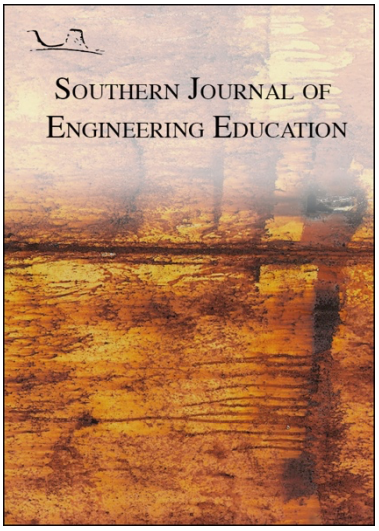

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Reconstructing the engineering student culture by promoting student wellness

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Reconstructing the engineering student culture by promoting student wellness

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Poor success and high attrition rates among engineering students at South African UoTs (universities of technology) require urgent, systemic intervention. Traditional curriculum reforms have failed to address the underlying cultural and mental health challenges that normalise chronic stress and discourage help-seeking behaviours. This study investigates the impact of a faculty-led wellness intervention as a strategy for improving academic performance and student retention within engineering education. The intervention is grounded in Ubuntu philosophy, which promotes interconnectedness and community well-being, and bioecological systems theory, which highlights the influence of social and institutional environments on individual development. These frameworks guided the design of wellness strategies that addressed both interpersonal and systemic barriers to student success. We evaluated the intervention's effectiveness at a South African UoT using a mixed-methods case study. Student attendance and performance trends were tracked between 2022 and 2024, focusing on a high-risk first-year module with approximately 70 students per cohort. At-risk students who were identified by assessment marks ≤45% or attendance ≤ 65% were offered structured academic and wellness support. Pre- and post-intervention data were compared using HEMIS (Higher Education Management Information System) records and statistical analysis of pass rates and attrition. Following the 2024 intervention, the module demonstrated a 35% increase in success rates and a 50% reduction in year-on-year deregistration. Among students who participated in the intervention, 27% passed the module, and 66% of those achieved distinctions. These findings suggest that culturally grounded faculty-led wellness programmes can meaningfully improve student outcomes while challenging traditional engineering education norms.

Keywords: Mental health, engineering education, success rate, engineering student culture, wellness

Introduction

This article examines the challenges related to mental health and wellness faced by engineering students at a South African UoT (university of technology). It evaluates whether faculty-led interventions can enhance academic performance and improve student retention. The article

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presents findings from a wellness programme aimed at addressing the systemic, cultural, and psychological barriers that students encounter in high-pressure engineering education environments.

High dropout rates and low academic resilience continue to pose significant challenges for higher education in South Africa, particularly within UoTs. Although curriculum reforms have been implemented to enhance academic outcomes, they have not sufficiently addressed the escalating mental health crisis affecting students (Mapaling et al., 2024). Engineering students face immense academic pressure, long hours of study, and a culture that often prioritises endurance over well-being. These challenging conditions are linked to increased levels of stress, anxiety, depression, and even suicidal thoughts (Jensen & Cross, 2021; Korsten et al., 2021).

Research consistently indicates that engineering students face a higher risk of mental health challenges compared to their peers in other fields (Campbell et al., 2021; Pandey et al., 2022). In South Africa, these challenges are exacerbated by financial stress, academic overload, and insufficient psychosocial support. Approximately 30% of undergraduate engineering students report experiencing symptoms of moderate to severe stress, anxiety, and depression (Jensen & Cross, 2021), along with an increased risk of suicide (Korsten et al., 2021). A study conducted in the Nelson Mandela Bay Municipality found a 16% prevalence of suicide attempts among university students (Alabi, 2022).

Despite the gravity of these issues, engineering students often refrain from seeking help, tending to internalise their distress and equate self-sacrifice with academic success (Wright, 2023; Godfrey & Parker, 2010). This detrimental culture is marked by sleep deprivation, emotional burnout, and isolation, all of which are reinforced by demanding curricula that provide little opportunity for self-care or community engagement. While wellness-based reforms have emerged globally, most research tends to focus on institutions in the United States and often overlooks the unique socio-economic and historical factors that influence South African students. There is an urgent need for locally relevant approaches that address not only academic underperformance but also the cultural and institutional systems that impact student well-being. These interventions are particularly timely given the anticipated shortage of qualified engineers in South Africa (Korsten et al., 2021).

Growing awareness regarding mental wellness has not translated into sufficient research on undergraduate engineering students in South Africa (Jensen et al., 2021). Jensen (2021) argues that engineering education needs to move away from a culture of excessive pressure and adopt proactive support structures focused on wellness. However, achieving this shift requires collaborative engagement among institutional stakeholders. Additionally, there is a lack of empirical research on how harmful norms are internalised and how wellness interventions can change these perceptions over time (Korsten et al., 2021).

This study aims to evaluate the implementation and impact of a faculty-led wellness intervention programme on student performance, retention, and well-being in a high-risk first-year engineering module at a South African UoT.

