Rewiring from Within: Exploring how participation in curriculum development impacts engineering academics professional and personal well-being

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Abstract

Addressing complex global challenges requires more than technical solutions; it demands an integrated approach involving economic, environmental, and social dimensions. Engineering education is a driver for Sustainable Development Goals (SDGs), but transformative engineering education requires a 'shift of consciousness' and focus on socio-emotional development. Our project developed a process called 'Clear,' rooted in Theory U for systemic transformation in engineering education and applying meta-patterns to support shifts in personal perspectives. The process enables engineering educators to slow down and explore fundamental questions about identity, purpose, and response-ability, which are essential precursors to effective engagement with complexities of developing an engineering curriculum. This approach is particularly relevant for developing innovative engineering curricula in South Africa and in comparable low- and middle income settings transforming away from inequality to justice. The study aims to explore how focusing on intrapersonal transformation, through the 'Clear' process, can facilitate systemic change in engineering higher education. Specifically, it explores personal awareness and development as foundational intrapersonal capacities to enable broader curriculum shifts. Research assistants conducted online interviews with 34 engineering educators engaged in the 'Clear' process. Audio-recorded interviews were transcribed verbatim and analysed using inductive thematic analysis to understand the participants' experience during and after the 'Clear' process. The analysis revealed themes such as the importance of community, the need for balanced reflective practice, and the interplay between intrinsic and extrinsic motivations for change. Participants highlighted the role of networking and the complexities of building learning communities, with their narratives showing evidence of both professional and personal well-being as a result of participating in the curriculum intervention. These insights suggest that individual transformation is crucial before addressing larger institutional goals, aligning with the principles of the Inner Development Goals (IDGs) framework. This work-in-progress suggests that integrating IDGs, such as "Being" into academic development can create a foundation for innovative, student-centred curricula. Future research will explore how individual attributes—such as career phase, personality, and socio-cultural values —shape engagement with systemic transformation efforts.

Keywords: engineering educators, innovative engineering curricula, transformation, well-being

1 Introduction

The challenge of transforming collective social systems, particularly within fields like engineering education, reflects broader global issues of violence, social injustice, and environmental degradation (Nordin & Sundberg, 2018; Case et al., 2016; Mitchell et al., 2021). These challenges often stem from a disconnection in how individuals relate to themselves, others, and the environment. To address these complex systemic problems, a shift is required from an ego-centric worldview to one that is ecosystem-aware—emphasizing mindfulness, inner leadership, and connection (Ankrah et al. 2023; Woiwode, 2020). This shift involves adopting new ways of observing, reflecting, and acting, fostering holistic solutions that address the root causes of systemic issues, leading to more meaningful and sustainable change (Ives et al., 2020).

However, the process of facilitating deep change in both individuals and systems requires an acknowledgment of the inherent complexity involved. Change theories often present simplified, linear models, overlooking the unique and subjective experiences of individuals as they navigate transitions. The reality is that every individual's capacity to respond to change is unique, influenced by personal context and pace of movement. This complexity is compounded within collective systems, where it becomes nearly impossible to pinpoint which decisions trigger specific outcomes (Mason, 2008; Morrison, 2008).

Recognizing these challenges, the Innovative Engineering Curricula (IEC) team—established through the Transforming Systems through Partnerships (TSP) project, co-funded by the Royal Academy of Engineering (RAE) and the South African Department of Higher Education and Training (DHET)—engaged with transformation coaches and academic leaders who had previously navigated institutional change. Their reflections revealed a key insight: before meaningful curriculum change can occur, educators themselves must feel resourced, connected, and clear. In their reflections, deep personal development emerged as the often-missing foundation for sustainable systemic change.

In response, we developed the *Change Makers in Engineering Education* program, using a structured reflective process we call *Clear*. This process integrates Theory U's approach to systemic transformation (Scharmer, 2009) with the Meta-States model of personal and cognitive development (Hall, 2000). We then tailored it by mapping key Meta-States to the specific tensions that engineering educators are likely to encounter, enabling participants to explore fundamental questions around identity, agency, and professional purpose. Over 18 months, we refined this process to support educators in navigating change while recognizing their own needs and boundaries.

