



Keeping 900+ Students on the Same Page: Communication Strategies for Mega Scale Teamwork in Engineering Education

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ABSTRACT

BACKGROUND & CONTEXT

Effective communication is a critical yet often overlooked component of mega-scale interdisciplinary engineering modules. With cohorts exceeding 900 students, ensuring clarity, consistency, and accessibility of information becomes a significant challenge. Miscommunication can lead to confusion, decreased student engagement, and administrative overload, impacting teamwork development. Prior research on mega-scale teaching emphasizes structured processes, but little attention has been given to how communication structures influence students' ability to collaborate effectively.

PURPOSE OR GOAL

This study examines two high-enrolment interdisciplinary engineering modules, one in the global north and one in the global south, investigating the practical implementation strategies that facilitate effective communication and teamwork development.

APPROACH OR METHODOLOGY

We use a comparative case study approach, analysing two mega-scale modules through autoethnographic reflection and instructional artefacts to explore how communication structures enable teamwork, manage complexity, and balance automation with human presence at scale.

OUTCOMES

Findings show that structured, multi-channel communication reduces confusion and administrative burden, fostering student independence. While automation streamlines responses, it may limit informal learning. Clear, repetitive messaging and multiple contact points maintain engagement, while proactive communication prevents teamwork issues like unclear roles and last-minute disorganization.

CONCLUSIONS

Clear and structured communication is essential for sustaining teamwork development in large-scale engineering courses. The study recommends that educators design communication strategies that balance automation with personal engagement, ensure consistency in messaging, and integrate structured team support mechanisms. These insights offer guidance for developing scalable, student-centered teamwork models that enhance learning while managing logistical complexity.

KEYWORDS

Mega-scale classrooms, teamwork development, communication strategies, interdisciplinary learning.

Introduction

Over the past three decades, higher education has expanded access and diversified student cohorts, a process widely referred to as massification (Hornsby & Osman, 2014; Yates & Young, 2010). In parallel, engineering curricula have embraced active, interdisciplinary approaches to better prepare graduates for complex global challenges (Lattuca et al., 2004; Kolb, 2014; Kolmos et al., 2024), promoting collaboration, problem-solving under uncertainty, and ethical reasoning.

These dual pressures converge in large-scale modules enrolling hundreds or even thousands of students. Delivering interdisciplinary teamwork at this scale is challenging: educators must coordinate hundreds of teams, track diverse trajectories, and maintain coherence across departments and formats. The challenges are not only logistical but deeply pedagogical. Students navigating ambiguity and shifting dynamics require consistent communication and structured guidance to stay engaged and aligned.

Recent research has begun to explore how structure enables learning in these contexts. Joyner et al. (2023) highlight the importance of aligned assessments, scaffolding, and support systems in scaled instruction. Within this, communication is pivotal, not simply for information exchange, but for managing expectations, relationships, and autonomy. While teamwork pedagogy and automation in higher education are gaining attention (Hernández-de-Menéndez et al., 2019; Van den Beemt et al., 2020; Sajadi et al., 2024), communication's role as a pedagogical tool remains underexplored. At mega scale, a vague announcement can trigger 100+ follow-up emails; inconsistent interpretation can fracture teams and derail progress. Communication becomes the backbone of the learning experience.

This paper is the fifth in a research series on interdisciplinary teamwork in mega classes. The first examined the educator's evolving role (Truscott & Smith, 2024); the second applied teamwork design frameworks to scale (Smith & Truscott, 2025a); the third addressed coordination and assessment trade-offs (Smith & Truscott, 2025b); and the fourth explored structure as a tool to enable autonomy and protect learning integrity (Truscott & Smith, 2025).

Here, we examine communication—identified in our third paper as a critical theme. Rather than treating communication as administrative, we explore its role in managing complexity, sustaining engagement, and enabling teamwork. We ask: How does communication act as a core mechanism within mega-scale interdisciplinary team project modules?

