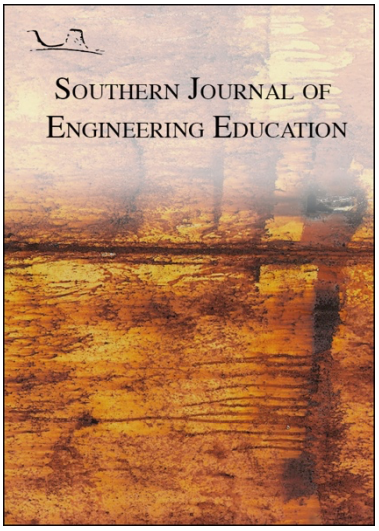

Southern Journal of Engineering Education

Publication details, including instructions for authors and other information can be found at https://journals.uct.ac.za/index.php/sjee

Fostering Resilience and Learning in Engineering Education through Peer-Led Tutoring in the Global South

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Submission received: 10 April 2024 / Published: 14 January 2025

To cite this article: Versfeld, J., da Silva Burke, T. and Kanyane, R. (2024). Fostering Resilience and Learning in Engineering Education through Peer-Led Tutoring in the Global South, *Southern Journal of Engineering Education*, *3*, 119–131. DOI: 10.15641/sjee.v3i1.1543

Southern Journal of Engineering Education, 2024
Vol 3, 119–131

Fostering Resilience and Learning in Engineering Education through Peer-Led Tutoring in the Global South

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Peer-led study groups have increasingly gained attention as a strategy to enhance student resilience and improve academic outcomes. In the Global South, where socio-economic challenges and limited resources often hinder student success, such interventions are critical. Despite the growing interest in collaborative learning, there is limited research on how these systems influence student resilience, particularly in environments that emphasise Ubuntu values of mutual support and interconnectedness. This study fills that gap by critically examining the role of peer-led study groups in high-impact engineering modules. Focusing on the experiences of students navigating complex academic challenges, it explores how these tutoring systems foster resilience and create supportive learning environments. Drawing on Relationship-Resourced Resilience (RRR) Theory, which highlights the importance of social connections in overcoming adversity, the study employs a qualitative methodology to analyse student feedback from interviews and focus groups. The findings illustrate the transformative potential of peer-led groups in creating an inclusive, supportive educational environment that goes beyond traditional lecture-based approaches.

Keywords: Student success; South Africa; peer-led groups

Introduction

The transition to higher education, particularly in engineering disciplines, poses substantial challenges for students, especially within the unique socio-economic and educational landscapes of the Global South (de Klerk, 2021; Tiroyabone & Strydom, 2021). The Global South is often used as a symbolic term to describe low-income and marginalised societies (Trefzer et al., 2014). While South Africa is classified as an upper-middle-income country (World Bank, 2018), it remains one of the most unequal nations globally, as indicated by its

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Gini coefficient (OECD, n.d.). The country faces stagnant economic growth and rising unemployment rates (Francis & Webster, 2019; World Bank, 2018). In South Africa, as in many other post-colonial contexts, education plays a pivotal role in cultivating the skills, knowledge, and attitudes necessary for ongoing development (Martin et al., 2017).

Engineering students in regions like South Africa often face under preparedness, financial constraints, and a lack of personalised academic support, resulting in low retention and graduation rates (Tiroyabone & Strydom, 2021). While traditional tutorial systems are designed to complement lecture-based learning, they frequently fail to meet the diverse needs of students who grapple with complex engineering concepts in these contexts.

Emerging research underscores the potential of peer teaching and collaborative learning in improving academic outcomes and fostering deeper student engagement (Arruda & Silva, 2021; Christie & De Graaff, 2017). However, there is limited research examining these pedagogical approaches within the Global South, where cultural and material constraints shape the educational experience. This study addresses this gap by investigating how peer-led tutoring systems, grounded in collaborative learning principles, can enhance student resilience and learning outcomes in this unique setting.

The theoretical framework guiding this study is Relationship-Resourced Resilience (RRR) Theory, which posits that students in the Global South, particularly within South African communities, draw on Ubuntu[1] values – emphasising collective well-being, mutual support, and interconnectedness – to navigate adversity (Ebersöhn, 2019). By embedding this cultural ethos within peer-led tutoring models, we explore how such systems can foster resilient learning communities in resource-constrained environments.

