregated these responses, displaying the most common obstacles in larger text. This allowed the lesson to pivot dynamically toward the major recurring difficulties identified by the cohort. To promote a collaborative and safe learning environment, all responses were anonymous and displayed in real-time. This study adhered to strict ethical guidelines; Participants were notified of their right to withdraw at any time (BERA, 2024). Recognizing the complexities of digital data collection (Kara 2015a, b), all Slido interactions were fully anonymized. No personal identifying data was collected, ensuring participant privacy throughout the digital intervention.

3.2 Participants

The sample for the Slido intervention comprised 39 undergraduate Psychology students across their second and third years of study. The cohort was characterized by a

significant international majority (85%), with White British students accounting for the remaining 15%. Recognizing this demographic composition, the author utilized anonymous participation as a deliberate digital pedagogy strategy. This approach was designed to bridge the potential equity gap often found in diverse classrooms, where factors such as varying English language proficiency or differing cultural norms regarding authority can inadvertently suppress the voices of international students.

Anonymity was structurally guaranteed by Slido's platform design, which processes responses without capturing user IDs or IP addresses, rendering all data non-identifiable. The ethical protocol for this study, approved by the Postgraduate Certificate in Academic Practice (PGCertAP) review board, emphasized informed consent and voluntary participation. Students were notified that while they could withdraw during the session, the lack of identifying markers meant that data could not be retracted once submitted. By removing the psychological burden of personal identification, the intervention allowed the academic input of the 85% international cohort to be judged solely on its quality, effectively decoupling social or linguistic anxiety from intellectual contribution and fostering a more representative range of perspectives.

During the instructional session, 25 of the 39 students present actively engaged with the live Slido features. This intervention focused on evaluating three key areas: student satisfaction with problem communication, the impact of the platform on content delivery and learning support, and student interest in specific interactive tools like the Q&A, emoji rating scales, and word cloud polls. To ensure a comprehensive evaluation, all 39 students provided qualitative feedback through a post-intervention questionnaire. This data, synthesized in Table 9, offers deeper insights into how Slido supported their specific learning needs and provides a basis for future pedagogical refinements.

3.3 Data collection and analysis

The research utilized a mixed-methods approach to analyze the data, integrating both quantitative and qualitative techniques to gain a comprehensive understanding of the Slido intervention's impact. This dual approach allowed for the triangulation of results, ensuring that the breadth of student engagement was captured alongside the depth of their individual experiences.

3.3.1 Quantitative approach: post-intervention questionnaire

The quantitative data were derived from 25 undergraduate respondents who completed the closed-ended items of a post-intervention questionnaire hosted on Qualtrics (Table 3). These items employed six-point and three-point Likert scales to measure student satisfaction with classroom communication and the perceived impact of Slido on learning support and content delivery.

Statistical analysis was conducted using SPSS Version 29, following the descriptive framework outlined by Pallant (2020). This involved calculating frequencies, percentages, and means to summarize the primary features of the data. By identifying

overall trends and satisfaction levels, this descriptive analysis established a robust baseline for assessing the intervention's general effectiveness.

3.3.2 Qualitative approach: thematic analysis

The qualitative data, gathered from open-ended questions within the same Qualtrics questionnaire, underwent thematic analysis as described by Braun and Clarke (2013). Facilitated by NVivo software, this process involved the systematic identification, analysis, and reporting of recurring patterns within the student responses.

To move from raw data to conceptual clarity, the author employed thematic data reduction (Tesch, 1990, as cited in Gray & Malins, 2007). This method condensed student feedback into manageable, meaningful themes, providing a deeper understanding of specific student experiences and suggestions for improvement. These qualitative insights complemented the quantitative findings by explaining the “how” and “why” behind the observed statistical trends.

To ensure the credibility and objectivity of the findings, a triangulation strategy was employed. This included a peer participation session with the author's supervisor and colleagues (Learning for Action, 2024). This collaborative “collective sense-making process” was vital for validating the identified themes and interpretations (Gray & Malins, 2007). By incorporating multiple perspectives during the analysis phase, the author significantly reduced the risk of researcher bias (Kara 2015a, b), thereby strengthening the study's overall conclusions.

3.3.3 Instrument design

The questionnaire design was informed by the work of Ningsih (2023), Dawadi et al. (2021), and Strijker et al. (2020). Following established principles of question design (Converse & Presser, 2011), the instrument was crafted to minimize response bias by avoiding overly complex phrasing and the solicitation of “non-attitudes” (Converse, 1970; Krosnick et al., 2005). The strategic combination of closed and open-ended questions ensured the study could provide both a measurable baseline and a rich, nuanced exploration of student participation.

4 Results

4.1 Real-time engagement with Slido polls and Q&A

During the classroom pilot, the author integrated several Slido prompts into a PowerPoint presentation, inviting students to engage with the platform in real-time. To ensure clarity and maintain data quality, the author provided specific orientation for each interaction type:

Confidence in Coding and Coding Stripes: For the prompt “I feel confident using coding and coding stripes,” students were briefed that this item utilized a numerical rating scale. This allowed them to quantify their current level of comfort with these specific software features.