The objectives of the study are to:

1. Identify the academic and psychosocial challenges experienced by at-risk engineering students;
2. Examine how Ubuntu philosophy and bioecological systems theory can inform a holistic intervention approach;
3. Assess the programme's impact on student attendance, pass rates, and attrition;
4. Explore how faculty-based wellness initiatives can challenge harmful cultural norms in engineering education.

The intervention was guided by two theoretical frameworks: Ubuntu, which emphasises interconnectedness and mutual care (Van Breda, 2019), and bioecological systems theory (Bronfenbrenner, 1979), which highlights the impact of social, institutional, and environmental systems on student development (Sheafor & Horejsi, 2012). Together, these frameworks offer a culturally relevant and systems-aware foundation for transforming engineering education through wellness.

The article will start with a review of the existing literature on student mental health and wellness in engineering education. Following this, it will outline the theoretical frameworks that underpin the intervention. The methodology will then be presented, detailing the intervention design and the approach to data analysis. The next section will discuss the findings and their implications for policy and practice. Finally, the article will conclude with recommendations for integrating wellness into engineering education in South Africa.

Literature review

What is mental health, and why does it matter?

The World Health Organisation defines mental health as 'subjective well-being, perceived self-efficacy, autonomy, competence, intergenerational dependence, and self-actualisation of one's intellectual and emotional potential, among others' (Härtl, 2001). Marques et al. (2011) postulate that mental health interventions should endeavour to develop psychological resilience, to increase a person's capacity to enjoy life, and to strike a balance between daily activities.

Mental health has been a topical issue since the early 2000s. A global commitment was made by including mental health as a Sustainable Development Goal (Docrat et al., 2019). Studies have shown that mental wellness in individuals is declining rapidly due to many contextual factors, such as exposure to social media, natural disasters, poverty, and many more. Young people are identified as a population at high risk, and many studies have advocated the prioritisation (Danowitz & Beddoes, 2018), as well as the development, of relevant policy frameworks to address the issues of undertreated mental health problems (Wang & Sheikh-Khalil, 2014). Most importantly, it has been demonstrated that neglecting mental health concerns has serious, long-lasting repercussions on young people's growth and development. This has resulted in a domino effect on economic prosperity at a much broader level, such as career development, and in social and personal spheres.

The prevalence of engineering students affected by mental health issues

Although many factors influence students' wellness and ultimate success over the years, mental wellness has been globally documented as one of the leading factors across various disciplines. Throughout their studies, students will encounter a plethora of stressful events that affect their academic performance, varying from psychosocial and financial challenges, extra-curricular activities, as well as challenges related to the study content. Students at South African universities are reported to have a high prevalence of mental health challenges, leading to a significant increase in suicidal ideation among students (Mogashana & Basitere, 2021). Although research indicates substantial increases in psychopathology among college students in recent decades, little trend data is available to examine prevalence rates across time (Lattie et al., 2019).

The challenge is rooted in the induction of students into institutions of higher learning. Gumede and Ajani (2020) found that South African learners transitioning into universities were often confronted with typical academic challenges such as academic writing in higher education, English as the primary language of teaching and learning, lack of basic computer skills, which were once again exacerbated by the students' reluctance to approach the institution for access to support services (Gamede & Ajani, 2020). Subsequently, many students are said to struggle with transitioning from secondary to tertiary education, such that they develop signs of anxiety and depression, ultimately struggling to find a sense of belonging (Mason, 2017). A study conducted on first-year students at two prestigious South African institutions discovered a high prevalence of developing mental health challenges (Mogashana & Basitere, 2021). However, some students may be more vulnerable to mental illness due to factors such as test stress, loneliness, and other psycho-social factors, e.g., poverty and educational background. It is undeniable that the multiplicity of the challenges experienced by students contributes to ailing mental health.

Several pedagogical interventions are available to assist engineering students with stress management and continuous motivation during their studies. Understanding and identifying the most suitable pedagogical intervention requires understanding the factors motivating engineering students and playing a role in their study approach. Studies show that engineering students who are primarily intrinsically motivated may benefit from less prescriptive assignments. Such assignments offer more freedom to choose from formative assessment topics in which they have a greater personal interest, essentially cultivating their investment in their studies. Extrinsically motivated engineering students, who typically consider the final summative grade to be the most important, may be less influenced by pedagogical styles and could benefit from a structured approach (Savage et al., 2011).

Research indicates that approximately 40% of engineering students typically do not progress past the first year, and that 30% of the remaining students who do manage to continue fail critical fundamental subjects throughout the chosen engineering course or discipline. The primary cause of student failure and poor throughput rates has traditionally been attributed to a lack of preparedness for the high academic rigour required by engineering studies. While most academic courses require a minimum of four hours of independent study for one hour spent in the classroom to truly solidify and grasp the application principles of complex

problems and theories (Boylan-Ashraf, 2018), engineering courses and studies generally require double that amount to consolidate theoretical knowledge into practical application.

The argument above is indicative of only the beginning of the challenges typical engineering students might face throughout their academic journey. As students progress through their studies, both their internal and external sources of motivation tend to decline, potentially reducing their engagement and participation in academic activities (Jensen, 2021). These findings are aligned with relevant studies highlighting the particularly high stress levels of engineering students; however, Jensen (2021) notes that the literature has not thoroughly examined how stress has become embedded within engineering culture, its broader implications for academic programmes, or how the effects thereof can be mitigated. The studies describe a particularly bleak outlook, with the rigour and selectivity of engineering programmes perpetuating a meritocracy of difficulty where student success can be attributed to the notion that successful students have been 'able to take it'.

