RESILIENCE IN CONTEXT: A COMPARATIVE STUDY OF ENGINEERING STUDENTS IN THE UNITED KINGDOM AND SOUTH AFRICA (RESEARCH)

C Mapaling [1]
Department of Psychology, University of Johannesburg
Johannesburg, South Africa
0000-0003-2731-9081

N Wint
Centre for Engineering Education (CEE), University College London (UCL)
London, UK
0000-0002-9229-5728

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ABSTRACT

This qualitative study investigates the academic resilience of engineering students within the distinct cultural, social, and institutional landscapes of the United Kingdom and South Africa. Engaging with 36 participants through semi-structured interviews, the research aimed to discern the elements fostering academic resilience and gauge students' preparedness for professional life. Two overarching themes were identified: similarities and differences in resilience experiences in these two contexts. Under similarities, individual resilience traits such as hard work, determination, and growth mindset emerged prominently, alongside the shared challenges of academic pressures and the transition to university life. The importance of support systems, including the role of peers, faculty, and university resources, was acknowledged across both contexts. Differences highlighted distinct institutional and cultural

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[1]

C Mapaling
curwynm@uj.ac.za

influences on resilience: South Africa grappled with resource constraints, technological gaps, and historical educational disparities, while the UK experience revealed more detailed insights into the role of institutional support and introspective resilience. By contributing to the discourse on engineering education and student success, this research underscores the imperative for engineering programmes to focus on nurturing resilient, future-ready responsible engineers, and emphasises the value of cross-cultural insights and cooperation in fostering inclusive and supportive environments that respond to the unique needs of students in different educational contexts.

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1 INTRODUCTION

Engineering education (EE) plays a crucial role in shaping the future of our societies, as engineers are at the forefront of addressing global challenges and driving technological advancements. However, the journey to becoming an engineer is often fraught with obstacles, requiring students to develop and maintain a strong sense of resilience. This work aims to explore how resilience is understood and fostered in two distinct educational contexts: the United Kingdom (UK) and South Africa (SA).

Resilience, defined as the ability to overcome adversity and adapt to challenging circumstances, is a key factor in determining student success and well-being (Mwangi and Watt 2021). Academically resilient students are those "who sustain high levels of achievement motivation and performance despite the presence of stressful events and conditions that place them at risk of doing poorly in school and ultimately dropping out of school" (Alva 1991, 19). In the context of EE, students face a myriad of challenges, including rigorous coursework, high academic expectations, and the need to develop a wide range of technical and interpersonal skills (Cajander, Daniels, and McDermott 2012; Llorens-Molina et al. 2022). Understanding factors that contribute to academic resilience and identifying effective strategies to support its development is essential for promoting student success and well-being.

Recent research has explored resilience in engineering education from various angles. A systematic literature review by Winkens and Leicht-Scholten (2023) found that resilience in EE is connected to both engineering students' personal attributes and to university systems. For students, resilience was linked to persistence, adaptability, learning from failures, coping with stress, and being a desired competence (Winkens and Leicht-Scholten, 2023). Resilience has also been described as the ability to manage or recover from stress (Huerta et al., 2021) and the term 'academic resilience' has been used to examine students' responses to academic challenges (Hunsu, Carnell, and Sochacka, 2021; Martin and Marsh, 2006).

Moreover, studies have associated resilience with self-regulation (Concannon et al., 2019) and self-efficacy (Anthony et al., 2016; Concannon et al., 2019) in engineering students. Resilience has also been investigated in relation to equity, diversity, and inclusion, focusing on specific groups like mature students (McGivney, 2007; Servant-Miklos, Dewar, and Bøgelund, 2021), women (Khilji and Pumroy, 2019), African American and Latino students (Samuelson and Litzlerb, 2016), and black women (Ross, Huff, and Godwin, 2021). Long and Mejia (2016) even present

resilience as an asset, arguing that society often overlooks the resilience of minorities while stereotyping them as low-income and poorly educated.

The UK and SA provide unique contexts for examining academic resilience within EE. Whilst both countries have a strong tradition of EE, they also present distinct challenges and opportunities for students. In the UK, as part of the Global North, the EE system is characterised by well-established infrastructure, a high level of industrial integration, and advanced research facilities (Engineering Council 2014; Polit and Beck 2010). In contrast, SA, situated in the Global South, faces unique challenges such as resource limitations, a need for educational transformation, and the imperative to align EE with rapid economic and social changes (Fisher and Naidoo 2020).