By guiding participants through reflective inquiry and structured engagement, the *Clear* process provides strategic tools to help them move beyond resistance and uncertainty. It supports a mindset shift, equipping educators with the confidence and insight to make informed decisions about their own growth and, in turn, contribute resourcefully to curriculum transformation.

This paper explores the experiences of engineering educators who participated in the Change Makers program, analyzing how their individual transformations have influenced their engagement with systemic change. Through qualitative thematic analysis, we examine how themes such as belonging, reflection, mindset, and capacity-building emerged.

2 Literature

As is the case in other postcolonial and low-and middle income countries, engineering education in South Africa operates within a complex landscape shaped by multiple intersecting challenges and imperatives. The higher education sector has undergone significant transformation since the end of apartheid, with institutions working to address historical inequalities while simultaneously responding to global technological advances, industry demands, and student needs. Engineering faculties, in particular, face unique pressures at this nexus of transformation, technical education, and professional accreditation requirements. Globally, frameworks such as the Washington Accord and the Bologna Process have sought to standardize engineering qualifications across borders (Kasuba & Ziliukas, 2004; Anwar & Richards, 2015), but these initiatives rarely account for deeply local challenges.

Within South African institutions, as in other countries, engineering educators often enter academia with deep technical expertise but little pedagogical training (Felder, Brent, & Prince, 2013). They juggle demanding teaching loads, research expectations, administrative duties, and professional accreditation requirements (Ogude et al., 2005), often without access to sustained academic development. Their classrooms reflect vast socioeconomic disparities in students' educational backgrounds, language proficiencies, and access to resources (Leibowitz et al., 2015). These pressures are compounded by shifts toward competency-based and employability-driven curricula, which require new pedagogies and a rethinking of teaching identities (Kolmos et al., 2016; Nodine, 2016).

Academic development programs often focus on surface-level teaching techniques or curriculum design, failing to support the deeper capacities needed to navigate these complexities (Graham, 2025). The Change Makers program was developed precisely to fill this gap: not as a set of tools, but as a developmental process rooted in reflective practice, personal clarity, and relational learning. It aligns with the Inner Development Goals (IDGs) framework, which argues that the Sustainable Development Goals (SDGs) will not be met without cultivating human capacities for self-awareness, collaboration, and intentional action.

Drawing on Scharmer's (2016) Theory U and Meta-States (Hall et al., 2001; Linder-Pelz & Hall, 2008), the program creates a structured yet open space for educators to recognize and act on their own developmental needs. This approach reflects Barnett's (2000) call for higher education to embrace epistemologies of uncertainty: helping academics not just deliver knowledge, but interrogate their roles, adapt to complexity, and act with clarity and purpose.

In this sense, Change Makers is less about training and more about transformation. It helps educators move beyond surface compliance with reform agendas toward a deeper ownership of change. Rather than prescribing what educators should do, it asks who they need to be. This human-centered approach to faculty development reframes curriculum reform as a relational, emotional, and ethical endeavor.

The approach is also rooted in Wenger's (1999) social theory of learning, which emphasizes identity formation through practice, meaning-making, and participation in communities. Change Makers acts as a community of practice, where educators can share experiences, build trust, and make sense of their roles in the transformation of engineering education.

By positioning faculty development as a key driver of curriculum transformation, Change Makers aligns with broader global conversations on engineering education reform that stress the importance of empowering educators to be agents of change within their institutions (Besterfield-Sacre et al., 2014; Walkington, 2002). This highlights the need for professional development strategies that extend beyond technical curriculum reform, supporting engineering educators in navigating the complex realities of higher education in an evolving global and local context (Case et al., 2016; Coso Strong et al., 2023).

3 Context

It is within this landscape that the *Innovative Engineering Curricula* (IEC) project (2021–2026) was launched. Funded through the TSP initiative by RAE and DHET, the project brought together seven South African engineering schools and the South African Society for Engineering Education (SASEE), with strategic input from University College London (UCL). While inspired by UCL's Integrated Engineering Programme, the IEC team recognized the need for local adaptation—to design a model responsive to the South African context and its institutional diversity.