Drawing on two case studies, Engineering Challenges at University College London and Joint Community Projects at the University of Pretoria, we examine how structured communication ecosystems are designed, implemented, and experienced in distinct contexts. We highlight three intersecting themes: expectation management, layered support ecosystems, and balancing automation with human presence. Insights are grounded in the lived experiences of two facilitators and reflect on the transferability of these approaches.

By foregrounding communication design as both logistical and pedagogical, this paper contributes to ongoing efforts to reimagine what meaningful, human-centred education can look like at scale.

Literature Review

As interdisciplinary engineering education expands, especially at scale, communication design is a core component of pedagogical infrastructure. While often considered a logistical support function, communication plays a central role in shaping expectation management, teamwork development, and the relational culture of large-scale learning environments. This section draws on cross-disciplinary literature to explore four interlocking themes: communication as pedagogical structure, social presence and mediated engagement, communication hierarchies and coordination at scale, and the role of communication in teamwork pedagogy.

Communication as Pedagogical Structure

In mega-class environments, communication is not incidental, it is what enables structure to be perceived, enacted, and sustained. Joyner et al. (2023) highlight how teaching at scale necessitates investment in structured, multi-channel communication strategies. These strategies often emerge through flipped classrooms, asynchronous delivery, and collaborative design among content experts, platform engineers, and learning designers. This design focus shifts communication from an add-on to an integral part of curriculum infrastructure. Asynchronous messaging, templated feedback, and scheduled reminders offer consistency and reduce ambiguity, particularly for diverse, large cohorts.

Clifton (2020) notes that communication also carries emotional and symbolic weight. Students expect clarity, but they also seek human connection and a sense that instructors care about their experience. In at-scale modules, where direct interaction with coordinators is limited, communication design must also signal care. This has led to the emergence of structured “human proxies,” such as mentors and teaching assistants, who become the interpersonal touchpoints of the course.

Social Presence and Mediated Engagement

The rise of online and hybrid teaching has focused awareness of how communication channels shape learners’ sense of connection. Vigness (2019) argues that the selection of communication modes directly influences students’ social presence and perceived belonging. In her study of asynchronous online learning, students who engaged via richer communication media (audio-video) reported stronger identification with their peers and greater satisfaction. These findings echo work by Garrison (2009) and Kear et al. (2014), who show that low social presence often leads to disengagement or withdrawal in online environments.

Translating these insights to mega-class contexts, mentorship and structured communication layers function as mediators of presence. In the JCP module, for example, mentors who have previously completed the course are trained to become relational bridges, offering support that the central coordinator cannot sustainably provide at scale. This creates a mentorship ecosystem that fosters peer-to-peer social learning, what Vigness (2019) refers to as “customer-to-customer” value exchange, recasting students as co-creators of the learning experience.

Communication Hierarchies and Organisational Coordination

Communication at scale also mirrors principles of organisational design. Erjavec et al. (2018) draw on media richness theory to examine how managers use different channels to support relational outcomes. Their findings show that satisfaction with internal communication is highest when the structure of communication aligns with the purpose and accessibility of the message. Top managers, they note, often rely on email and structured print material to convey formal messaging, while interpersonal channels (mentoring, meetings) are used for nuanced relational work.

This layered approach resonates with Bolman and Deal’s (2017) typology of vertical and lateral coordination. In stable systems, vertical communication suffices, but in complex or turbulent environments, lateral systems (e.g., mentorship, peer coordination) are essential. Both JCP and Engineering Challenges implement these dual structures: coordinators manage top-level guidance while mentors and departmental leads handle context-specific support. This matrix-like approach requires careful boundary-spanning roles that reinforce clarity without overwhelming any single node in the system.

The Role of the Facilitator at Scale

As interdisciplinary teaching scales up, the role of the educator undergoes a fundamental shift, from content expert to facilitator, systems thinker, and boundary-spanner. Truscott and Smith (2024) describe this transition as one marked by adaptability, uncertainty, and learning-through-doing. Facilitators of mega-scale modules must not only deliver content, but

coordinate complex logistical structures, curate student experience, and hold together distributed teaching teams with empathy and clarity. Their work is rarely visible in conventional metrics, yet it is central to student learning and teamwork success.