Understanding student well-being

Student development is a multifaceted process that requires efforts from multiple stakeholders. As such, we argue that the development of a well-rounded, future-ready engineering graduate must occur in and outside the classroom, acknowledging the complex nature of human development while considering a student's psychosocial well-being. Essentially, Blockland (2019), as cited in Mogashana & Basitere (2021), maintains that student support interventions need to be holistic in nature and need to help students achieve success through tapping into and developing their intangible inner abilities.

The promotion of well-being in the classroom has aided students in overcoming obstacles, recovering from negative experiences, and maintaining a high quality of life (Bache & Scott, 2018; Norrish et al., 2013; Schwanen & Atkinson, 2015; Wong et al., 2006). There are two main types of well-being: (1) hedonic, which includes seeking pleasure and avoiding pain (often due to extrinsic factors); and (2) eudaemonic, which includes seeking to reach one's full potential (often due to intrinsic factors – Ryan & Deci, 2008). As such, Perkins et al. (2021) encourage engineering educators to transition from a fixation on academic achievement to a mindfulness of student wellness in and outside the classroom.

Engineering student culture

Although undergraduate students in general are reported to experience high levels of stress and anxiety as a result of a heavy workload (Korsten et al., 2021), the engineering discipline seems to be set apart from the rest, characterised by a unique culture that embodies masculinity and patriarchy, and deprioritises student well-being (Perkins et al., 2021). Instead, the undergraduate student culture is characterised by a system of tough competition and the denial of mental health-related challenges in engineering students.

The institutional and learning environment significantly influences the engineering and engineering education culture, which is shaped by an individual's home, community, school, and workplace, thereby creating a culture and norms that provide situated experiences. These greatly influence the understanding, identity, interest, and, most importantly, the approach to finding solutions to engineering problems (Carberry & Baker, 2018). As such, understanding a student cohort's cultural dynamics is critical when developing supportive frameworks, academic interventions, or determining the depth of understanding of prior knowledge. These factors are essential for effectively lecturing or introducing engineering subject content to a student cohort, regardless of the level of standardisation of the subject content or the approach to teaching; however, this can be particularly challenging in a UoT with large student intakes.

The challenges posed by these larger groups are especially evident when attempting to foster a learning environment that promotes the importance of student interaction, engagement, and participation, which has been shown to cultivate student involvement for learning, positively affecting cognitive growth. However, Van de Merwe and Maharaj (2018) identified four specific factors influencing South African engineering student success, namely the problematic school system, the high dropout rates, financial constraints, specifically expensive programme costs, and the requirement of professional accreditation by the Engineering Council of South Africa (Van der Merwe & Maharaj, 2018).

Carberry indicates that Western society has adopted a culturally influenced belief that engineering is a driving force behind innovation and technology, which subsequently fosters entrepreneurship through accredited programmes that educate students in applied sciences, computing, engineering, and engineering technology. However, an unintentional consequence was the development of a distorted masculine engineering identity, neglecting the conceptual principle that engineering supports society by improving lives and communities (Carberry & Baker, 2018).

Revisiting the concept of intrinsically and extrinsically motivated students, it is necessary to consider the effects of student attendance at engineering lectures and classes on student throughput and pass rates. Purcell (2007) notes that a linear regression analysis on attendance data sets showed a strong correlation between lecture attendance and examination performance. Every 10% increase in student attendance at lectures showed a 3% increase in examination performance, which agrees with the outcomes of other studies. However, despite this correlation, it was found that a typical engineering student at a traditional university attended only 68% of classes and lectures (Purcell, 2007). In response to this statistic, most traditional universities in South Africa require students to maintain an 80% lecture attendance rate to pass the module as a prerequisite, together with a minimum final mark of 50% or above.

Boylan-Ashraf's (2018) research underpins the significance of high class-attendance rates as a factor influenced by student motivation. In short, attending scheduled class sessions is essential for students to understand the importance of independent study time. Without attending, students are unlikely to dedicate sufficient time to independent study, which is necessary to develop further the concepts discussed during the missed class (Boylan-Ashraf, 2018).

However, a large part of the engineering culture among students can also be defined by their approach to studies, knowledge creation and knowledge acquisition, where students often approach their exams, module content and studies in general with a short-term, exam-focused mindset rather that striving for the proper comprehension and long-term retention that lecturers often highlight are key to the successful and timeous completion of their studies, rather than viewing each module or subject they complete as a foundational building block for learning that facilitates comprehension in future subjects. Students often view each year or exam as an academic hurdle to be overcome and quickly forgotten, focusing solely on passing the subject rather than developing a deeper understanding that bridges the gap between theoretical knowledge and practical application, thereby promoting critical thinking and complex problem-solving.

As a result, once these students transition from their first or second years, they face compounded challenges, having to relearn foundational concepts from the previous year to effectively grasp the content introduced in the new modules, and relearn what was essentially viewed by the lecturer as prerequisite knowledge. This cycle unfortunately reinforces the perception and culture perpetuated in engineering studies that the coursework can be

excessively demanding as students struggle to process the new materials with the gaps in their prior learning and knowledge.