From early 2021, the IEC team met regularly online, creating a collaborative space where partners from research-intensive universities, universities of technology, and comprehensive institutions could co-develop approaches. This inclusive structure enabled cross-pollination of ideas and helped surface shared challenges and possibilities for curriculum innovation.

A central realization was that curriculum reform cannot succeed unless both staff and student ability to engage with change are addressed. Facilitating integrated curricula and professional competencies requires more than new content or delivery models—it requires emotionally resourced, relationally connected educators. This insight catalyzed the development of the Change Makers program as a core component of the IEC project.

Change Makers was designed to offer safe, developmental spaces where engineering educators could reflect on their own identities, connect with peers, and develop the resilience needed to lead change. Unlike typical faculty development initiatives, it is not a 'training' but a process of self-alignment and collective inquiry. Participants explore the tensions they face in academic life and identify sustainable practices to support both personal well-being and professional engagement.

By encouraging a culture of trust and dialogue, the program enables participants to build shared language, articulate challenges, and engage more confidently in curriculum transformation. It addresses the human conditions under which reform can actually succeed.

4 Method

This study aimed to explore the value participants derived from attending the Change Makers program. The research design was qualitative and interpretive, employing semi-structured interviews and thematic analysis to address the research question: *What is the value that participants derived from attending the Change Makers program?*

4.1 Participant Recruitment and Context

The Change Makers in Engineering Education program consists of a two-day workshop designed to support engineering academics and administrative teams in navigating change. While each iteration follows a structured process, the format is adapted to the composition and developmental needs of the participating group. All workshops are grounded in the *Clear* process—a reflective, experiential model that integrates Theory U and Meta-States—and support individuals in identifying personal and professional tensions, articulating change strategies, and engaging with others around shared challenges across institutions, departments or administrative teams.

The national open group format invites participants from all 16 engineering schools in South Africa to attend as individuals. These sessions are highly diverse and cross-institutional, with participants bringing a wide range of professional identities, institutional contexts, and disciplinary backgrounds. The first day focuses on self-reflection, exploring personal well-being, identity, and agency in relation to participants'

roles as academics. On the second day, the emphasis shifts toward developing personal change strategies. While individual journeys are foregrounded, participants often find resonance in one another's experiences, discovering common systemic tensions across institutions and gaining insight from their peers.

In contrast, departmental groups attend the workshop as part of a broader curriculum transformation effort at their home institution. Here, the first day similarly emphasizes individual reflection and baseline setting, but the second day transitions into team-based work. Participants co-develop departmental change strategies aligned with their shared curriculum goals. These sessions are often timed to coincide with either the start of a curriculum renewal process or a point where momentum has stalled. The language and focus are more explicitly tied to curriculum design, teaching practices, and team alignment.

Finally, administrative department sessions are tailored to professional and support staff who hold critical but often overlooked roles in enabling academic transformation. The first day mirrors the other formats, offering space for individual insight and personal leadership development. The second day is highly contextual, focusing on team functioning, interdependencies, role clarity, and navigating institutional tensions. These sessions create opportunities for greater cohesion and enable staff to contribute more resourcefully to institutional change processes.

Across all formats, participants are grouped intentionally based on their roles and affiliations—national participants apply or are nominated independently, while departmental and administrative teams attend as intact units. The format of each session is responsive to this structure, ensuring relevance and resonance.

Invitations were distributed randomly, ensuring that participants across different institutional roles and workshop types were represented. From this pool, eight participants were selected for in-depth analysis in this paper—six from national open groups and two from engineering departments. While the selection was random, the resulting sample captured a rich diversity of institutional contexts, disciplines, career stages, and personal experiences. This diversity enabled us to explore how the *Clear* process resonated across different roles, shedding light on how participants engage with systemic change through the lens of personal clarity and belonging.

4.2 Data Collection

Two research assistants conducted semi-structured interviews with each participant. The interviews explored personal and professional experiences related to the program using a set of 7 predefined open-ended questions:

1. What were your experiences of attending the Change Makers workshop?
2. What were your expectations before attending the workshop?
3. How did you feel after attending the Change Makers workshop?
4. Elaborate on the value, if any, your attendance had to you personally or professionally.
5. Do you mind sharing some of the changes, if any, you made after attending the workshop?
6. When you reflect on yourself, your life, your job personally or professionally, are there any changes you still plan to implement?
7. If there was a learning community where you could actually engage in and get resources for your classroom. What would that look like for you?