In both the JCP and Engineering Challenges modules, the coordinator role mirrors that of a product manager or integrative leader (Bolman & Deal, 2017), responsible for aligning communication, assessment, mentorship, and institutional systems. The coordinator's visibility to students is often low by design, email protocols, mentor hierarchies, and query systems all intentionally direct traffic away from them to maintain sustainability at scale. Yet behind the scenes, these individuals orchestrate dozens of workflows, mediate cross-functional tensions, and ensure consistency across an evolving ecosystem. Their influence is less about direct teaching and more about designing the architecture in which learning can reliably occur.

This orchestration requires comfort with ambiguity and constant decision-making in conditions of complexity. Truscott and Smith (2024) note that facilitators thrive not because they know all the answers, but because they are willing to plan iteratively, adapt continuously, and share their learning openly. Their roles are emergent, shaped more by lived experience and community of practice than by formal training. Institutional support is therefore critical. Where universities recognise the unique demands of these coordinator-facilitators, particularly the tension between formal authority and informal relationship-building, they create space for this work to flourish. Where such recognition is absent, burnout, invisibility, and systemic inefficiency often follow.

Communication and Teamwork Pedagogy

Effective teamwork relies on shared norms, clarity of roles, and communication that supports accountability and trust (Kimpton & Maynard, 2023). Communication failures are a common reason for group dysfunction, particularly when coordination is poor or expectations are unclear (Pauli et al., 2008). Poor group outcomes, they argue, often stem from a lack of scaffolding, be it motivational, interactional, or logistical.

In mega-scale modules, class-wide communication structures are critical not only for coordinating logistics, but for shaping how students engage with each other. The tone, protocols, and frameworks set by the practitioner implicitly model what good communication looks like. Thus, the practitioner plays a dual role: managing communication at scale, and setting the norms and expectations that small teams will adopt. For this reason, the practitioner needs to indicate to teams how and why communication is important within a team, as well as consider how they communicate with a team and vice versa.

In well-structured mega-class modules, communication plays a scaffolding role across all three domains. Pre-structured group contracts, email protocols, and grievance procedures reduce interactional ambiguity and support early-stage norm-setting. As Tuckman's (1965) model of team development suggests, communication scaffolds are especially critical during the "storming" phase of group work when conflict or uncertainty can derail progress. Modules that model professional communication patterns not only support learning but prepare students for real-world organisational life.

Together, these studies position communication not as background noise, but as an intentional, designed part of the learning environment. Communication enables scale by compensating for the absence of direct contact. It structures relationships, manages cognitive load, models professional norms, and builds social presence. In doing so, it becomes an invisible architecture through which students come to understand not only what they are expected to do, but how they are expected to be.

Context and Methods

This paper draws on a collaborative autoethnographic approach, informed by six months of structured reflection and dialogue between the two lead authors, longstanding coordinators of mega-scale, interdisciplinary engineering modules at the University of Pretoria and University

College London, respectively. Our inquiry focused on how communication design influences student autonomy, teamwork development, and system coherence in large-class settings.

We drew from three data sources: (1) ongoing autoethnographic reflections anchored in facilitation experience and informed by Kimpton and Maynard's (2023) teamwork framework; (2) module artefacts such as study guides, rubrics, mentorship training materials, communication protocols, and announcements; and (3) bi-monthly cross-institutional conversations that enabled comparison of implementation strategies and surfacing of context-sensitive insights. Our method is grounded in shared narrative inquiry and supported by thematic analysis. Through progressive focusing and peer dialogue, we distilled recurring tensions and design principles related to communication at scale. To support credibility and mitigate bias, we employed peer-checking, iterative theme validation, and member sense-making across contexts. A fuller methodological account, including analytic processes and validation strategies, is detailed in (Smith & Truscott, 2025a).