This study aims to contribute novel insights by addressing the following research question: How do peer-led tutorial systems in high-impact engineering modules foster student resilience and learning experiences in the Global South? Through a qualitative exploration of student experiences in small peer-led study groups, this research provides evidence-based perspectives on how such models can overcome the limitations of conventional tutorials. Additionally, it highlights the importance of collaborative learning strategies in enhancing both the academic

[1] Ubuntu is a moral worldview originating from Nguni languages spoken in sub-Saharan region and translates to ‘A human being is a human being because of others’.

and psychosocial dimensions of student life, advocating for a shift toward more inclusive and supportive educational practices.

Implementation of the peer-led study group intervention

The 2022 pilot of the peer-led study group intervention for the mechanics module at the University of Pretoria represented a shift in pedagogical strategy, aimed at revitalising student engagement and fostering deeper comprehension of complex engineering concepts. The pilot introduced small, peer-led groups designed to address existing challenges in traditional tutorial formats, which often failed to meet students' needs in grasping complex engineering concepts. These peer-led groups created an interactive, supportive environment that allowed students to work collaboratively, encouraging active engagement and inquiry rather than passive learning. Based on feedback from the 2022 pilot, the intervention was further refined in 2023 with significant enhancements aimed at improving both the quality of tutoring and the overall learning experience. The key modification in the 2023 implementation was the integration of trained tutors, who provided more detailed conceptual guidance without undermining the collaborative nature of the peer-led groups. This dual approach – maintaining the peer-driven focus while adding targeted academic support – struck a balance between formal instruction and the benefits of collaborative learning, creating an enriched learning environment.

The inclusion of tutors was informed by ongoing feedback from students and lecturers, reflecting a responsive, iterative approach to addressing the specific educational hurdles that engineering students face. These refinements also included the earlier rollout of structured study sessions at the beginning of the academic cycle, allowing students to engage with the material from the outset, thereby reducing the sense of being overwhelmed by difficult content as the semester progressed.

In this evolved model, the role of study leaders was redefined. Rather than acting as traditional tutors who deliver direct instruction, they took on the role of facilitators, guiding group discussions, encouraging peer-to-peer learning, and fostering a supportive, interactive environment. Study leaders were selected not just for their academic ability but for their capacity to lead and support their peers, and they received additional training to equip them with the skills needed to manage group dynamics and facilitate learning effectively.

The expansion of the intervention also included additional tutoring sessions, particularly before major assessments, and the introduction of peer advisors who offered a blend of

academic content reteaching and emotional support. This combination of roles further strengthened the collaborative learning environment, creating a space where students could actively engage in problem-solving while receiving guidance when necessary. This intervention model is a distinct departure from traditional tutorials and consultations, which are often underutilised and perceived as formal or rigid.

Methodology

This study employed a qualitative research approach to explore the impact of the peer-led study group intervention that took place in 2023 at the University of Pretoria. The research sought to gain deep insights into how peer-led study groups foster student resilience and learning in high-impact engineering modules. By focusing on student and tutor experiences, the study aimed to uncover the psychosocial and academic dimensions of these peer-led interventions.

Data collection was conducted through semi-structured interviews, focus groups, and online surveys. A total of 24 participants were included in the study, comprising 18 students and 6 tutors. The participants were enrolled in or facilitating a high-impact mechanics module, a subject known for its complexity and high failure rates. Students ranged from second-year to fourth-year engineering students, ensuring a mix of academic levels and experiences with peer-led study groups. Among the students, approximately 60% had no prior experience with structured peer-led tutoring systems, while the remaining 40% had participated in informal peer-learning activities in the past.

The online survey consisted of questions that sought to gauge the students' perception of the benefits of the study groups, the ways in which they benefited, if their grades improved, and their recommendations for improving the study groups. The surveys were distributed to all participants immediately after the intervention concluded, providing additional data on their perceptions and experiences. The focus groups were conducted with two of the study leaders to obtain their feedback on what worked well and their suggestions for enhancing the learning community experience in the future. These lasted approximately 90 minutes each, were conducted with two groups of study leaders, each consisting of three tutors. These sessions facilitated in-depth discussions about the challenges and successes of facilitating peer-led groups. The semi-structured interviews lasted between 30 to 60 minutes and were conducted over a two-month period (April to May 2023). These interviews provided an opportunity for

participants to reflect on their experiences with the study groups. The quotations that are provided in the Findings section below are taken only from the semi-structured interviews.