Chitkara (2014) emphasises that studying is a skill which students are not naturally proficient in, and that, like any other skill, it requires deliberate development through effective study habits before a student can truly excel academically, and at-risk students can significantly improve their academic performance through participation in student development and support interventions at an early stage (Chitkara, 2014). This also encourages students to actively participate in their learning journey, fostering a sense of ownership and responsibility early on, and highlighting the need for early identification and reporting

The reluctance of students to seek academic assistance stems from several interconnected factors. Many students, particularly those experiencing academic difficulties, avoid help-seeking behaviours out of a fear of confirming their perceived inadequacies, or realising that their chosen direction of study might not align with their interests (Bandura, 1977). However, Bean and Metzner found that the effective implementation of institutional interventions can significantly impact a student's decision to complete the course, primarily when the interventions are focused on addressing both academic and psychological challenges (Bean & Metzner, 1985).

An explanation of the faculty-based student wellness programme

The wellness intervention implemented by FEBE (the Faculty of Engineering and the Built Environment) in the selected UoT is grounded in a multi-systemic, humanitarian approach, rooted in the African philosophy of Ubuntu.

Guiding philosophy: Ubuntu as a foundation. Ubuntu, a Nguni term meaning 'I am because you are', emphasises humanity, compassion, and interconnectedness. It reflects a belief in the collective responsibility to support one another and uphold dignity (Van Breda, 2019; Muwanga-Zake, 2009; Murithi, 2007). This philosophical foundation guides the programme's design and intentions but does not function in isolation. As Rankopo and Diraditsile (2020) note, Ubuntu also represents the practical use and sharing of community resources to promote collective well-being. Thus, while Ubuntu informs the ethical and cultural vision of the programme, its implementation involves structured, measurable, and collaborative interventions (Rankopo & Diraditsile, 2020).

Programme structure and stakeholder roles. The student wellness programme is embedded within the Executive Dean's Office and implemented through the Faculty Student Success Coach Office It is one of the core institutional structures supporting undergraduate student development across academic, personal, and social domains.

Key stakeholders involved in the programme include:

- *Lecturers and academic staff*: provide referrals and monitor student engagement
- *Student Faculty Representatives*: act as communication bridges between students and faculty
- *Institutional counselling services*: offer professional mental health support
- *Senior student mentors*: support first-year students and high-risk modules
- *Support staff*: facilitate workshops, monitor progress, and manage resources

This collaborative structure enables early identification of at-risk students and coordinated, context-specific responses. The programme offers a combination of academic and psychosocial support services. These are summarised below and aligned with the programme's goal of reducing attrition, improving student success, and promoting wellness in engineering education.

Practical components of the wellness programme. The faculty-based student wellness programme offers a structured combination of academic and psychosocial support services. These services are designed not only to improve academic outcomes but also to enhance students' well-being, in alignment with the programme's overarching goals of reducing attrition, fostering student success, and transforming the culture of engineering education to prioritise care, resilience, and holistic development.

Social development interventions. To cultivate a supportive and inclusive environment, the programme offers a variety of social development initiatives. Students are provided access to career counselling and personal development services to equip them with the tools to navigate both academic life and future career pathways. In addition, students participate in workshops focused on stress management, substance abuse awareness, emotional well-being, and personal safety. These sessions are intended to reduce stigma and provide practical strategies for managing the demands of academic life. Judgment-free support spaces are also available, where students can openly discuss personal or academic challenges in a safe, supportive environment.

A key part of the social development initiative is the peer mentoring system, in which senior students are assigned to high-risk modules and to first-year student groups. These mentors offer experiential guidance, helping their peers navigate complex course material and manage workload expectations. Another cornerstone of this initiative is the Life Skills Module, a compulsory, credit-bearing course for all first-year engineering students. The module emphasises essential competencies such as time management, emotional intelligence, teamwork, and strategies for seeking academic or emotional support when needed. It helps lay the foundation for a more reflective and resilient engineering student experience.

Academic support services. Alongside social development, the programme provides a range of proactive academic support services, primarily delivered through the Faculty's Academic Coaching Office. These services are designed to address academic challenges before they escalate into failure or disengagement. The academic interventions include tutoring and educational assistance, particularly targeted at historically high-failure modules. Students also have access to academic advising, which helps them develop structured study plans and make informed decisions about their academic journey.

The programme runs frequent workshops on writing, study skills, and exam preparation, helping students to improve their academic performance through skill development rather than just content mastery. In response to the particular challenges posed by engineering coursework, the office also offers specialised training in STEM learning techniques**.** This support is further complemented by the integration of digital learning resources via the institution's Learning Management System (LMS), making study materials and tools accessible at any time.

These academic services are continually adapted throughout the semester to meet students' evolving needs. Regular monitoring of assessment performance and attendance trends allows the office to identify students who may benefit from tailored interventions and to invite them to engage with support early, rather than reactively.