Case Study Descriptions

This study examines two high-enrolment, interdisciplinary engineering modules that operate in vastly different contexts but face shared challenges related to communication and teamwork at scale. The Joint Community Projects (JCP) module at the University of Pretoria (South Africa) and the Engineering Challenges module at University College London (UK) provide valuable insights into how intentional communication design can support student autonomy, reduce logistical complexity, and sustain teamwork development across extremely large cohorts.

Joint Community Projects (JCP) – University of Pretoria

The JCP module is a flagship service-learning initiative in the Engineering, Built Environment and IT Faculty at the University of Pretoria, enrolling over 1,600 students annually. Students are grouped into over 350 interdisciplinary project teams that collaborate with community partners on real-world interventions across Gauteng. The module operates more like a distributed organisation than a conventional class, requiring significant communication infrastructure to support project delivery, reflection, and assessment. The coordination team consists of 2 academics and 1 administrator, and then there are 15 final year students as “senior managers” and 35 3rd year students that are “junior managers”. Mentors (trained former JCP students) are embedded in every group and serve as a structured support tier for professional and developmental issues.

Engineering Challenges – University College London

Engineering Challenges is a first-year module that forms part of a redesigned, integrated engineering curriculum for undergraduate programmes across the Faculty of Engineering at UCL. Delivered to seven departments, the module requires extensive coordination across disciplinary boundaries, assessment types, and teaching teams. Each department contributes teaching staff known as departmental leads who contextualise the module within their degree programmes, while a central module lead maintains overall coherence. In total, the module involves around 15–20 academic staff and 45 postgraduate teaching assistants (PGTAs), many of whom work on specific components. Given the complexity of the teaching team and student body, clear communication is essential to prevent breakdowns in coordination and ensure that all stakeholders operate with aligned expectations.

Comparative Overview

Together, these cases illustrate how communication design at scale is not simply a logistical challenge but a pedagogical strategy. While their tools and institutional contexts differ, both modules demonstrate the necessity of intentional, layered communication to sustain interdisciplinary teamwork, enable autonomy, and reduce the burden on teaching teams.

Table 1: Comparative Overview of JCP and EC

Feature	JCP (UP, South Africa)	Engineering Challenges (UCL, UK)
Cohort Size	±1650 students	±950 students
Team Structure	±350 interdisciplinary teams across 18 Departments	Paired disciplinary groupings with interdisciplinary framing (±150 teams across three 3 paired cohorts)
Support Hierarchy	Mentors → Online Form → Coordinator Inbox	PGTAs → Department Leads → Module Lead
Communication Channels	Blackboard announcements, shared email inbox, web queries, mentors, in-person briefings	Moodle, forums, workshops, departmental briefings, PGTA communications
Automation	Scheduled announcements, query triage, structured email protocols	Live feedback sessions, scheduled workshops, automated Moodle content
Communication Philosophy	Model professional communication; minimise noise, maximise clarity; structured escalation	Increase reach through redundancy; balance clarity with local adaptation; structured guidance
Feedback Strategy	Peer, mentor, community input + standardised reflections and final videos	Live assessments + submitted written work with standardised rubrics and moderation

Findings

Re-evaluation of previous autoethnographic reflections to focus on the role of communication with these two modules revealed three intersecting findings that underpin effective communication for interdisciplinary teamwork at scale: (1) Communication as Expectation Management, (2) Structured Multi-Layered Communication Ecosystems, and (3) Balancing Automation with Human Presence.

Communication as Expectation Management

In both modules, communication is not simply about conveying information but about framing and reinforcing expectations. This includes behavioural expectations (e.g., professionalism in emails), procedural expectations (e.g., reporting lines for grievances), and academic expectations (e.g., structure and timing of deliverables).