The interviews provided rich narratives that illustrate participants' experiences, expectations, and outcomes from the program.

4.3 Data Analysis

The data analysis followed a collaborative, iterative process:

1. Initial Observations:
   The 34 interview transcripts were divided among eight researchers. Each researcher reviewed a subset of four transcripts and wrote initial observations and impressions based on participants' narratives.
2. Team Review:
   The research team consisted of:
   - Two main facilitators and designers of the Change Makers program.
   - Two researchers who participated in the Change Makers program but were not part of the national Innovative Engineering Curricula (IEC) team.
   - Three engineering education researchers from the IEC core team.
   - One researcher with an educational psychology background who had no prior involvement with the Change Makers program.
3. The team convened to share their observations and impressions, collectively discussing and refining initial insights.
4. Thematic Analysis:
   The collective observations informed the development of a list of emergent themes. The themes were iteratively refined through group discussions, with researchers building on each other's reflections. This collaborative process ensured that diverse perspectives were integrated and that themes were grounded in participants' narratives.

5 Findings

Participants approached the Change Makers program with varying expectations, often anticipating structured sessions on engineering curriculum or conventional team-building activities. Instead, they encountered a program that prioritised personal growth, reflective practices, and resilience building. This shift in focus surprised many participants, with some expressing deep gratitude for the unexpected emphasis on self-reflection and personal well-being. They found value in stepping back to consider aspects of their lives and professional identities that they often neglect.

A particularly memorable feature of the program was the "laptop framing" activity (explained further), which many participants highlighted as impactful, underscoring the program's thoughtful design. Across the various groups—departmental teams, national Change Makers participants, and administrative staff—experiences diverged. Voluntary attendees, especially those in the national program, were more open to the reflective nature of the sessions, while mandated participants often viewed the program as an imposition. Despite this, common outcomes emerged, including a stronger sense of community and belonging, shifts in mindset toward professional integration, and reflections on the importance of balancing work and personal well-being. The program also allowed insights into team dynamics and conflict resolution, equipping participants with strategies applicable to both academic and administrative environments.

Sense of Belonging and Human Connection
Participants consistently expressed how the program cultivated a deep sense of belonging and community. As one attendee shared,

"I think I felt, for the first time at a workshop, that I felt seen. I felt seen as a human, and not just seen as a lecturer." P13

Another participant stated "that it is important to take it easy sometimes and *be a human being as opposed to being a tool. P33*

This sentiment of being valued extended beyond professional roles, facilitating genuine connections among participants. Another participant reflected,

"It can be lonely sometimes. So, it's nice to be in a community of like-minded individuals." P4 Another person experienced it as "kind of inspirational, because you're surrounded by people with similar sort of intentions. P23

The value of shared experiences was another recurring theme. Participants found solace in sitting down with peers from different institutions to discuss shared challenges. One noted, *"It was a great thing to sit down… You sit down and talk with people who are facing the same challenges, the same pressure of offering the best education. I realised that people are feeling the same thing that I'm feeling. The first thing that I gained is confidence." P13 .* Another attendee confirmed, *"it's been nice to share experiences, share ideas, get other people's perspectives and so on." P1*

Personal reflection, baseline and setting boundaries

The workshop participants were *"pleasantly surprised that it's the first time ever I've been to something where they said: Don't focus on the student, focus on yourself. And so those two days were actually probably the first two days I've ever spent in my career in academia thinking about myself and reflecting on me and making me think about things that I've probably never even had the inclination to think about." P1*

Participants realized that they *"need to set a correct baseline, and we need to recognize the non-negotiables so that we can be able to function properly in our daily basis, so that, I think that was a highlight for me, when they referred to sleep and eat." P3.* Another participant stated *"it also pushes me to love myself more because for me to honor my non- negotiables, says I'm taking myself seriously. So I need to take myself seriously, so that my surroundings or the people around me can take me seriously, right, and that I can then be the best version of myself." P13*