In the UK, the impact of Brexit on the EE sector and the experiences of international students and staff is a pertinent issue (UCL Centre for Engineering Education, n.d.). In SA, the need to increase diversity and representation in the engineering field, particularly among women and underrepresented groups, is a pressing concern (Direito, Chance, and Malik 2019). While the UK also faces challenges in diversifying EE (according to HESA, in 2021/2022 ~80% of engineering students in the UK were male and ~63% were classed as 'home'), it notably differs in its reliance on international students for revenue (PwC, 2024), a trend less pronounced in SA.

By fostering cross-cultural dialogue and collaboration, this paper aims to contribute to the ongoing efforts to create inclusive, supportive, and transformative EE environments that nurture academic resilience and success.

2 METHODOLOGY

2.1 Research approach and design

This study employed a qualitative research design, situated within an interpretivist paradigm, to explore the resilience of engineering students in the UK and SA (Denzin and Lincoln 2003; Kivunja and Kuyini 2017). The interpretivist approach allowed for a deep understanding of participants' subjective experiences and the meanings they attached to their resilience in their respective educational contexts (Oakley 1998).

2.2 Participants and sample

Purposive sampling was used to recruit 36 participants, their characteristics shown in Table 1, with 13 engineering students from Nelson Mandela University in SA and 23 from Swansea University in the UK. The former is a comprehensive university in SA, the latter being a public research university located in Wales, UK.

In both cases, students were studying a broad range of engineering disciplines. The mean age of participants in both the UK and SA is notably consistent, averaging 23.5 years. This similarity in age distribution underscores a commonality in the student demographics between the two distinct geographical and educational contexts.

Table 1: Participant Information

	SA	UK
	Population	
Student population (Institution)	28, 000	22, 000 (HESA, 2022)
Home students	~95 %	81% (HESA, 2022)
Engineering students		15% (HESA, 2022)
	Sample	
Sample size	13	23
Gender identity (M/F)	10/3	17/6
Age range	21-28	18-39
Level of study	All Bachelors (final year)	2 Foundation Year (pre-Bachelor) 5 First year 5 Second year 2 Third year 9 Masters
Home/International	9/4	9/14

2.3 Data generation

Semi-structured interviews were selected as the primary data generation method, as they provided the opportunity to explore participants' experiences, thoughts, and feelings in depth while maintaining a focus on the research questions (Guba and Lincoln 1994). An interview protocol was developed, which included open-ended questions and prompts to guide the discussions (Jacob and Furgerson 2012). The questions focused on participants' educational experiences, their understanding of resilience, examples of times they demonstrated or developed resilience, and their views on the importance of resilience in education and the workplace. In both contexts, interviews were conducted either face-to-face or via video conferencing, guided by the participants' preferences and availability. Each interview spanned from 20 minutes to one hour. With the participants' consent, all interviews were audio-recorded and transcribed verbatim for data analysis.

2.4 Data analysis

Reflexive thematic analysis, as outlined by Braun and Clarke (2019, 2021) and Byrne (2021), was employed to analyse the transcribed data, underscoring the researchers' active role in identifying and interpreting meaning patterns within the datasets. This analysis adhered to Braun and Clarke's six-phase process: familiarisation with the data, generating initial codes, searching for themes, reviewing

themes, defining and naming themes, and producing the report (Braun and Clarke 2019). Analysis was conducted independently for the datasets from each context, then integrated to compare the resilience experiences of engineering students in both contexts. Reflexive practices were maintained throughout the analysis to recognise the researchers' subjectivity in data interpretation (Braun and Clarke, 2019). To validate the findings, strategies such as member checking—inviting participants to comment on the initial themes—and peer debriefing—discussing the analysis and findings with colleagues for additional insights and to challenge biases—were implemented (Baumbusch 2010; Noble and Smith 2015).

2.5 Ethical considerations

To ensure the integrity and ethical conduct of this research, appropriate measures were taken in both the UK and SA. In the UK, ethical approval was obtained from Swansea University, aligning with institutional guidelines and standards for research involving human participants. In SA, the Research Ethics Committee: Human (REC-H) at Nelson Mandela University granted institutional ethical clearance before the research began. Informed consent was secured from all participants, and ethical standards were consistently upheld throughout data generation in both countries, thus maintaining the integrity of the research processes.