Within Engineering Challenges, different pairs of departments work on different aspects of an overarching project, and so it is very important that students only see the information that is relevant to them and their project. This avoids confusion - what is relevant to me? - and overload - there is too much here! Customised communication also extends to reminders, only those attending a specific workshop that week or haven't completed an activity get sent reminders to avoid the email avalanche of but I've done this! This includes Moodle's automated overdue assignments reminders, which one year showed for all students and not just those who hadn't submitted, causing many emails.

In JCP, these expectations are codified in a detailed study guide that outlines protocols for email communication, reporting grievances, working in teams, and maintaining professionalism. For instance, students are required to consult the study guide and ClickUP announcements before contacting mentors or using the structured query form. Failure to follow protocol results in group demerits and, after repeated breaches, grade penalties. This formalised approach encourages students to manage their own engagement responsibly and mirrors professional escalation structures found in the workplace. The group contract further reinforces shared accountability within teams. Teams are required to define expectations for

punctuality, contribution, respectful interaction, conflict resolution, and even contingencies for "firing" a team member. By embedding these tools early in the course, JCP makes expectations visible, explicit, and non-negotiable, shaping both team culture and individual behaviour.

Engineering Challenges also uses approaches and techniques from the workplace to structure and manage expectations. Students are given processes to resolve disagreements within the team and are expected to have at least attempted to use them before escalating to department or module leads. The module also uses job descriptions to set team members' expectations of what they should and should not be doing. Teams are required to meet once a week to specifically discuss the progress of the project and then submit minutes for that meeting. This models the communication patterns of teams and prompts the flow of information. However, not all communication of expectations needs to be explicit. Peer assessment is used as part of the assessment within Engineering Challenges. One of the first actions a team does within the project is selecting 4 peer assessment criteria from a list of 10 provided by the module lead. By stating that these are the 10 criteria that we, the teaching team, think you should select from, we are saying to students this is our expectation of what is important for teamwork. How far first-year engineering students internalise a very subtle form of expectation setting can be argued, but as part of a consistent message across the whole module, every bit helps.

In both contexts, managing communication expectations early and explicitly reduces confusion and prevents miscommunication from escalating into large-scale logistical challenges. As one module lead noted, even a small oversight in instruction can generate hundreds of redundant queries. This approach echoes Joyner et al.'s (2023) framing of communication as curriculum infrastructure, deliberately structured to support learner autonomy and reduce ambiguity at scale.

Structured Multi-Layered Communication Ecosystems

Both modules rely on communication ecosystems that mirror organisational hierarchies rather than traditional classroom dynamics.

Within JCP, these layers of communication are tied to different functions. Mentors are trained to focus on professional development and personal support, not administrative logistics, ensuring their role is clear and protected. For logistical questions, students must use a dedicated online form, which automatically logs queries and allows any of the three module coordinators to respond via a shared email account. This increases transparency, reduces duplication, and ensures continuity even if a coordinator is unavailable.

Within Engineering Challenges, area specialists are needed to tailor content to both an area and a degree programme as well as teach that content. So it is necessary to clearly communicate to both staff and students what information is module-wide and what needs to be contextualised for a specific department or area. The hierarchy of PGTAs, Departmental Leads and Module Lead allows for a distribution of scarce resources where needed. PGTAs can handle basic questions and information distribution within the classroom, freeing Departmental Leads up to more complex questions, team issues and leading the workshop. The same is true for the Module Lead.

These communication structures are reinforced by multiple platforms, announcements, forums, websites, and in-person briefings, intentionally layered to provide redundancy without overwhelming students. In both modules, communication is scaffolded: early information is simplified and high-priority, with increasing complexity introduced as students settle into the project cycle. Importantly, both modules differentiate the purpose of communication types: broadcast announcements for key milestones, reflective prompts for learning integration, and discussion channels for peer-based clarification. This scaffolding aligns with the project timeline and is intentionally light-touch at the beginning of the semester to avoid early overload.

These distributed hierarchies reflect Bolman and Deal's (2017) model of lateral and vertical coordination, in which effective teamwork and communication in complex systems rely on boundary-spanning roles and differentiated responsibility.