Identification and monitoring of at-risk students. A core component of the faculty-based wellness programme is the early identification and continuous monitoring of students who may be at risk of academic failure or disengagement. This proactive approach ensures that intervention occurs before students reach a critical point, reinforcing the programme's preventative and student-centred ethos.

Students are flagged as at-risk based on two key indicators: assessment performance below 45% and class attendance below 65%. These thresholds serve as early warning signals, enabling faculty and support staff to initiate timely, appropriate responses. Once a student meets one or both criteria, they are confidentially referred to relevant academic or wellness support services.

Ongoing monitoring and support. The system does not stop at identification; it emphasises continuous engagement and follow-up. To protect student privacy while ensuring effective intervention, confidential feedback loops are maintained with lecturers, allowing academic staff to stay informed without accessing sensitive details from counselling or support sessions.

In addition, attendance at wellness and academic support sessions is carefully tracked**,** helping the programme evaluate each student's level of engagement and the impact of specific interventions. Based on this data, personalised support plans are co-developed with students, tailored to their specific academic or emotional needs, and built around their willingness to engage with available services. By promoting voluntary participation in the programme, rather than enforcing mandatory intervention, the system helps to foster trust and reduce the stigma often associated with seeking help. This approach reflects the Ubuntu-informed values of respect, empathy, and shared responsibility, ensuring that students remain at the centre of their own academic and personal growth journeys.

Framework and methodology

The bioecological systems theory, developed by Bronfenbrenner, is one of the most prominent theories that uphold the reciprocal relationship between humans and their environment. This theory advances perspectives in understanding 'how communities, socio-economic factors, and political issues trigger individuals' mental health problems' (Chigangaidze, 2021). Bronfenbrenner (1979, p. 3) defined human development as 'a lasting change in the way in which a person perceives and deals with his environment' (Bronfenbrenner, 1979). The theory further explains that interactions between an individual and complex, multilevel, and dynamic socio-ecological systems significantly impact their development. This hypothesis posits that developing humans are nested within the core hub of ecological systems. Four well-known socioecological systems made up Bronfenbrenner's original theory, namely microsystem, mesosystem, exosystem, and macrosystem. He later added a fifth element, known as the chronosystem. A brief discussion on the different elements of the theory is offered:

a) Microsystem: the individual's immediate environment in which they exist and are in regular contact. The theory emphasises a strong relationship in which a developing person's conduct is influenced by their surroundings and, in turn, influences those surroundings.

b) Mesosystem: interactions and processes occurring inside microsystems. The mesosystem was characterised as a 'set of interrelations between two or more settings in which the developing person becomes an active participant' (Bronfenbrenner, 1979).

c) Exosystem: a system 'consisting of one or more settings that do not involve the developing person as an active participant, but in which events occur that affect, or are affected by, what happens in that setting' (Bronfenbrenner, 1979). A developing individual in this system does not actively participate in or directly interact with the social ecology, yet system components nevertheless impact them.

d) Macrosystem: the broader culture and ideological worlds, belief systems, societal values, political trends, and community practices are powerful elements in an individual's development (Mulisa, 2019).

e) Chronosystem: this phase recognises that an individual is an ever-evolving system. Therefore, it examines the changes in individuals' lives as they age and the socio-historical context of the local community (Tudge et al., 2022).

In the context of bioecological systems theory, the university support programme discussed above views students as complex systems with different extensions contributing to their function. Most importantly, as per the theory, we also recognise that students have agency over their lives.

Therefore, for any intervention to succeed, students must make conscious decisions to apply the provided strategies, ensuring they excel academically. Mulisa (2019) further indicates that bioecological theory is an instrumental theory that can aid higher education practitioners in better understanding complex student learning environments. The theory also emphasises that many factors contribute to students' success in higher education. Hence, there is a need for more programmes, such as those offered at the UoT, to support engineering students and ensure a fertile, nurturing learning environment.

The Faculty Student Success Coach Office acts as the central hub for the wellness programme, providing three interconnected services: academic support (including tutoring, exam preparation, and STEM learning techniques), social development (focusing on career counselling, stress management, and interpersonal skills), and peer mentorship, all aimed at fostering community.

As a community-centred approach, the senior student mentors and tutors provide experiential guidance on the successful navigation of the engineering programme, working in conjunction with professional staff to deliver specialised workshops and one-on-one support, not only from a lecturer's perspective, but also from a student's perspective, as a community-centred approach reflecting the Ubuntu principles of collective responsibility.

When the monitoring and report system works effectively, the at-risk students are proactively identified and invited to personal sessions and workshops as an early intervention. However, one of the programme's primary functions is to encourage students, identify and acknowledge their struggles, and to voluntarily engage with and access student support services at the first onset of academic, mental, physical, or socio-economic challenges.

Implementation and evaluation methodology

This study used a mixed-methodology approach to evaluate the efficacy of the suggested interventions and reporting structure. It combined a quantitative analysis of student success and pass rates from 2022 to 2024 with a qualitative assessment of student participation in the interventions. While the proposed interventions and reporting structures were implemented in 2024 at a UoT faculty-wide, across all engineering disciplines and subjects, this study focused specifically on reporting a high-risk module for first-year students as a representative case study.