A participant at the burnout stage voiced that boundaries are necessary for finding work-life-balance: *" I tried to work on my personal self with getting more sleep and prioritizing my work a bit. So I worked on my sleep patterns. … Balancing my life, my workload, my personal life, my studies, my family life. I need to prioritize that and work it out, get it balanced. Because one is dominating the other. So I do not have enough time for all the other things. … So obviously, I don't have time for myself, like exercises, I'm not sleeping enough, being married. So I'm at the burnout stage." P32*

"I don't think I implemented that, but it's in my mind. I have that thinking the whole time that at some point I must take it easy. Yeah." Like taking it easy, taking your work at work. And when you're at home, be at home. Which is something that sometimes I don't find time for. I'm always on on a busy mode and that is not good because it takes a toll. So just being easy and being at home. And that is something that we also learned out of that session." p33

Support and Capacity Building

The program's emphasis on personal development and resilience was deeply appreciated, providing participants with tools to navigate both professional and personal challenges. One participant noted,

"You know, we don't have all the answers. We're learning with the students as well. Sometimes you can stand up and say, 'I don't have the answers. It's not me, and I need to learn more.' This session gave us that support." p7

The safe, supportive environment also encouraged participants to express themselves openly.

"It allowed you to express. It was a safe place where you could say what you wanted and be free, and I think we didn't have that before," P7

Beyond the immediate outcomes, participants left feeling renewed and empowered. As one participant described,

"I felt energised. You feel like you've got some extra tools to deal with everything that's coming your way. You feel inspired and ready to carry on." P23

This renewed energy often came with a reminder of the importance of self-care.

"If you want to do the best work that you need to do, then you can't… You have to ground yourself first. You've got to take care of yourself." Another attendee agreed that "we also need to take care of ourselves. Because when we take care of ourselves, that's how we are able to also take care of others. P23

6 Discussion

The findings from the Change Makers program offer powerful evidence that meaningful curriculum transformation in engineering education must begin with the personal and professional well-being of educators. Participants entered the program expecting technical discussions on curriculum or traditional team-building exercises. Instead, they encountered a reflective process centered on personal growth, resilience, and relational engagement. This unexpected emphasis—rooted in Theory U's premise that internal transformation precedes external change (Scharmer, 2016)—elicited a deep, and at times disorienting, re-evaluation of self, work, and purpose.

A key theme to emerge was participants' experience of being genuinely "seen"—not just as professionals, but as full human beings. This was particularly powerful in an environment where faculty often feel reduced to performance metrics, student throughput, and institutional compliance. The experience of being recognized for who they are, rather than solely for what they produce, created a sense of psychological safety and connection. "I felt seen as a human, not just a lecturer," one participant reflected. This speaks directly to the Inner Development Goals (IDGs), which highlight *being*, *relating*, and *acting* as core developmental capacities essential for transformative systems change. By nurturing self-awareness, empathy, and purpose, the Change Makers program helped participants access and develop these inner resources.

The sense of belonging and community was especially important. Wenger's (1999) concept of communities of practice is helpful in understanding how this sense of connection enabled deeper learning and professional identity development. Participants described the value of sharing their struggles, learning from one another, and realizing they were not alone in facing systemic constraints. This mutual recognition supported a growing confidence to act differently—not just within the classroom, but within their broader institutional roles. It also reflects the *relating* dimension of the IDGs, where interpersonal connectedness and collaboration become foundational for wider professional change.

In addition to relational shifts, the program also encouraged participants to critically examine their own boundaries, well-being, and work-life balance. Several reported recognizing the need for healthier personal baselines—what one participant described as honouring "non-negotiables like sleep and eating." These practices, though seemingly basic, represent an important form of self-leadership and resilience. They align

with the *being* dimension of the IDGs, which stresses the importance of inner grounding, presence, and care in contexts of complexity and stress.

The program also shifted how participants thought about curriculum—not simply as content to be delivered, but as a space for reflection, adaptability, and shared inquiry. One participant noted: "It's definitely shifted the way I think about things… There's a lot that it did to me in terms of mind-changing and the way I see things now." These emerging perspectives mirror Barnett's (2000) argument that higher education must prepare educators and students alike for supercomplexity—through the development of critical action, epistemological openness, and the capacity to operate amidst uncertainty.