Balancing Automation with Human Presence

Automation plays a critical role in reducing administrative load and ensuring consistency. Yet, both modules also recognise the risk of over-automation. Students, particularly those navigating university for the first time, still need human contact for guidance, reassurance, and sense-making.

In JCP scheduled reflections and templated assessments (like the one-page project proposal and video reflections) are designed to guide engagement while reducing the need for direct staff feedback at each step. These tools function as both learning interventions and communication checkpoints, providing structure without requiring constant staff input.

Template reports or specified outlines are used extensively within Engineering Challenges. These clarify what is required in an assessment, reducing the number of queries about what should be included. Each assessment has detailed instructions on how the assessment functions, how to submit and what regulations cover the assessment, again reducing the need for clarification. Within Engineering Challenges, the method of assessment and type of submission portal have been chosen to streamline the return of feedback and processing of submission. For example, the use of live assessments within the module allows for the instant return of feedback to teams. Teams submit their weekly meeting minutes in an MS Form as it is the act of submission in this case, not the contents, that is the focus of the assessment. MS Forms allows us to download responses into a spreadsheet and analyse as necessary.

Both cases strike this balance by ensuring automation handles logistics, while human mentors, tutors, and lecturers focus on relational and reflective engagement. JCP's emphasis on modelling professional communication norms, through tone, protocol, and boundaries, also helps students recognise when human contact is appropriate and when to rely on the system. This design resonates with Vigness's (2019) work on mediated engagement, which underscores the importance of balancing clarity and connection in learning environments that rely on asynchronous and automated elements.

Discussion

These findings suggest that effective communication in mega classes is inseparable from module design, it is both a logistical tool and a pedagogical strategy. In both JCP and Engineering Challenges, communication is intentionally structured to manage expectations, support autonomy, and reduce unnecessary intervention. This aligns with the growing recognition that mega classes require systemic thinking, where communication, assessment, structure, and support operate as an integrated whole.

Communication as an Organisational Design Principle

In both modules, communication is treated not as a reactive mechanism but as a foundational design element. Echoing organisational theory, both courses construct a communication hierarchy that reflects a professional environment. This reframing enables students to navigate their responsibilities with greater clarity, and reduces reliance on constant direct contact with lecturers. Communication, in this sense, becomes a proxy for distributed leadership (Kezar and Holcombe, 2017), where clarity of roles and escalation pathways promotes accountability.

The detailed communication protocols found in the JCP study guide function as both policy and pedagogy. They simulate the kind of structured, chain-of-command interactions students might encounter in the workplace. For example, the grievance procedure maps directly onto organisational HR processes, beginning with team-level resolution, moving through mentorship, and only reaching coordination or departmental level when necessary.

This design mirrors what Truscott and Smith (2025b) previously noted: scale transforms the educator into a system architect rather than a direct instructor. Effective communication is part of this architecture, functioning as connective tissue between design, delivery, and experience.

Designing for Redundancy and Clarity

Findings reinforce the principle that in mega classes, no single channel can reliably reach all students. Redundancy, far from being inefficient, is a necessity. Repeating key messages across email, LMS announcements, live briefings, and mentor check-ins increases the likelihood that information is received and understood. However, redundancy must be purposeful. Overloading students at the wrong time, especially in transitional periods (e.g., early semester), can lead to disengagement.

In JCP, clear guidance on communication hierarchy and consequences for protocol breaches sets a strong tone. Similarly, Engineering Challenges introduces information in digestible layers, aligned with the students' growing project maturity. This staged approach helps avoid both overload and gaps in understanding.

Human Support in an Automated World

Despite increasing automation, students still need human support. Mentors (JCP) and PGTAs (Engineering Challenges) provide relational scaffolding, helping students navigate ambiguity and conflict. Their role is not to repeat instructions but to offer developmental support where most needed. The resulting communication ecology is deliberate: integrating automation and human contact to support student learning and autonomy.