Challenges in Case Classification: For the open-ended prompt “Explain any problems you face classifying cases,” students were encouraged to provide free-text insights in a descriptive, conversational style.

Matrix Coding Task Self-Efficacy: For the instruction “I am confident in my ability to use the Matrix coding task,” the author utilized an emoji-based rating system. This was framed as a visual and intuitive method for students to express their psychological confidence levels.

Throughout the session, participants could view and read their classmates’ anonymized responses on-screen, fostering a transparent and shared learning environment. The metrics below are derived directly from the Slido Emoji and Rating Polls (see Tables 1 and 2) and provide a quantifiable assessment of student perceptions. Specifically, the data for the prompt “I feel confident using coding and coding stripes with NVivo” utilized a 1-to-5 star rating system represented by emojis, with a total of 10 votes cast.

Table 1 Students vote to a poll question using Slido Emojis feature

Confidence Level (Emoji)	Rating Description	Number of Votes (Count)	Percentage of Votes (%)
Sad 😞	Strongly Disagree	0	0%
Slightly Sad 😞	Disagree	2	20%
Neutral 😐	Neutral	2	20%
Happy 😊	Agree	5	50%
Strongly Happy ❤️	Strongly Agree	1	10%
	Total Votes	10	100%

Table 2 Students vote to Slido’s Q&A and polls

Category	Metric	Value
Engaged participants	Engaged participants(Polls or Q&A)	22
	Participants asking in Q&A	9
	Participants up or down voting in Q&A	4
	Participants voting in polls	14
Q&A engagement	Participants asked a question or voted in Q&A	12
	Q&A engagement score	54.54%
	Anonymous/all questions	13/14
	Answered questions	9
Poll engagement	Upvotes/downvotes	6/0
	Participants voted in a poll	14
	Total poll votes	14
	Average votes per poll	

4.2 Anonymous participation and digital inclusion: evidence from Slido

The data presented in Table 1, which records student responses via the Slido Emoji feature, highlights the potential of interactive EdTech to foster digital inclusion and facilitate effective feedback loops. The emoji-based poll serves as a low-barrier form of multimodality, ensuring that participation remains accessible and equitable for all students, regardless of their digital proficiency or personal reticence (Dastyari & Jose, 2024; Matteson, 2024). Crucially, the poll elicited immediate and honest feedback: while 60% of students expressed agreement (Agree/Strongly Agree), the presence of 20% disagreement and 20% neutrality demonstrates that the anonymous format successfully reduced psychological barriers. This enabled students to express uncertainty truthfully without fear of social judgment (Hashim et al., 2021; Johnson et al., 2020).

This real-time visibility of student doubt, specifically the 40% non-agreement, facilitated a vital, EdTech-driven feedback loop (Hattie & Timperley, 2007; Ferguson, 2011). Armed with this data, the instructor was able to execute a strategic pedagogical shift (Matteson, 2024), pausing to address specific areas of confusion instantly. In this context, the technology served to enhance the learning process rather than merely functioning as a tool for institutional surveillance (Khreiche & Deng, 2026). The findings illustrate how specific features like emoji polls, when managed through a purposeful pedagogical lens, can resist the commercial logic often embedded in platform design. By using sentiment distribution to respond to student needs in the moment, the intervention prioritized human-centered learning over data collection for capitalist ends.

Table 2 provides further quantitative evidence linking anonymity to enhanced digital inclusion through the Slido Q&A feature. The most significant finding is the near-total reliance on anonymity, with 13 out of 14 questions submitted anonymously. This overwhelming preference suggests that anonymity is essential for lowering barriers such as the fear of judgment or microaggressions that typically silence marginalized students in verbal settings. By creating a psychologically safe digital space, the tool actively promoted deeper inclusion. The data also confirms high levels of active involvement: nine distinct participants used the Q&A feature, and four utilized the up/down voting feature to democratically validate and prioritize peer inquiries without the need for public speaking.

The Slido intervention, targeting a highly diverse cohort of 39 Psychology students, successfully bridged the equity gap by empowering previously silent voices. Notably, all nine students who inquired or responded during the session were international students, yielding an engagement rate of 54.54% for the Q&A segment. These findings confirm that anonymous online features successfully overcame barriers related to English language proficiency and cultural differences specifically for the intended majority group. While individual identities remained protected, the high participation rate proves that anonymity is a key catalyst for a truly collaborative and equitable learning environment.

4.3 Observational data without Slido

The observational data presented in Table 3 highlights a significant participation gap within traditional, verbal Q&A settings. Of the 39 participants present, only six contributed orally, resulting in a low engagement score of 15.38%. This metric directly quantifies the limited scope of the student “voice” in conventional environments and corroborates existing research indicating that traditional lecture formats often inhibit participation among reserved or introverted students. When contrasted with the 54.54% engagement rate observed during the digital intervention, it becomes evident that Slido facilitates a substantially higher volume of interaction by mitigating the psychological barriers associated with public inquiry.