Despite differences in institutional context and participant motivation—some attended voluntarily, others as part of mandated departmental efforts—the findings revealed a consistent appreciation for the program's approach. Even participants who initially resisted the reflective format acknowledged its long-term value. This broad resonance across contexts suggests that programs like Change Makers meet a widely felt but often unarticulated need among educators for spaces of pause, meaning-making, and peer connection.

However, the findings also highlight a challenge: integrating these reflective and relational approaches into institutional culture. While the program created a powerful developmental experience, the broader university context often lacks the structures, incentives, and time to support such work. For these practices to scale, institutions must begin to view faculty well-being, identity development, and community-building not as peripheral "extras," but as integral to academic excellence and systemic transformation.

Taken together, the findings point toward three key implications for engineering education reform:

- Faculty development must attend to inner capacity building, emphasizing well-being, clarity of purpose, and self-leadership as foundations for curriculum change.
- Intentional communities of practice should be cultivated, not only to share expertise but to foster belonging and reduce isolation.
- Institutional transformation requires rethinking academic support structures, prioritizing developmental time, reflective space, and relational learning as critical to both educator and student success.

By engaging educators as whole people, the Change Makers program demonstrates that faculty can become more grounded, connected, and capable agents of transformation. This supports not only curriculum reform, but the deeper cultural and systemic shifts needed for South African engineering education to flourish in a complex and uncertain world.

7 Limitations and future research

While this study provides valuable insights into the impact of the Change Makers program, several limitations should be acknowledged. First, the study relies on self-reported experiences, which, while rich in narrative detail, may be subject to response bias. Second, the analysis is based on a sub-set of 8 interviews out of a total of 34. Although the selected interviews reflect a diversity of roles and experiences, this limited sample may not fully capture the breadth of perspectives present in the full dataset, potentially affecting the generalizability of findings. Future research will include analysis of the full dataset to provide a more comprehensive understanding of the impact of the Change Makers program.

Third, the study focuses primarily on engineering educators within the South African context. While the findings may have broader applicability, further research is needed to explore how similar faculty development models function in different national and institutional settings. Given the growing emphasis on holistic faculty development in higher education, comparative studies across diverse educational systems would be beneficial.

Additionally, the study raises important questions about the role of personal attributes—such as career phase, personality, and socio-cultural values—in shaping engagement with systemic transformation efforts. Future research should explore these dimensions in greater depth to better understand how different individuals experience and apply the insights gained from faculty development programs.

8 Conclusion

This study affirms that meaningful transformation in engineering education cannot be achieved through curriculum reform alone—it must begin with those who enact change: the educators themselves. The Change Makers program, embedded within the broader IEC initiative, offers a compelling model for how personal development, self-awareness, and community-building can become strategic levers for systemic educational reform.

By intentionally shifting the focus from technical knowledge and curriculum delivery to the inner development of educators, the program enabled participants to reflect on their identities, set personal boundaries, and reconnect with their purpose. These individual shifts created the conditions for deeper engagement with curriculum transformation, not as a top-down directive, but as a personally meaningful and contextually grounded process. The resulting mindset shifts, increased sense of belonging, and strengthened professional agency point to the value of approaching faculty development as both a relational and reflective practice.

At the same time, the findings highlight the systemic tensions within higher education—particularly the lack of institutional space, time, and recognition for faculty well-being and reflective engagement. For faculty development to have a lasting impact, institutions must go beyond supporting curriculum design and begin to prioritize the inner capacities and lived experiences of academic staff. The Inner Development Goals (IDGs) offer a helpful lens for framing these capacities—such as self-awareness, connection, and purposeful action—as central to the future of higher education.

Ultimately, the Change Makers program demonstrates that educators who are supported as whole people—grounded, connected, and clear—are far more likely to become effective agents of curriculum innovation and institutional transformation. As South African engineering education continues to evolve in response to global and local challenges, the integration of personal and systemic development will be critical for sustaining change. Faculty development initiatives that honour this complexity, and that begin

with individual transformation, will be essential for cultivating the kind of resilient, adaptable, and human-centered educational systems our future demands.

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