Implications for Practice

The communication strategies identified in this study suggest that mega class success depends on more than just “keeping students informed.” It requires designing a culture of communication, one that is predictable, consistent, and aligned with the professional outcomes of the course. The use of structured templates, scheduled updates, and tiered support allows educators to manage complexity while maintaining pedagogical integrity.

More than managing flow, communication design at this scale teaches students how to engage as professionals-in-training. From email etiquette to conflict resolution procedures, the communication structure becomes part of the hidden curriculum, shaping students' sense of agency, accountability, and role within a larger system.

At the same time, a key challenge persists: how to preserve opportunities for informal learning and teachable moments within these highly structured systems. Both cases show that it is possible, but it must be designed for, not left to chance.

Conclusions and Implications

As mega-scale interdisciplinary modules become more common in engineering education, the role of the facilitator evolves beyond traditional teaching. In cohorts exceeding 900 students, communication is not an add-on to instruction, it is the infrastructure that enables it. This paper has shown that when communication is deliberately structured and embedded into the design of a module, it becomes a powerful pedagogical tool, supporting student autonomy, fostering teamwork, and sustaining coherence across an otherwise fragmented experience. When neglected, communication becomes a source of confusion, disengagement, and unsustainable workload.

This paper does not aim to generalise but to offer grounded insights drawn from two contrasting contexts. Engineering Challenges, a first-year module in a Global North university, spans multiple degree programmes and has a large international cohort. JCP, in contrast, is a second-year standalone module in a Global South institution, serving socio-economically diverse students. Together, these cases demonstrate how communication design can adapt across contexts while addressing shared challenges.

Our overarching research project begins to address a critical but underexplored intersection in engineering education: the convergence of system-level massification and the pedagogical turn toward active, team-based learning. While each of these trends, expanding enrolments and the shift to more student-centred methodologies, has been widely discussed in isolation, their combined impact on educational design, facilitation, and communication at scale remains poorly theorised. This work does not claim to be definitive but aims to open space for grounded, practice-based insights into how large-scale active learning environments can be designed and supported in engineering education.

Facilitating interdisciplinary teamwork in mega classes is less about delivering content and more about designing and maintaining systems that enable learning, alignment, and self-direction. The findings from JCP and Engineering Challenges illustrate that effective communication at this scale demands more than logistical efficiency, it requires system-level thinking. Facilitators must act as architects of predictable, layered ecosystems where students know where to turn, mentors can guide effectively, and staff can stay aligned across complex teaching teams. This involves more than broadcasting announcements. It means scripting expectation management, embedding professional norms, balancing automation with human contact, and curating the emotional tone of the learning environment. Communication becomes a cultural force, shaping not only what students know, but how they feel as they navigate high-stakes, real-world teamwork.

Even with strong systems, tensions remain: redundancy can overwhelm; automation can depersonalise; clarity can feel rigid. These are not flaws but signs that mega-class communication must continually balance structure with responsiveness. Based on our cross-institutional reflections, we propose five guiding principles for designing communication in mega classes:

- Design for Redundancy, Not Repetition: Use multiple channels intentionally, reinforcing key messages at different times and in different formats to increase reach without creating noise.
- Structure Escalation Pathways: Clarify where students should go first, next, and last, with consequences and tone aligned to support learning, not punishment.
- Model Professional Norms: Frame communication expectations (tone, response time, detail) as part of students' development as professionals, not just logistical necessity.
- Balance Automation with Presence: Automate what can be standardised; humanise what requires care, complexity, or emotional support.
- Curate Communication as Culture: Recognise that tone, timing, and responsiveness shape student experience. Communication is not just information, it is atmosphere.

Mega classes magnify the risks and rewards of communication. When thoughtfully designed, communication systems reduce friction, enable teamwork, and build student confidence. In this context, facilitation is not about simplification but about making complexity navigable. Communication, when done well, becomes the quiet infrastructure that makes active, meaningful education possible at scale.

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