Furthermore, the traditional setting demonstrated lower pedagogical efficiency; of the six verbal questions raised, only 50% were addressed by the speaker. This suggests that spontaneous verbal exchanges may be less conducive to maximizing the time allocated for student feedback compared to the organized, digital queue provided by EdTech.

The shift in engagement levels indicates that the anonymity provided by digital platforms acts as a critical intervention in addressing student comfort and their willingness to engage within large groups. Pre- and post-intervention analysis suggests that the primary obstacle to participation is frequently a psychological barrier rather than a lack of academic interest or subject knowledge. By providing an anonymous channel, the intervention successfully lowered the perceived risk of social judgment, resulting in a measurable change in classroom behavior. This transition from a 15.38% baseline to a high level of digital participation provides empirical evidence that addressing student anxiety through technology can significantly enhance both the inclusivity and the volume of academic discourse.

Table 3 Observational data without Slido intervention

Category	Metric	Value	Explanation
Q&A Without Slido (In-Person/Verbal)	Participants joined	39	The total size of the group.
	Participants asked a question	6	Given observational data (verbal askers).
	Total questions asked	6	Total number of verbal questions raised.
	Answered questions	3	Number of questions addressed by the speaker.
	Q&A Engagement Score	15.38%	

4.4 Post-intervention survey results

Descriptive statistics from the post-questionnaire, detailed in Tables 4 and 5, provide a comprehensive overview of student perceptions regarding the integration of Slido into the classroom. The analysis reveals a predominantly positive response to the platform, with a significant majority of students identifying Slido as an effective tool for both communication and instructional support. Specifically, 68% of the 25 respondents rated their overall experience using Slido to communicate academic issues as “Good” ($M=3.24$, $SD=1.16$ on a 4-point scale). This strong endorsement suggests that the platform is highly effective in cultivating an environment conducive to open dialogue. These results are likely attributable to the platform’s core features of anonymity and real-time interaction, which effectively lower the threshold for student participation and reduce the hesitation typically associated with public inquiry.

Student satisfaction with Slido’s impact on instructional facets was notably high. The platform’s influence on content delivery ($M=2.36$, $SD=0.64$) and learning support ($M=2.24$, $SD=0.66$) was rated positively on a 3-point scale. A combined 96% of the 25 respondents categorized its influence on the pace of delivery as either “Good” or “Excellent” ($M=2.28$, $SD=0.54$), while 88% provided a similar rating for its contribution to learning support ($M=4.06$ on a 6-point scale; $SD=0.72$) (Tables 4

Table 4 Descriptive statistics of student engagement with Slido

Aspect Assessed (Questionnaire Item)	<i>N</i>	Mean	Median	Standard Deviation	Minimum	Maximum
Overall, how was your experience of using Slido in classroom to communicate any issues/problems facing? (1–4 scale, 4=positive)	25	3.24	4	1.165	1	4
Please rate the Slido application in classroom based on - Content of delivery (1 =Fair, 2 = Good, 3 =Excellent)	25	2.36	2	0.638	1	3
Please rate the Slido application in classroom based on - Pace of delivery (1 =Fair, 2 = Good, 3 =Excellent)	25	2.28	2	0.542	1	3
Please rate the Slido application in classroom based on - Learning Support (1 =Fair, 2 = Good, 3 =Excellent)	25	2.24	2	0.663	1	3
Which aspects of Slido would you like to include as a follow-up? - Questions and Answers (1 =No, 2 =Maybe, 3 =Yes)	25	2.44	2	0.583	1	3
Which aspects of Slido would you like to include as a follow-up? - Emojis-based training (1 =No, 2 =Maybe, 3 =Yes)	25	2.64	3	0.569	1	3
How do you feel using Slido in classroom for learning? (1–6 scale, 6=Extremely satisfied)	21	4.06	4	0.725	3	5
Please share a specific example of how Slido helped you in the classroom. (Qualitative)	39	6.38	2	6.765	1	21
How could Slido be improved to enhance the learning experience? (Qualitative)	39	5.38	1	5.981	1	19

Table 5 Student satisfaction, perceived impact, and feature interest in Slido application

Aspect assessed (Questionnaire item)	Response category	Frequency (n)	Valid Percent (%)
Overall experience using Slido for communicating issues/problems (N=25)	Don't know	3	12
	Poor	5	20
	Good	17	68
Slido application based on - Pace of delivery (N=25)	Fair	1	4
	Good	16	64
	Excellent	8	32
Slido application based on - Learning Support (N=25)	Fair	3	12
	Good	13	52
	Excellent	9	36
Which aspects of Slido would you like to include as a follow-up? - Questions and Answers (N=25)	No	1	4
	Maybe	12	48
	Yes	12	48
Which aspects of Slido would you like to include as a follow-up? - Open Text (N=24)	No	2	8.3
	Maybe	11	45.8
	Yes	11	45.8
Which aspects of Slido would you like to include as a follow-up? - Emojis-based training (N=25)	No	1	4
	Maybe	7	28
	Yes	17	68
How do you feel using Slido in classroom for learning? (N=18)	Neither satisfied nor dissatisfied	4	22.2
	Somewhat satisfied	5	27.8
	Extremely satisfied	9	50

and 5). These findings suggest that students perceive Slido as a versatile tool that effectively balances the dissemination of content with the enhancement of overall comprehension.