Participation in this study was entirely voluntary, and no academic penalties or rewards were tied to involvement. Informed consent was obtained from all participants, ensuring they understood the purpose of the study and their right to withdraw at any time. Students and tutors were mentored into their roles prior to the intervention, with tutors receiving formal training in group facilitation and study leaders receiving guidance on managing group dynamics. This preparatory phase was critical to ensuring that participants were equipped to maximise the benefits of the peer-led model.

Thematic analysis was employed to identify recurring patterns and themes within the data. This method facilitated the exploration of how peer-led study groups contributed to both academic engagement and psychosocial support, through the lens of Relationship-Resourced Resilience (RRR) Theory. The themes that emerged from the data were coded and organised to highlight key insights into the supportive dynamics, group interactions, and learning processes within these peer-led environments.

Results

Both students and study leaders reported on the positive impact of peer social connection on learning especially for a challenging module like mechanics. Students highlighted several key factors, including the assistance provided by classmates who understood the difficulties of the material and could offer relevant insights. The presence of these classmates created a more comfortable and supportive learning environment, where students felt empowered to ask questions and engage in meaningful learning opportunities. Furthermore, the presence of stronger students in the group provided a valuable opportunity for weaker students to model effective learning techniques and improve their comprehension of challenging concepts.

In addition to these benefits, students also reported that participation in these study groups increased their willingness to participate in future study groups and recommend such groups to friends. This can be attributed to the smaller group size, which fostered students' confidence and aided in comprehending difficult material. The collaborative nature of these groups created a sense of shared experience, which further enhanced students' engagement and motivation to learn.

The post-intervention qualitative data analysis showed that the students who participated in the study group intervention reported an increase in their ability to form bonds within and across peer networks, utilize learning-community networks, and place a higher value on shared experiences with their classmates. Themes are outlined and verbatim quotes given to illustrate participants' experiences of the intervention. The main themes identified from the post-intervention interviews with participating students and study leaders are:

Theme 1: Leveraging social connectivity for enhanced academic resilience

The utilization of resources provided by social ecologies can vary greatly, as it is influenced by the perceived availability of both informal and formal resources (Ebersöhn et al., 2020). Thus, it is crucial for students to understand the value of social connectedness as a protective resource, particularly during times of academic stress related to a challenging course. The collaboration that took place in study groups not only aided in the comprehension of difficult concepts but also highlighted the positive impact of social connection. By promoting the benefits of social connectedness, students could better understand the role of social support in their academic lives, as shown the in the following quotes:

> The study group sessions were very helpful. The groups were fantastic, and it was nice to work with others going through what you are going through and having that support.

> The choice of students to run the study groups was great.

> It is a good platform to help students help each other.

Studies have demonstrated that peer mentorship can enhance not only motivation, but also provide balance to mitigate stress and burnout. Peer support, whether in the form of guidance or simply a listening ear, may aid in internal stress management or learning coping strategies (Cheetham & Varga-Atkins, 2021). Student-led networks necessitate the establishment and maintenance of productive partnerships among learners within the same peer group. The implementation of study groups facilitated communication and interaction among students, resulting in a heightened level of peer connection and learning as evidenced by the following post-intervention quotes:

> We challenged each other and helped each other.

> Working on the problems with my group helped me to grasp the material more easily.

> Coming together and helping each other with the work really helped me.

> All the leaders had different approaches and strong points, so we were able to give different ways to look at a problem.

Theme 2: Collective resilience: navigating academic challenges together

In addition to student's appreciation of the benefits of peer connection (working together on the module compared to working alone), students reported that participation in the intervention made them aware of shared experiences students went through. The realisation that other students were facing similar difficulties in the module proved to be a valuable experience for the participants. By acknowledging the struggles of their peers, they gained a sense of support and empowerment.

> You realise that you are not the only struggling so we could comfort and support each other.

> Learning from other students who have done the module before was insightful.

> Knowing that we weren't the only ones in the class gave us hope and kept us motivated to keep going.

The findings of recent research indicate that engineering students often enter university with a 'STEM-ego', a term used to describe a strong sense of academic self-efficacy. This confidence is particularly common among high-achieving high school graduates who pursue programs in Science, Technology, Engineering, and Mathematics (STEM) – disciplines known for their focus on critical thinking, problem-solving, and technical expertise. These students frequently assume they will not require additional support to succeed, underestimating the challenges posed by the rigorous demands of higher education. Nonetheless, this perspective can have adverse effects on their academic performance and their willingness to seek help. The results from this study highlight that these students are not familiar with failure, as they have been accustomed to receiving good grades in high school. For those students who struggle with this particular module, this can be a novel experience as they confront failure for the first time in their lives. Consequently, sharing similar experiences of difficulty with the module helped students feel less isolated and empowered them to persist in their studies.