2.6 Limitations of the study

This comparative case study on the academic resilience of engineering students in SA and the UK offers valuable insights but has limitations. Conducted at only two universities, its findings might not extend to other institutions (Polit and Beck 2010). The small sample sizes limit the breadth of student experiences captured (Boddy 2016; Vasileiou et al. 2018). Reliance on self-reported data from interviews may introduce biases (Althubaiti 2016; Rosenman, Tennekoon, and Hill 2011). Finally, its cross-sectional design provides a snapshot rather than a longitudinal view of academic resilience (Caruana et al. 2015; Farrington 1991).

3   FINDINGS AND DISCUSSION

This section describes the results of the thematic analysis results, uncovering the nuanced experiences of engineering students in the UK and SA. It reveals both shared and distinct aspects of their resilience journeys, shaped by their unique educational and socio-cultural environments. Through examining individual resilience traits, coping mechanisms, and support systems, alongside cultural and institutional influences, we unpack the complexities of their experiences.

3.1 Similarities

In the exploration of similarities, we observe common threads in the resilience narratives of engineering students from both the UK and SA. Despite their geographical and cultural differences, these students share key resilience traits and face comparable challenges. This section highlights these shared experiences, emphasising universal aspects of academic resilience in EE. Excerpts are numbered to allow the reader to identify quotes from the same participant.

Individual resilience traits: Students in both contexts emphasised the importance of personal characteristics such as hard work, determination, and a growth mindset in fostering resilience. For example, a UK participant remarked, "*I approached this more as an opportunity to learn… because I'm not treating this as someone else's*

mistake. I rather try to take it as my own and see if actually there's something wrong" (UK#23), underscoring the significance of self-reflection and personal growth. Another UK student shared, "*the idea that instead of focusing on the fact that last time when I did a lot of work, it didn't go so well, like its instead trying to build on what I did for the last assignment*" (UK#6), highlighting the importance of building on past experiences to improve future outcomes. Similarly, a SA student stated, "*I am a person who does not give up so easily, and when I tell myself that I need to fight, besides passion because at some point it's not all about passion, but it's about achieving what you want*" (SA#4), illustrating the significance of perseverance and goal attainment.

Coping with challenges: Engineering students in the UK and SA faced similar challenges, including the transition from high school to university, balancing academic demands with personal responsibilities, and navigating the coronavirus (COVID-19) pandemic. One UK student highlighted the distractions and temptations encountered when starting university: "*now you can do whatever you want to… so like that's also kind of one that pushes my resilience because now I have to keep my morals... there's no reason for you to get up early or anything*" (UK#1). This reflects the personal responsibility and self-discipline required at this educational stage. Similarly, an SA student shared, "*Interacting with people was a bit challenging to me, and even speaking or asking lecturers was a big challenge to me*" (SA#4), indicating the social and communicative hurdles faced in the university environment.

Support networks: In both the UK and SA, the significance of supportive networks including lecturers, tutors, and peers was universally recognised for providing essential guidance and encouragement. The influence of these networks extended to shaping students' sense of belonging and, consequently, their resilience. Engaging educators were seen as having the potential to "*inspire you to be a bit more resilient*" (UK#19) and to "*initiate the curiosity in someone, like the desire to learn*" (UK#12), making clear "*why you have to learn this*" (UK#12) to motivate students in a manner that supported resilience. Lecturers were appreciated for "*trying their best to give me as much as they can, and they even make themselves available*" (UK#9), enhancing student motivation and accountability. The motivational advantage of group settings was highlighted by a UK participant: "*when you're in a group you've got the motivation of working with people around you, whereas alone you don't have that so it makes it harder*" (UK#13). Within SA, the value of peer relationships, as well as the support from tutors and lecturers, was strongly emphasised, with students articulating the vital assistance they received from these relationships during their academic journey. SA#10 described a more informal peer support by saying that "*having a friend from South Africa that helped you with the English enough to transition with the language … built confidence.*" This sentiment was echoed by another SA student who mentioned, "*Lecturers give you, like, personal contacts, email. Talk to me whenever we have a problem with this, just communication*" (SA#1), illustrating the critical role of accessible and interactive support systems in fostering resilience among engineering students.