Students also expressed a strong desire to expand Slido's interactive capabilities. 48% of respondents favored the continued inclusion of both "Questions and Answers" and "Open Text" as follow-up features. Furthermore, a substantial 68% demonstrated a specific preference for "Emoji-based training," with high interest scores recorded for both the use of emojis ($M=2.64$, $SD=0.57$) and the Q&A functionality ($M=2.44$, $SD=0.58$) (Tables 4 and 5). This interest in more dynamic and expressive features highlights significant opportunities for diverse pedagogical applications that could

further enrich the student experience. Overall, general satisfaction with Slido as a learning tool was considerable, with 77.8% of respondents reporting they were either “Somewhat satisfied” or “Extremely satisfied.”

In conclusion, these results validate Slido’s pedagogical value in fostering classroom engagement and active learning. The findings demonstrate the platform’s effectiveness in streamlining communication and improving the quality of content delivery. Given the high levels of satisfaction and the appetite for expanded interactive features, Slido emerges as a promising technology for inclusive higher education. Future optimization efforts should focus on utilizing these dynamic features more broadly and providing comprehensive training to maximize their instructional potential.

4.5 Inferential analysis

Due to the small sample size ($N \leq 25$), a series of Fisher-Freeman-Halton (FFH) Exact Tests were conducted to examine the associations between categorical variables. These results, summarized in Table 6, revealed several key findings regarding student engagement. A statistically significant association was found between students’ overall experience using Slido for communicating issues and their rating of

Table 6 Summary of associations between key student perceptions of Slido’s classroom application (Fisher-Freeman-Halton Exact Tests)

Association (Independent Variable vs. Dependent Variable)	Test	Value	Exact Sig. (2-sided)	<i>N</i> (Valid Cases)
Overall Communication Experience * Content Delivery	Fisher-Freeman-Halton Exact Test	11.544	0.003	25
Learning Support * Pace of Delivery	Fisher-Freeman-Halton Exact Test	16.745	<0.001	25
Learning Support * Content of Delivery	Fisher-Freeman-Halton Exact Test	6.768	0.098	25
Learning Support * Emojis-based Training	Fisher-Freeman-Halton Exact Test	8.961	0.031	25
Content of Delivery * Pace of Delivery	Fisher-Freeman-Halton Exact Test	7.592	0.053	25
Feeling Satisfied for Learning * Open Text Usage	Fisher-Freeman-Halton Exact Test	2.224	0.762	24
Feeling Satisfied for Learning * Question and Answer Feature	Fisher-Freeman-Halton Exact Test	3.339	0.261	18
Feeling Satisfied for Learning * Emojis-based Training	Fisher-Freeman-Halton Exact Test	3.984	0.514	18

the application's content delivery ($FFH=11.54, p=.003$). This suggests a strong link between a positive user experience in troubleshooting and the perceived quality of the instructional content itself.

Further significant associations were identified regarding the impact of Slido on learning support. A strong relationship was found between perceptions of learning support and the pace of delivery ($FFH=16.74, p<.001$), indicating that a well-paced lesson is essential for students to feel supported in their learning. Additionally, a significant association was observed between learning support and emoji-based training preferences ($FFH=8.96, p=.031$). This suggests that students who feel academically supported are more likely to prefer expressive, emoji-based feedback methods within the platform.

Conversely, several associations did not reach statistical significance. No significant relationship was found between Slido's impact on learning support and the methods of content delivery ($FFH=6.77, p=.098$), nor was there a significant association between content delivery and the pace of delivery ($FFH=7.59, p=.053$). Finally, no statistically significant associations were found between general satisfaction with Slido and a preference for specific features, such as Open Text ($FFH=2.22, p=.762$), the Question-and-Answer feature ($FFH=3.34, p=.261$), or Preferential Emojis ($FFH=3.18, p=.514$). These results suggest that while these functional tools are part of the platform, overall student satisfaction with learning is not directly tied to a preference for one specific feature.