> I appreciated the fact that there were other people who found the module a bit tricky and were making an effort to do better.

> For some of these students it was their first time failing so it really made them lose hope, but for the students who stuck with it through with the module, it really helped them to see other students also struggling.

Theme 3: Optimising learning through small group dynamics

Many of the students entering South African universities are in diverse economic, academic, and psychosocial positions. As a result, South African universities try many initiatives to support students holistically. Thus, there has always been an understanding of the need for holistic support (intellectually, ethically, culturally, socially, and even physically) but there appears to be a lack of understanding as to what that support would mean practically. Strydom and Loots (2020) contend that, despite well-intentioned efforts to support students, the practical implementation of such support often fails to incorporate students' perspectives, leaving their voices notably absent from discussions surrounding intervention strategies.

In the engineering department at the University of Pretoria, various types of academic support are offered to students. However, lecture halls and even tutorials are often attended by a more diverse range of students. Students may be reluctant to ask questions in big groups which can interfere with their learning. Because the study groups were small, it was beneficial for students as they felt more comfortable to ask questions between peers.

> Being helped by my classmates, they understand the struggle best and they can relate the most thus making it easy for me to learn from them and as I'm more comfortable around them I can ask as much as I want.

> Learning from other students who also find certain concepts difficult, because the lecturers don't always understand how difficult it is to grasp.

Collaborative learning, defined as a process in which peers assist one another in addressing challenging aspects of a course, is a key characteristic of tutoring (Cheetham & Varga-Atkins, 2021). This approach offers various advantages, such as establishing social connections and complementing lectures, while also providing students with teaching and leadership opportunities. However, students in the Faculty of Engineering, Built Environment, and Information Technology (EBIT) frequently view tutorials differently, as they are often taught in large groups and do not provide an environment where students feel comfortable asking questions. Students reported that smaller study groups were more beneficial, as they felt comfortable asking questions and learning from one another, as shown in the following quotes.

> Working in smaller groups helped us to see different ideas on how to tackle a problem.

> I enjoyed how we were all helping each other and giving each other some advice on how to tackle questions. That doesn't always happen in lectures and tutorials because the groups are too big, and you feel shy to ask questions.

Theme 4: Fostering inclusivity and engagement across student communities

In recent years, there has been a broadening of the discourse around student support initiatives to encompass not only the acquisition of academic skills but also the psychosocial dimension (Tiroyabone & Strydom, 2021). As part of orientation, students are frequently encouraged to participate in student communities. However, there are challenges related to the use and accessibility of these communities, particularly for day students. Students in residence tend to have a stronger sense of community, as residences often organise study groups. Conversely, non-residential students may struggle to feel a sense of belonging. Students who were part of the mechanics study group reported an increased understanding of the benefits of these communities, which, in turn, made them more receptive to participating in other student communities, as seen by the following quotes:

> I think the day students benefitted more from the study groups than the res students, because at res we have those study groups. For the day students it helped them a lot to have that support.

> It really helped me. It made me realise that working in a group helps you to not feel alone. I wish they had study groups for every module.

Discussion

The current study highlights the crucial role of social connections in fostering academic resilience, reinforcing findings from Rudd, Meissel, and Meyer (2021), who advocate for the importance of peer interactions as a supportive mechanism. However, by embedding these interactions within the socio-cultural context of the Global South and guided by the Ubuntu principles of interconnectedness and collective support, the research introduces a unique and culturally nuanced pathway for resilience. This culturally embedded approach is particularly significant for addressing the adversities faced by engineering students in South Africa, where socio-economic barriers and academic pressures intersect. Peer-led study groups, in this context, go beyond offering mere academic support – they foster a deep sense of community and belonging, which is vital for both academic and emotional well-being. This community-

oriented support system not only aligns with Ubuntu values but also provides a profound counterbalance to the traditional, often isolating, academic structures found in higher education. The insights gained from this study resonate with the work of Pointon-Haas et al. (2024), which emphasises the critical role of social connectivity in academic resilience. However, our research contributes a broader perspective by contextualising this within the unique educational landscape of the Global South.

