



Starting the conversation with African engineering educators about student success

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ABSTRACT

CONTEXT

The literature on student success is rich, but most of it is written from the perspective of the Global North. The interventions proposed in the literature may not be practicable or relevant in an African context, or may not be seen by decision makers to be applicable. A preliminary review of the literature shows limited formal African scholarship on engineering student success. We seek to surface and value the expertise on student success that already exists in African engineering institutions, and add it as a contribution to the literature.

PURPOSE

The objective of the larger research project is to expand the literature on student success to include perspectives from sub-Saharan Africa. We aim to understand existing African models for student success in engineering, which can enable practical interventions in curriculum design and in institutional support structures. The goal of this paper is to begin to understand student success in the context of three African engineering institutions.

METHODOLOGY

This paper presents the first phase of the research, in which we explore the perspectives of a small number of experienced engineering educators from a range of countries and institutions in sub-Saharan Africa, through the medium of an online focus group. This initial unstructured conversation gives us an understanding of the current situation in which educators find themselves. The focus group data was interpreted using Bourdieu's theory of practice, which addresses inequalities in education.

OUTCOMES

The focus group data has allowed us to scope the range of contexts in which student success should be considered in sub-Saharan Africa, and identified critical areas for deeper study and further questioning. Based on this, we have developed an interview guide for semi-structured interviews with a wider group of participants, and confirmed that Bourdieu's theory of practice is an appropriate theoretical framework for analysing the second phase interview data.

CONCLUSIONS

In order for engineering education research to contribute to changes in practice, it needs to be relevant for local contexts. This research begins to develop scholarship around student success from multiple African perspectives, recognising the expertise of African engineering educators, and enriching our understanding of how African engineering institutions engage with this topic.

KEYWORDS

Student success; engineering education in Africa; Bourdieu's theory of practice

Introduction

This paper seeks to begin a conversation about the factors which influence engineering student success in sub-Saharan Africa, with the long-term aim of developing models which can enable practical interventions in curriculum design and institutional support structures that are relevant for the African context.

We began our research into student success in sub-Saharan Africa by conducting a preliminary database search. We looked for sources which mentioned student success in STEM contexts in higher education in sub-Saharan Africa, and obtained approximately 200 sources, in contrast to the thousands of sources on student success worldwide. Three-quarters of sources originated from South Africa, and reported on South African universities, although South Africa is only 1 of the 46 countries in sub-Saharan Africa. The remaining sources represent the rest of sub-Saharan Africa, which contains multiple regions with a diversity of contexts in terms of languages, infrastructure, economic resources and education levels. We acknowledge that an electronic database search is a limited methodology for surveying African scholarship. Nonetheless, the global literature on student success will be enriched by adding multiple diverse narratives from the varied contexts of sub-Saharan Africa.

Research in student success has developed from being primarily focused on student agency to understanding the impact and importance of universities, curricula and lecturers on individual student behaviour, as explained by Tinto in a reflection on his own career in the South African lectures (Tinto, 2014). Tinto (2014) concludes that solutions to student success should be centred on the experience of students on campus and their engagement with lecturers, primarily their experience in the classroom. Boles and Whelan (2017) also identify the teaching and learning relationship between students and lecturers as critical to student success, and emphasise that these interactions happen both inside and outside the classroom.

Many authors also acknowledge the importance of factors that are beyond the control of the classroom, such as financial pressures on students, pre-tertiary education which does not sufficiently prepare students for the technical requirements and values of engineering studies, lack of career guidance, large class numbers, and psycho-social factors for individual students (e.g., Tinto, 2014; Mogashana, 2015; Ahmed, Kloot & Collier-Reed 2015; Boles and Whelan, 2017; van der Merwe and Maharaj, 2018). We note that this array of factors are reported in most contexts in the student success literature. However, an important difference between the African context and wealthier countries is the extent to which these factors affect the majority of students at a university rather than the minority, and also the availability of institutional resources (both budgetary and personnel) which would allow universities to mitigate these factors.

In Africa, most universities which teach engineering and STEM are elite institutions in their countries, but nonetheless struggle with resource constraints. Students come from disrupted and unequal schooling, many with constrained financial resources, and the student body contains multiple dimensions of diversity and inequality, depending on local context, including socio-economic inequality, race, gender and first generation university students. (Mogashana, 2015; Wuhib, 2017; Adjei, 2019).