4.6 Correlation analysis of student perceptions of Slido

A correlation analysis was conducted to examine the relationships between various dimensions of student perception regarding the Slido platform. The results, presented in Table 7, reveal several statistically significant associations that highlight the interconnected nature of the digital learning experience. A robust positive correlation was observed between a student's overall positive experience using Slido and the perceived quality of content delivery ($Rho = 0.659, p<.001$). This finding suggests that for an interactive platform to be well-received, the educational content it facilitates must be perceived as high-quality. Similarly, a strong positive correlation was identified between students' ability to provide specific examples of Slido's helpfulness and their subsequent suggestions for improvement ($Rho = 0.799, p<.001$). This indicates a productive feedback loop: when students have tangible, positive experiences with the platform, they are more likely to offer constructive input for its enhancement. Furthermore, a significant correlation was found between the perceived quality of content delivery and the pace at which that content was presented ($Rho = 0.799, p<.001$). This highlights a synergistic relationship where effective pacing directly enhances a student's perception of the material's overall quality. Conversely, the use of emojis as a follow-up feature showed only a weak positive correlation with both overall student experience and learning support ($Rho = 0.410, p=.042$). These results suggest that while emojis may not be primary drivers of learning or satisfaction, they serve as a valuable supplementary tool for low-stakes feedback. Their utility likely lies in providing a lightweight communication channel that allows students to express general sentiments or reactions without the cognitive load of formulat-

Table 7 Spearman's Rho correlation coefficients for student perceptions of Slido in the classroom

Spearman's Rho	Overall experience	Content delivery	Classroom Mgmt.	Learning & engagement	Questions	Open-ended Qs	Multiple-choice	Classroom feel	Slido helped	Slido improve
Overall experience	1	0.659**	0.247**	0.181	0.076	0.553**	0.224**	0.180**	0.755**	0.079
Content delivery		1	0.584**	0.381**	0.247	0.630**	0.557**	0.551**	0.565**	0.137
Pace of delivery			1	0.577**	0.247	0.558**	0.761**	0.741**	0.367**	0.06
Learning support				1	0.324	0.901**	0.842**	0.763**	0.717**	0.896
Questions and answers					1	0.218	-0.025	-0.082	0.001	0.27
Open to text						1	0.963	0.806	0.68	0.375
Facilitated training							1	-0.015	-0.099	0.067
Classroom feel								1	0.189	0.026
Slido helped									1	0.799**
Slido improve										1

* Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed)

ing a written response. By assessing the “emotional temperature” of the classroom or offering non-verbal cues of understanding, emojis function as a minor but useful component of the broader digital toolkit for student-instructor interaction.

4.7 Qualitative analysis: anonymity, safety, and equitable participation

This study utilized a qualitative approach to explore student experiences with Slido, specifically focusing on the pedagogical value of the platform. Thematic analysis was performed using NVivo (Jackson & Bazeley, 2019) on open-ended responses from 39 participants. To complement this analysis, key concepts were visualized through word clouds (see Figs. 2 and 3), which helped identify recurring terminology and sentiments. The findings suggest that Slido serves as a robust tool for enhancing student engagement, collaboration, and critical thinking, while specifically addressing the need for equitable participation (see Table 8).

The most significant finding of the analysis, cited by 48.7% of students, highlighted Slido’s pronounced effectiveness in encouraging equitable access. This was primarily achieved through the platform’s capacity for anonymous conversation and inclusive idea-sharing, ensuring that all student voices could contribute regardless of social standing or confidence levels. One student’s response emphasized the platform’s utility in being “able to put forward ideas about different topics as a group” (Table 8; Fig. 2). This theme of universal contribution and collaboration was strongly reinforced by the related word cloud, which prominently featured terms such as collaborative, environments, questions, and learning.

Furthermore, students highlighted the platform’s vital role in facilitating uninterrupted Q&A and brainstorming sessions. The text-based environment allowed participants to bypass common classroom dynamics that often favor the loudest voices; one student noted the environment was “less noisy as people could just type [their]

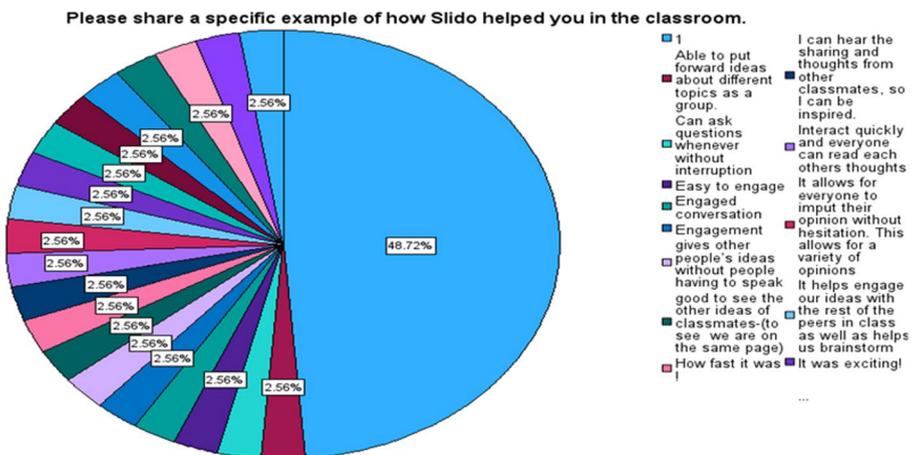


Fig. 2 Distribution of student-perceived benefits of Slido’s classroom assistance, including illustrative testimonials

Fig. 3 Word cloud of key themes from student feedback on Slido



question [with] no interruption,” while another confirmed they could “ask [a] question whenever without interruptions.” This direct, barrier-free access to critical discourse and intellectual exchange was also reflected in the Fig. 3 word cloud, which featured terms like critical, thinking, questions, and ideas.