This representative case study module was selected based on the consistency of lecturer participation in the timely identification and reporting process of at-risk students; the varied academic performance prior to the implementation of the proposed theoretical framework and interventions; and the availability of reliable data across all three years of the study period. The sample size of 60 to 70 students per annual cohort, investigated in the representative case study, aligns with recommendations in Cohen et al. (2002), which state that sample sizes of 30 or more participants are generally sufficient for statistical analysis in educational settings. The

Faculty Student Success Coach's Office facilitated all interventions and student communication.

Although the personal interventions of the students identified as at risk were the focus, the Faculty Student Success Coach Office invested extensively in a focused advertising campaign highlighting access to the faculty and institutional student support interventions as a general service available to all students. The department-hosted webinars on exam preparation, stress management, and time management, as well as 'how to study' sessions for high-risk modules, were available to all UoT students. The study complied with the relevant ethical principles, considering the uniform implementation of the interventions, faculty-wide and without discrimination.

Student identities were protected throughout the reporting and intervention process, and data were anonymised for analytical purposes. Exceptional care was taken to ensure that students identified as at-risk were not stigmatised or otherwise disadvantaged, and the reporting structure, process, and evaluation criteria were explained to all students. All interventions and reporting were implemented to support student wellness, mental health and academic success, as were the principles of Ubuntu described in the theoretical framework.

The methodology and interventions were guided by the theoretical framework detailed above and Bronfenbrenner's original theory, allowing consideration of multiple systemic factors influencing student mental health, stress, and performance, including the immediate environment, interactions among support structures, and institutional policies and practices. Further, the broader cultural and societal influences within the engineering studies environment were considered to facilitate holistic interventions while acknowledging the complexity of the factors influencing an engineering student's success, mental health, and overall well-being.

The 2022 to 2023 data were analysed in depth to establish student performance trends, examining individual assessment outcomes, class attendance, and online Learning Management System (LMS) participation and engagement. This analysis aimed to distinguish between temporary adjustment issues, which are particularly common among first-year students, and more concerning social, mental, or academic challenges that persist and worsen over time, often resulting in course deregistration or failure.

The findings provided lecturers with evidence-based guidelines and systematic identification strategies to facilitate early reporting and proactive interventions. By recognising

the warning signs of a more persistent problem before academic deterioration further, the programme aimed to prevent the escalation of academic and mental health pressures that often compound student difficulties.

Systematic analysis framework based on academic performance trends. The assessment performance analysis followed a systematic progression, beginning with an initial evaluation of the first formal assessment combined with class attendance data, then evolving into a historical analysis as subsequent assessments accumulated throughout the year. This approach tracked whether students showed significant performance deterioration and whether declining assessment results correlated with changes in class attendance patterns.

Initial risk identification criteria for early identification and reporting. As part of the initial evaluation, when specifically analysing the student performance in the first assessment mentioned above, all students scoring 45% or below were classified as high risk, regardless of class attendance records. The purpose of this initiative was to enable the Academic Excellence Office to conduct general well-being checks, with a particular focus on first-year students, to identify potential financial, learning, or disability challenges that could be mitigated at an early stage.

Additionally, students with attendance of 65% or below were flagged as at-risk regardless of assessment scores, since literature demonstrates that students who fail to attend classes are reluctant to engage with study content and typically fail to compensate through reflective or self-paced study. This trend is evident when evaluating a student's assessment performance over a whole academic year, in conjunction with their class attendance, which shows a proportional decrease in both.

Historical assessment performance analysis. As the academic year progressed and both formative and summative assessments were completed, students who maintained 50% performance and regularly attended interventions and classes were closely monitored by the lecturer and academic office as borderline cases.

The 2022 to 2023 data analysis revealed that the second assessment typically proved most indicative of the trajectory the student would follow for the rest of the year as the initial adjustment period passed, and clear trends could be established for class attendance, intervention and LMS participation and engagement. Academic performance allowed for a definitive assessment of whether the student performance was improving or deteriorating, once

again enabling targeted intervention strategies, especially for continuous evaluation subjects or year modules.

Data collection methods. The module's success and pass rate were systematically analysed to track the quantitative metrics and data for student cohorts from 2022 to 2024, which were obtained from HEMIS (Higher Education Management Information System). A student was identified as at-risk based on the faculty's reporting system, and framework detailed above, which lecturers implemented by tracking student class attendance and assessment performance.

As such, following the completion of the official assessments, students who complied with the criteria outlined above were reported to the Faculty Student Success Coach's Office for intervention.

This office documented student attendance and engagement in counselling services, as well as lecturing staff reporting frequency, which was communicated to the department and shared with the respective students. The Office monitored student participation in activities designed to support their academic success. These interventions focused on stress management, time management, study planning, setting personal and educational goals, and improving study techniques.

Data analysis. Using comparative statistical analysis, the quantitative data were analysed using inferential statistics to compare the pre-intervention success rates established in the 2022 to 2023 success rate data analysis with the 2024 post-intervention success rates; and to evaluate the difference in performance between at-risk students who participated in the interventions compared to the performance of the non-participants, using the Faculty Student Success Coach Office database for intervention participation records.