Gender dynamics: The conversation around gender dynamics in EE revealed additional layers of complexity. Female students face unique challenges, including gender discrimination and heightened pressures to prove themselves in a predominantly male sector. For example, the UK data touched upon these gender-

specific resilience demands, as a student recounted, "*horror stories from like woman being groped and stuff… I think that requires a lot of resilience. Also, I wouldn't want to work in like a super macho cultural workplace. I couldn't come to work like I know I couldn't handle it. It's too much. That would require a lot of resilience*" (UK#8). In SA, the sentiment resonates, with a student expressing, "*When you go into the engineering field as a lady, already people think that it's a male-dominated field. So, you go in with like a two mind of working as much as harder as them so you would end up maybe working like two times extra*" (SA#4). This underlines the critical intersection of gender and resilience, highlighting the necessity to address and comprehend these dynamics within the EE sphere, across both SA and the UK.

3.2 Differences

This section describes how varying cultural, social, and institutional factors uniquely shape participants' resilience journeys and abilities to navigate and overcome the specific challenges they face. For example, the UK findings offered more detailed insights into the role of institutional support in fostering resilience. A UK participant noted a "*myriad of things*" (UK#2) that were offered in terms of support with another saying, "*I have the full support I need*" (UK#11). Others listed the types of facilities they had access to with one saying the "*support team is really, really helpful to the students. They are on call to take measures to ensure students are at their best and also the psychological support from the students' support at university and also mentors, especially my project guide is really good to help me be more resilient towards situations*" (UK#14), with another explaining that "*suppose if you are facing struggling you can go to the Students Union and discuss with them. If you are some struggling in economies. You can get economic support, if you are struggling in your wellbeing or something there is some group where you can just pop in and just discuss with them. So, like there are more resources*" (UK#7). This indicates that responsive and supportive institutional practices are essential in enhancing resilience among UK engineering students. In contrast, in the SA context, institutional support was not as prominently or favourably discussed. A South African student expressed, "*I haven't necessarily used any support from the varsity system*" (SA#6), indicating a potential gap or underutilisation of institutional support mechanisms in enhancing student resilience.

Differences in support may be a result of the general marketisation of higher education within the UK (Brown, 2015) which has meant that the ability of the higher education institutions to charge increased fees became dependent upon their ability to demonstrate 'excellence' as part of the Teaching Excellence Framework (Department for Education, 2015) and thus an increased focus on metrics such as student satisfaction which is measured via the national student satisfaction survey (NSS). With this in mind, it is interesting to note that the majority of participants who spoke favourably of support within the UK context were international students and often compared the situation to their experience within their home country, with one saying "*general support is a lot more positive…I found, like professors here are lot more friendly than they are back in, my hometown or my country*" (UK#2). Much of these discussions were based around hierarchy and status and the fact that lecturers were more accessible in the UK "*because back there in my country… what I see in my university is that you can't sit next to the lecturer and talk about different subjects, because the lecturer is something up high, and you can't even get in touch…But here there are too many staff everyone. I think everyone tries to help you*" (5). In

comparison, home students in the UK tended to be more critical of the support provided by university, thus highlighting the way in which experience and expectations shape resilience, this being articulated by one student who said "*to be honest its [resilience] very rare in the Western world… Very, very rare. Because, for example, the only way you can really get resilience, like I was saying is going through tough times or going through hardships of some sort, and the thing here is life I've seen is generally too easy*" (UK#1).

4   SUMMARY AND ACKNOWLEDGEMENTS

This study examined the academic resilience of engineering students in the UK and SA, uncovering nuanced experiences shaped by individual traits, cultural backgrounds, and institutional environments. While students in both regions face common academic pressures and life balance challenges, those in SA additionally navigate resource constraints, technological disparities, and the enduring effects of historical inequalities (Mapaling, Webb, and du Plooy 2022). Despite these hurdles, students from both countries exhibit significant resilience, harnessing personal strengths, supportive networks, and university resources to manage their challenges.

The findings emphasise the necessity for engineering programmes in both countries to bolster academic resilience through tailored support, inclusive curricula, and the creation of nurturing educational environments (Mapaling 2024). Such strategies are vital for developing a cadre of engineers who are not only academically adept but also socially responsible and prepared to tackle global challenges (Engineers Without Borders UK n.d.).

In conclusion, this study not only highlights the resilient nature of engineering students in diverse settings but also underscores the pivotal role of individual, communal, and institutional support in fostering academic success (Mapaling, Webb, and du Plooy 2021). It advocates for global collaboration in EE to equip students as future innovators and leaders. Future research should explore the efficacy of specific resilience-enhancing interventions, sampling multiple universities, recruiting larger and more diverse participant groups, incorporating additional data sources beyond self-report, and adopting longitudinal designs to examine the long-term effects of resilience on the academic and professional journeys of engineering students.

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