The concept of collective resilience is vital for navigating academic challenges, as echoed by Cheetham & Varga-Atkins (2021). The current study's findings provide a deeper understanding of how peer-led groups foster this collective resilience, particularly within the complex and demanding field of engineering education. By applying Relationship-Resourced Resilience (RRR) Theory (Ebersöhn, 2019), peer-led tutorials show how students draw on the collective strength of their peers to overcome academic struggles. The ability to share academic challenges within a supportive group allows students to view difficulties as shared experiences rather than personal failures. This collective problem-solving process not only enhances academic outcomes but also strengthens students' capacity to cope with the pressures of their courses. Our findings also align with the work of Meuleners, Neuhaus, and Eberle (2023) on the efficacy of peer-led Positive Psychology Interventions, which underscores the power of Ubuntu-driven collectivism in enhancing educational success. The unique feature of the current study is its focus on how culturally grounded, collective resilience contributes to overcoming the specific educational challenges found in the Global South.

The benefits of small group dynamics in improving learning outcomes, as documented by Rudd, Meissel, and Meyer (2021) are reinforced by the results of the current study, which delves into the additional complexities of implementing such dynamics within the Global South's engineering education context. Engineering students in South Africa face diverse socio-economic and academic challenges, and peer-led study groups offer an adaptable solution that is responsive to these varied needs. In smaller, more intimate learning environments, students feel empowered to engage, ask questions, and participate in deeper discussions, which may be less accessible in larger, more formal settings. The smaller group sizes facilitate a more interactive and student-centred learning environment, as well as provide a space for students to build leadership and peer-teaching skills. Additionally, such group dynamics can be adapted to address the unique needs of students in under-resourced, high-pressure educational settings, particularly within the context of the Global South (Sedghi, 2013).

Our findings on fostering inclusivity and engagement through peer-led study groups add a significant contribution to the discourse on educational interventions in the Global South. Our research shows how peer-led study groups offer both psychosocial and academic benefits by creating inclusive, supportive learning communities. These groups are especially beneficial for students from diverse backgrounds, including those who may feel marginalised in traditional educational structures, such as non-residential students or those from underprivileged socio-economic backgrounds. By bridging these diverse student demographics, peer-led groups foster a sense of belonging and encourage active participation in the learning process. This inclusivity is critical in a field like engineering, where students often feel isolated due to the demanding nature of the discipline. The holistic support systems provided by peer-led groups ensure that students receive both academic guidance and emotional support, addressing the full spectrum of their needs and promoting long-term success in their educational journeys.

In synthesising these insights with broader educational literature, the current study not only validates the efficacy of peer-led interventions but also deepens the understanding of their impact within the specific cultural and socio-economic context of South Africa. By advocating for a holistic approach to engineering education that prioritises both academic success and student development, the research contributes a vital perspective to the global conversation on enhancing higher education through peer support. As the demands of the modern educational landscape continue to evolve, our findings underscore the need for reimagined educational strategies that move beyond academic instruction to incorporate emotional and psychosocial resilience. This holistic framework recognises the complex realities of the modern world and advocates for educational models that emphasise collective resilience, peer support, and community-driven success – particularly within the Global South – where resource constraints make such approaches even more critical.

Conclusion

The findings from this study underscore the significant role that peer-led study groups play in fostering not only academic success but also psychosocial resilience. By providing a collaborative, supportive environment, these groups have proven to be more effective than traditional tutorials in facilitating deeper engagement with complex engineering concepts.

The study's emphasis on Ubuntu values and Relationship-Resourced Resilience (RRR) Theory further highlights the importance of social connectivity in academic settings,

particularly in regions where socio-economic factors exacerbate the stresses of higher education. The peer-led study groups not only enabled students to navigate academic challenges but also fostered a sense of belonging and collective resilience, which is crucial for their overall development and well-being. This culturally contextualised approach aligns with the unique needs of students in South Africa and other similar environments, demonstrating that educational interventions must be adaptive and sensitive to the broader socio-cultural context. The smaller, more intimate group dynamics fostered by this intervention were particularly beneficial for students who might otherwise struggle in large, impersonal lecture halls or traditional tutorials. The ability to ask questions, engage in discussions, and receive peer support in a non-threatening environment was pivotal in helping students grasp difficult material and gain confidence in their academic abilities.

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