The success rate was evaluated as the percentage of enrolled students achieving a final grade of 50% or above, including deregistered students as part of the class group to obtain a conservative measure that accounts for student attrition. The pass rate was the percentage of registered students who achieved a final grade of 50% or above, excluding students who deregistered throughout the year, and focused specifically on students who completed the module.

The year-on-year statistics of the pass and success rates were compared. The analysis was used to determine whether the success rate improved, whether the number of students who

deregistered for the subject decreased, and whether there was a correlation between the level of participation in wellness interventions, academic performance improvement, and the continuation of studies.

Results and discussion

A review of the Faculty Student Success Coach Office intervention statistics, assessing students throughout the period following the implementation of the Office's reporting and support structure, revealed notable observations among the at-risk students. The representative case study shows that 45% of the identified students struggled with both poor attendance and academic performance in formal assessments.

In comparison, 55% of the students complied with the UoT's prerequisite 80% class attendance policy, but still performed poorly in formal assessments, underscoring the reality that attendance alone does not necessarily guarantee meaningful comprehension, learning, or academic success. This finding aligns with Boylan-Ashraf's (2018) research, emphasising that class attendance must be coupled with academic and social integration for meaningful engagement. The disconnect between attendance and academic performance suggests that students may be experiencing passive participation, being physically present in class without cognitive or emotional engagement (Choi & Hur, 2023).

In 2024, reports focusing on at-risk students indicated that 73% of those identified, and who were contacted by the Faculty Student Success Coach Office for participation in academic and wellness interventions, still failed the module, while 27% managed to pass. Notably, 66% of the students who passed did so with distinction. This underscores findings by Freeman et al. (2014) that intervention effectiveness in engineering education may be particularly beneficial to students who are intrinsically motivated and somewhat engaged, while those facing multiple barriers may require a more intensive individualised support initiative aligned with Bronfenbrenner's micro and meso-system interventions.

Freeman et al.'s (2014) research on active learning supports the 2022 to 2023 data analysis, which demonstrates that regardless of the pass marks, regular class attendance is essential for maintaining academic momentum. The representative case study further supports this analysis, confirming that the decline in class attendance inevitably leads to deteriorating academic performance, irrespective of the severity of the decline.

Despite efforts by the Faculty Student Success Coach Office to engage students and provide support, participation in the proposed interventions and wellness programmes, and class attendance remained inconsistent, with some students failing to fully commit to participating. These findings coincide with Bandura's (1977) self-efficacy theory, highlighting the reluctance of students with low academic success and self-efficacy to seek assistance or participate in academic interventions. Consequently, this reluctance often contributes to the pervasive and toxic engineering culture of 'toughing it out', which celebrates struggling through engineering studies and the formation of communities around shared pain and suffering rather than fostering a supportive environment focused on development, mental health, and wellness, or popularising the participation in intervention programmes.

However, the analysis of the year-on-year success and pass rates for the representative case study module, detailed in Table 1, shows that initially, there was a 7.7% decrease in the success rate preceding the implementation of the proposed interventions. Following the successful completion of the proposed interventions in 2024, there was a significant – 35% – increase in the overall student success rate compared to 2023. This is supported by the corresponding increase in pass rate, with a 23.5% increase in the 2024 pass rate compared with 2023.

Table 1: *Success and pass rates from 2022 to 2024*

Year	Success Rate (%)	Pass Rate (%)
2022	56.00	66.00
2023	51.67	62.00
2024	70.00	76.56

When analysing the success rate improvements between 2023 and 2024, in the context of Bronfenbrenner's ecological systems theory, the 18.33% increase in the 2024 success rate suggests that the proposed theoretical framework and interventions successfully address micro- and mesosystems. From a microsystem perspective, the individual counselling, study skills, and academic interventions appear to have improved students' immediate learning environment and ultimately their coping strategies. It also seems that these interventions improved students' confidence in applying their newly acquired knowledge, while mesosystem interventions not only improved communication between lecturing and support staff but also empowered lecturers to identify and report at-risk students early.

Although viewed in the light of a representative case study, the improvement in the 2023 to 2024 success rate, compared to the decline observed in the 2022 to 2023 success rate, suggests that the sustained efforts to campaign for awareness of the faculty-wide intervention programme may indicate a shift in the engineering culture wherein help-seeking behaviour was normalised. This connects to the concept that institutional interventions grounded in Ubuntu philosophy can promote a cultural shift from celebrating individual struggle to fostering collective support.

These findings should also be examined in conjunction with the student registration and deregistration statistics detailed in Table 2, which show a 50% decline in the 2023 to 2024 deregistration rates following the implementation of the intervention programme, compared to the 179.23% increase in the deregistration rates observed from 2022 to 2023. While the results indicate a notable improvement in student performance, there is still room to refine individual interventions to promote students' voluntary participation.

Table 2: *Student registration from 2022 to 2024*

Year	Deregistered Students	Students	Deregistration (%)
2022	4	67	5.97
2023	10	60	16.67
2024	6	70	8.57

Although the case study sample is relatively small, this trend may suggest a gradual shift in students' perception of academic support and intervention programmes, moving away from traditional engineering culture. This shift could be linked to the faculty's awareness campaign, which actively promoted intervention, guidance, wellness, and support initiatives, aligned with Bean and Metzner's (1985) model for student attrition, which emphasises the focus of interventions on both academic and psychological well-being, ensuring that these resources are accessible not only to at-risk students, but to the entire student cohort; and that, most importantly, that the students are aware of this support and how to access it.