The analysis distinctly revealed that Slido enhanced anonymity and fostered equitable participation, especially for individuals who might be naturally shy, hesitant to speak aloud, or hindered by cultural differences. This feature effectively removed significant personal barriers to contribution. Students shared that “Slido gives space to ask questions when I [doubt] my voice” and that they felt “safe to ask questions without interruptions” and “safe to see we are on the same page with classmates’ ideas.” By allowing everyone to “input their opinion without hesitation,” the tool made it “easy to engage” and “interact quickly.” The word cloud explicitly corroborated this with the terms equitable, social, critical ideas, and technology.

Finally, a consistent theme throughout the data was the participants’ positive user experience. Students expressed a high level of enjoyment and excitement, with comments such as “It was exciting!” and “It was fun to write how I could import interviews.” This positive reception indicates a successful technological integration into the curriculum, with the word cloud featuring related terms such as technology, Slido, and digital (see Table 8; Fig. 3).

4.8 Demonstrated impact on equitable participation and access

The qualitative findings regarding enhanced anonymity and equitable access are strongly substantiated by the quantitative data, demonstrating a significant shift in participation patterns. Out of 39 participants in the study, 22 students (56.4%) were engaged (participating in polls or Q&A), confirming the platform’s success in overcoming traditional barriers to involvement. Crucially, the Q&A feature exhibited a highly equitable access model, evidenced by the high volume of anonymous contributions: 13 out of 14 total questions (92.8%) were submitted anonymously. This overwhelming preference for anonymity directly supports the student comments

Table 8 Student perceptions of Slido's classroom benefits

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
Able to put forward ideas about different topics as a group	19	48.7	48.7	48.7
Can ask questions whenever without interruption	1	2.6	2.6	51.3
Easy to engage	1	2.6	2.6	53.8
Engaged conversation	1	2.6	2.6	56.4
Engagement	1	2.6	2.6	59
gives other people's ideas without people having to speak	1	2.6	2.6	61.5
good to see the other ideas of classmates-(safe to see we are on the same page)	1	2.6	2.6	64.1
How fast it was!	1	2.6	2.6	66.7
I can hear the sharing and thoughts from other classmates, so I can be inspired.	1	2.6	2.6	69.2
Interact quickly and everyone can read each others thoughts	1	2.6	2.6	71.8
It allows for everyone to input their opinion without hesitation.	1	2.6	2.6	74.4
This allows for a variety of opinions	1	2.6	2.6	76.9
It helps engage our ideas with the rest of the peers in class as well as helps us brainstorm	1	2.6	2.6	79.5
It was exciting!	1	2.6	2.6	82.1
It was fun to write how I could import interviews	1	2.6	2.6	84.6
it was less noisy as people could just type there question no interruption	1	2.6	2.6	87.2
Made it easier to answer questions	1	2.6	2.6	89.7
Making the classroom more interactive	1	2.6	2.6	92.3
seeing the reaction of my classmates all at the same time	1	2.6	2.6	94.9
Slido gives space to ask questions when I doubt about my voice	1	2.6	2.6	97.4
We got to see everyone's ideas whether people were too shy to normally participate	1	2.6	2.6	100
Total	39	100	100	

about feeling safe and empowered (e.g., “Slido gives space to ask questions when I doubt about my voice”), indicating the platform's success in empowering previously silent or marginalized students.

Furthermore, the data quantifies the claims of uninterrupted access and improved classroom interaction. A total of 14 questions were asked across the observed session, a high volume that represents a measurable increase over typical verbal Q&A in a traditional classroom setting, effectively showcasing the platform's ability to facilitate a high volume of critical discourse without interruption. The engagement extends beyond just asking questions; 12 participants either asked or voted in the Q&A, demonstrating broad and active engagement with the content. The fact that the Q&A resulted in 6 upvotes and 0 downvotes also suggests a positive and constructive environment for idea-sharing, further confirming the platform's value as a tool for equitable and comfortable interaction.

4.9 Student recommendations for Slido enhancement

Analysis of student feedback regarding potential improvements to Slido (Table 9; Fig. 4) reveals a notable dichotomy: while 53.85% of responses were non-specific, the remaining unique contributions (each representing 2.56%) offer invaluable, actionable insights. This “silence” from over half the respondents may indicate general satisfaction; however, it also raises questions about the users’ imaginative scope for transformative educational technology. This creates a challenge for educators to elicit more profound feedback in future iterations. Despite the high number of non-specific responses, the concrete suggestions provided, visually reinforced by the word cloud in Fig. 5, highlight crucial developmental pathways for the platform.