A number of African studies emphasise stories of success, focusing on how different groups of students overcame structural and cultural constraints, as exemplified by Mogashana's 2015 study of the agency of Black South African students. Resilience is identified as an element of success in Adjei's 2019 research on the persistence ("hustling") of low income STEM students in Ghana. Wuhib (2017) describes how residential communities impact the success of women in STEM in Ethiopian public universities.

We aim to broaden the sources and the types of narratives that are captured, and to situate South African experiences among multiple sub-Saharan African contexts. In this paper we

report on the first phase of this research, in which we used an online focus group to explore the perspectives of experienced engineering educators from three African universities. Our research question asks *How is student success understood across different contexts in African engineering institutions?* The outcome of this preliminary research is to identify critical areas for our ongoing investigation, and to develop an interview guide for interviews and focus groups with a wider group of participants.

Theoretical framework

The literature on student success agrees that it is a phenomenon where the interaction between structural, socio-cultural, and individual factors is important, and therefore Bourdieu's theory was proposed to analyse the data. This paper aims to evaluate whether the sociological notions of **field**, **capital** and **habitus** are effective for interpreting African engineering educators' discussions of the factors influencing student success.

According to Bourdieu's theory of practice (Bourdieu, 1977), social practice is the result of an interdependence between the habitus of the individual, the field in which social interactions occur, and the capital which is valued. The **field** is a space defined by the specific capital which is valued, and by specific rules for obtaining capital. **Capital** may be viewed as the assets (cultural, social as well as economic) which, when possessed, enable membership of the field. The **habitus** of the individual (which is related to agency) is the set of embodied patterns of behaviour that the individual has acquired through all the fields in which they have participated. The habitus is influenced by experiences, values, beliefs, and education, as well as factors such as gender, race and religion.

Student success can be explained in Bourdieu's terms as a product of student **habitus** meeting the **field** of university structures, which value certain forms of cultural and social **capital**. Student habitus is shaped by interactions with the field in the past and present, and shapes the field in the future (Crossley, 2001; Raey, 2004). We can understand this interaction by seeing how lecturers' habitus has been shaped by their past experience of the field as students, and then how their habitus influences the field for future students. Thus, student success is a function of habitus, but habitus is influenced by field. Bourdieu himself has used the notions of field, capital and habitus to study the success of students in Algeria (Bourdieu & Wacquant, 1992), addressing the subject of the reproduction of inequality through education.

Methodology

We selected a focus group because we wanted to open the conversation without too many preconceptions about what the answers would be. We aimed to have a broad, general conversation in a context where there is not extensive literature. The medium of an online focus group, including people with similar levels of experience in the same conversation, allows the participants to make connections and highlight disparities between their different contexts. We obtained ethical clearance for this project from the Faculty Research Ethics Committee at the University of Pretoria, and all participants gave informed consent.

Participants

We recruited three participants to whom we have given pseudonyms of Frida, Lerato and Michael. We contacted the participants via email, in which we explained the project and invited them to participate in a one hour online focus group. We chose the participants using purposeful sampling (Emmel, 2013), with variation between different countries and contexts in Africa. The sampling also has a homogeneous component, as all our participants have played multiple roles in engineering education, with experience of teaching, administration, mentorship as well as research, and all have at least 10 years of experience as engineering educators.

Frida is a lecturer at a rural university in Uganda, University A, with fewer than 5 000 students. Besides her lecturing responsibilities, Frida gives support to students and staff with the learning management system and library resources, mentors students, takes a lead in guiding students to find internships for industrial training, and is a patron of the student professional association. Lerato is a lecturer at a well-resourced urban university in South Africa, University B, with more than 25 000 students. Lerato supports students to overcome non-academic challenges, and has published research in the field of student success. Michael is a lecturer at an urban university in Tanzania with more than 15 000 students, University C. Michael has played a range of roles, including registrar, assisting students with challenges as part of the registration process, coordinator of student practical training, and examination officer.

Data Collection and Analysis

The data was collected in a focus group on an online platform which lasted one hour. The focus group was recorded via the online platform, and sent to an outside consultant for transcription. Both researchers acted as facilitators during the focus group. The session began by reminding the participants of the overall purpose of the discussion:

What are the factors associated with student success in your context, from your perspective and experience?