However, the varying success rates among intervention participants, specifically the 27% passing students following the interventions, with only 66% of those students achieving a distinction, indicate a need for a more tailored approach for individual student intervention profiles, necessitating future research to identify factors that could not only predict intervention

success, but also improve intervention recommendations at an individual level focusing on a student's intrinsic motivations.

Conclusion

Although numerous research articles and studies have examined the importance of mental health and wellness among engineering students, there is a need for additional research in a South African context, particularly among students at the UoT. Such research should examine how best to support student learning while promoting student wellness and mental health. The research should be embedded in a student cohort with diverse economic, academic, and cultural backgrounds. The individual student's prior knowledge and environmental exposure should be considered, as they all affect the extent to which the student can relate to and ultimately comprehend the practical examples and learning materials.

The need for such research is emphasised by the decline in mental well-being and the increase in stress levels observed among engineering students at institutions where student throughput is prioritised. The need is underscored by a student culture that has historically perpetuated an unhealthy approach to learning rather than fostering one that encourages engineering students to understand their material. There is a general lack of appreciation for applying theoretical knowledge to practical solutions, while effectively utilising all available resources to promote student mental and academic wellness.

While the analysis of year-on-year success and pass rates from 2022 to 2024 provides evidence of the efficacy of the wellness intervention programme implemented within the Faculty of Engineering and the Built Environment, the results and findings detailed in this article must be interpreted with the limitations of a representative case study in mind.

Although Cohen et al.'s (2002) recommendations for educational research consider a sample size of 30 or more participants sufficient for statistical analysis in educational settings, this limit limits the applicability and generalisability of the findings across different departments, despite the framework being implemented faculty wide. Further, while the framework provides interventions and support at all levels of study, the analysis of the HEMIS data focuses primarily on the efficacy of interventions for first- and second-year students in one high-risk module.

Ethically, these interventions should be available to all students regardless of department, academic performance level, or year of study, as withholding beneficial support measures from any student could potentially exacerbate and contribute to a student's mental health or academic difficulties. As a result, this consideration prevents the establishment of traditional control groups, necessitating a heavy reliance on historic HEMIS data for analysis of findings and results. This data examines individual assessment performance, pass rates, success rates, student registration statistics, and historically unreliable attendance records.

It is also important to acknowledge that the improvements in success rates and student attrition in the 2024 academic year could be attributed to exosystems such as improvements in teaching methods and assessment strategies, while the cultural specificity of the intervention framework based on Ubuntu principles may limit the application of similar frameworks to other cultural contexts without making significant changes.

An in-depth analysis is recommended on the implementation of structures and support systems that promote student engagement and participation. The significant improvement in 2024 demonstrates that addressing student wellness through a bioecological systems approach rooted in Ubuntu philosophy can significantly enhance academic outcomes in engineering education for at-risk students and the remaining cohort. However, the 73% failure rate observed among students who were contacted and identified as at risk indicated that, while the overall approach might be practical, the individual interventions require further refinement, with a focus on promoting student engagement and participation not only in the intervention but also in class.

These findings challenge the traditional engineering education culture found in UoTs, normalising and perpetuating high-stress learning environments that discourage help-seeking behaviour, and prioritising mental health and general well-being as fundamental influences on academic performance. Instead, they support a more holistic approach that recognises the interconnectedness of wellness and academic performance and acknowledges the importance of proactively addressing mental health concerns rather than reactively. The findings especially highlight the importance of continuous monitoring and reporting of student performance and attendance as an ongoing mechanism that supports a guided learning approach, while encouraging students to take responsibility for their learning journey and the achievement of their personal and academic goals.

The results validate the investment in and implementation of the proposed theoretical framework and approach. They also suggest that when fully integrated into faculty culture and practices, such approaches can substantially improve student retention, progression, and academic success in engineering programmes as well as the long-term mental health, physical health, and well-being of not only engineering students but ultimately engineers in industry and practice.

All the above factors support the necessity of successfully implementing and integrating student development and support programmes into academic institutions and student culture. The significance of open discussions regarding the importance of mental health, wellness, and awareness in an academic engineering culture must be emphasised, while recognising that the success of these programmes largely depends on the active participation of students and lecturers. However, it is worth noting that the sustained commitment and availability of any interventions at a UoT require adequate resource allocation, support, and concerted development for diverse student cohorts.

This study aligns with evidence supporting comprehensive, culturally informed student support initiatives in engineering education. The initial improvement in success rates and student attrition supports the development of sustained, systematic interventions and structures aimed at transforming the engineering culture, actively promoting student wellness, voluntary student participation, and supportive communities.

The integration of Ubuntu philosophy into the framework, alongside bioecological systems theory, provides a foundation and a culturally relevant approach for UoTs in the South African education context. However, the success of the programme and the replicability of its results depend on institutional commitment, continuous development, and student-centred engineering teaching strategies that foster an environment that promotes student participation, engagement, and comprehension.

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