Table 9 Student recommendations for Slido enhancement

Valid Response	Frequency	Percent	Valid Percent	Cumulative Percent
(Unspecified/No specific suggestion)	21	53.8	53.8	53.8
Answer could also be put there	1	2.6	2.6	56.4
Could have more	1	2.6	2.6	59
Getting the program to work ok.	1	2.6	2.6	61.5
Greater specificity regarding questions presented	1	2.6	2.6	64.1
Have them be integrated in the lecture more	1	2.6	2.6	66.7
Idon't know	1	2.6	2.6	69.2
Increasing collaboration and communication in class	1	2.6	2.6	71.8
May not without word limits for some questions type	1	2.6	2.6	74.4
Maybe if emojis were more	1	2.6	2.6	76.9
More colours for dyslexic people / unique text colours	1	2.6	2.6	79.5
More fast and more interactive way to include Everyone	1	2.6	2.6	82.1
More single answer questions	1	2.6	2.6	84.6
n/a	1	2.6	2.6	87.2
N/A	1	2.6	2.6	89.7
Not sure	1	2.6	2.6	92.3
Nothing	1	2.6	2.6	94.9
Reveal which answers were incorrect	1	2.6	2.6	97.4
To have more words about emotions	1	2.6	2.6	100
Total	39	100	100	

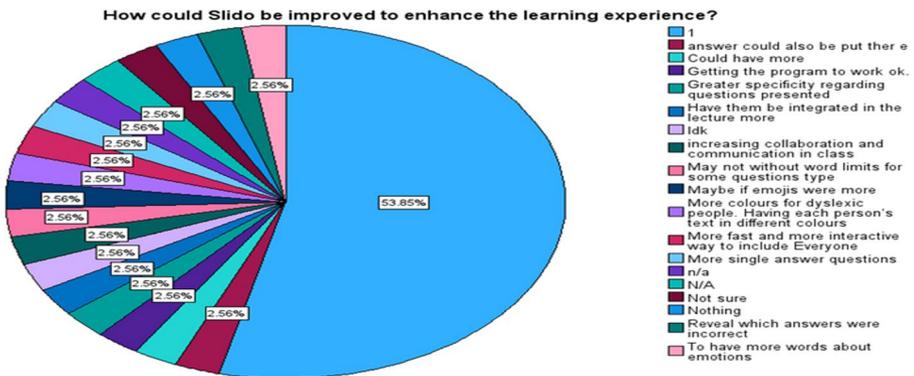
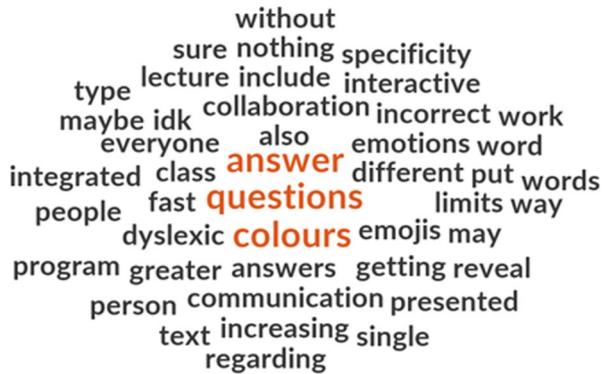


Fig. 4 Student suggestions for Slido enhancement

Fig. 5 Word cloud of student recommendations for Slido enhancement



One primary theme that emerged was Pedagogical Integration and Q&A Streamlining. Students expressed a desire for “greater specificity regarding questions presented” and requested that the platform “have questions be integrated in the lecture more” (Fig. 4). These suggestions indicate a push for Slido to evolve beyond a simple polling tool into a seamlessly embedded, pedagogically purposeful component of the learning experience. Keywords from the word cloud supporting this theme include answer, questions, limits, specificity, and words (Fig. 5).

Furthermore, student feedback pointed to a vital need for Inclusivity and Enhanced Visual Experience. Keywords such as colours, dyslexic, and emojis highlight a call for enhanced accessibility and visual learning features. Specifically, the request for “more colours for dyslexic people” emphasizes the necessity of inclusive design to meet diverse learning needs. This suggests that current educational technology often overlooks specific accessibility features, demanding more proactive consideration for varied user experiences and better support for emotional expression.

The final theme identified was Dynamic Interaction and Collaboration, reflecting a desire for enhanced group participation. Students explicitly sought features that would facilitate “increasing collaboration and communication in class” and real-time feedback, such as “revealing incorrect answers.” This demand indicates a need for robust tools that transition Slido from a Q&A tool into a holistic collaborative learning platform. By supporting complex group work and real-time discussions, the platform can more effectively promote equitable access to advanced learning activities. Furthermore, the capacity for real-time, objective feedback, represented by the keyword revealing, suggests an implicit function of anonymity, allowing students to engage safely with formative assessments without fear of public judgment. Key terms reinforcing this theme include collaboration, communication, fast, interactive, and program.

5 Discussion

The findings suggest that the Slido intervention successfully transformed the classroom from a site of social performance into a space for equitable participation. By substituting high-stakes verbal public speaking with an anonymous digital chan-

nel, the study effectively dismantled the “participation hierarchy” common in large, diverse cohorts. The empirical shift from a 15.38% verbal engagement rate to a 54.54% digital engagement rate provides a compelling testament to the efficacy of digital pedagogy when it prioritizes psychological safety. This transition empowered the “silent majority,” with 92.8% of respondents utilizing the anonymity feature to contribute.

Crucially, anonymity functioned as a fundamental requirement for inclusion, particularly for international students who cited “doubt about [their] voice” in verbal settings. By creating a “safe space” shielded from the fear of judgment or microaggressions, the intervention enabled previously silent international students to become primary contributors. This mediation lowered social barriers to intellectual exchange, facilitating a trajectory toward improved academic performance (Chen, 2023). These results align with broader evidence that EdTech adoption strengthens both pedagogical integration and learning equity (Bawa & Bawa, 2025). Digital tools act as “leveling” instruments; Bawa (2025) notes that these benefits are disproportionately significant for under-resourced learners. This is further supported by the “Personalization-Agency Loop” (Singh, 2025), where adaptive pacing and instant feedback shift students from passive observers to active participants. Singh found that this transition strengthens self-efficacy, with 80% of students reporting increased engagement, a virtuous cycle mirrored in this study’s shift toward equitable participation.

Beyond engagement, the study positions digital pedagogy as an essential tool for instructional partnership. High satisfaction regarding lecture pace (96%) and learning support (88%) confirms that real-time feedback loops allow for the dynamic addressing of misconceptions (Hattie & Timperley, 2007; Ferguson, 2011). The robust correlation ($Rho = 0.659, p < .001$) between user experience and content quality suggests that students perceive the platform as a core component of a high-quality environment rather than a mere novelty. However, a critical tension remains regarding the potential for passive consumption. While satisfaction was high, the 53.85% rate of non-specific feedback suggests a risk of “passive acceptance,” where students utilize technology without critically evaluating its utility. This highlights a pedagogical imperative: educators must design activities that move students from being mere “consumers” to active collaborators. Specific requests for accessibility features, such as color-coded text for dyslexic users, demonstrate that when students are empowered to critique their tools, they become co-creators of inclusive design (Cela et al., 2015).

5.1 Advanced contribution

This study advances the understanding of equitable digital participation by providing empirical evidence of the differential impact of anonymous digital tools on previously marginalized students, a gap in existing literature focused mainly on overall engagement. Students frequently praised the platform for providing a safe space for shy or hesitant individuals to participate. By quantifying how international students, who remained silent in verbal settings, became the primary contributors under the veil of anonymity, this research establishes a clear link between digital pedagogy and

the dismantling of traditional participation barriers. Students' interest in features like "Questions and Answers" and "Open Text" suggests a preference for a more active, collaborative learning model.

5.2 Limitations and recommendations

While this study provides valuable insights, it is important to acknowledge its contextual and methodological limitations. The high prevalence of non-specific feedback (53.85%), such as "it helped," suggests that while students appreciated the tool, they may have lacked the prompts or the "evaluative fluency" required to articulate detailed, analytical critiques. Furthermore, as this study was conducted within a specific academic cohort, the results may be influenced by unique disciplinary norms or specific group dynamics.

Future research should move beyond measuring basic participation and satisfaction, instead investigating how specific pedagogical interventions cultivate a more reflective approach to technology. Singh (2025) cautions that technological success remains fragile and deeply dependent on human factors; without intentional design, students may over-rely on automated assistance, potentially undermining deep conceptual mastery. Future longitudinal studies could explore whether the boost in engagement seen via Slido translates into long-term retention of complex theoretical concepts.

Additionally, the findings indicate that the full potential of these tools is often constrained by digital equity gaps and a lack of professional development. Consequently, this study recommends that institutions not only normalize anonymity as a primary equity tool but also prioritize digital fluency training for educators. This institutional shift should include a commitment to inclusive design for neurodiversity, such as customizable interfaces for dyslexic users (Cela et al., 2015). By transitioning from simple polling to a genuine instructional partnership, educators can create a dynamic feedback loop where student input has a direct and transformative impact on the learning experience.

6 Conclusion

This study demonstrates that the integration of anonymous digital tools is far more than a technical upgrade; it represents a fundamental shift toward a democratic and inclusive classroom. By contrasting traditional verbal engagement with digital participation, this research provides empirical evidence that the student "voice" is frequently suppressed by the psychological and social barriers inherent in conventional lecture formats.

The overwhelming preference for anonymity confirms that a safe, judgment-free space is essential for the inclusion of marginalized groups, particularly international students. While the risk of passive technology consumption persists, the findings reveal that strategic digital pedagogy can transform students from passive observers into active contributors. Ultimately, these results advocate for a human-centered approach to EdTech, where technology serves as both a bridge to inclusion and a catalyst for equitable academic discourse.

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The author was responsible for the conception and design of the study, the collection of all primary data, statistical data analysis and interpretation, and the initial and final preparation of the manuscript. Additionally, the author contributed to the final review and approval of the manuscript.

Data availability The dataset used and analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Competing interests The author declares that she has no competing interests.

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