The discussion focused on three themes: defining student success, identifying the factors that affect student success, and understanding the impact of diversity on student success.

Initial analysis was done by the researchers based on their informal notes from the session, identifying overarching themes that they noticed during the discussion. The transcription was coded using inductive coding (Braun and Clark, 2006), and the common themes were then developed.

Limitations

This first phase of the planned larger study is necessarily limited by our methodological choice to begin with a single online focus group. The participants in this study come from Anglophone countries in Southern and Eastern Africa. This paper is thus missing perspectives from West Africa, and from Lusophone and Francophone countries. We also do not capture student perspectives.

Results

In this section, we describe the understanding of student success that we gained from our focus group. We then discuss the range of factors that impact this success. Throughout our presentation of the results, we will highlight the multiple categories of diversity that run through this data.

What is understood by “student success”?

When defining student success, the participants spoke of three broad aspects: firstly, the concrete success of passing exams and gaining the qualification; added to that, the deeper success of gaining the requisite knowledge and skills for the profession; and finally, the development of the whole person. Lerato expressed this multi-layered understanding: “So success is more than just about the qualification, success is about what they overcome in the process of becoming.” These interconnected and nested definitions of success are all expressions of the **field**, and what the field values: students move from the field of their pre-tertiary education, through the field of the university, and onwards to the field of professional life. In this paper we focus our understanding on the field of the university, but the values of pre- and post-tertiary fields exert an influence.

Student success understood as passing the exams

The first, and most obvious aspect of student success is that a student who passes the exams and gains the qualification is a student who has succeeded. Valuing this aspect of success can be problematic, with students and the institution focused only on surface achievement, as Michael challenges: "...it leads now the students towards studying to pass exams only."

Student success understood as gaining the requisite knowledge and skills

Michael expressed most clearly the second aspect of student success, "To me student success is when a student is ... able to acquire the relevant knowledge and skills". The idea of what this knowledge and these skills are is broadened by Frida, who notes the importance of students "being able to leave a better person, in terms of how they interact with others, how they look at problems, how their critical thinking is." She references the demands of the post-university environment:

... industrial training feedback that we get usually has issues around non-readiness of the student, especially in terms of the soft-skilling aspects – leadership, communication, report writing – as opposed to the technical aspects, whereby somebody is a good programmer but they are not a good team player.

Student success understood as development of the whole person

Lerato and Frida both emphasised the importance of a holistic understanding of the growth of the individual student, rather than just focusing on their academic performance in understanding student success. Frida identifies success with the student having a sense of purpose, "It's about a student being able to discover who they are in the first place so that they are able to pursue that which is really at the centre of their heart." This reminds us that university studies do not define a person's success. This broad understanding of student success moves away from a focus on the **field**, towards an emphasis on **habitus**: the student's preferences and agency are also important.

Lerato problematises these definitions of student success, pointing out that student perceptions of success are diverse, and related to class and privilege. For students from poor, working class backgrounds, success is often directly related to obtaining the qualification and gaining employment. In contrast, students from middle-class backgrounds may focus more on ideas of excellence, and whether they are at the top of their class. This connects student success with interacting concepts of social, cultural and economic **capital**.

Factors that influence student success

Student success is a complex phenomenon that is sensitive to inequality, with systemic as well as individual contributors. In contrast to Tinto's primary emphasis which is on the student classroom experience (Tinto, 2014), our participants focused on issues outside of the classroom, as Lerato explains:

...it doesn't matter if a lecturer does the best tutorial or [has] the best teaching methods or ... [has] given the best explanation on a concept. If you are hungry, if you are worried about whether your parents are eating at home or not, if you're worried about where you are going to sleep ... if you are worried about who's going to pay your fees, ... , it doesn't matter how great the lecturer, the teaching and learning circumstances can be, you can still fail.

We begin by considering the economic circumstances of the universities, and then focus on the economic circumstances of students, their educational and social backgrounds, as well

as psychological factors which affect individual students. We end by identifying the institutional support structures which universities have put in place to address these factors.

Institutional resources

Our participants reported challenges relating to the economic circumstances of their particular universities. Frida and Michael both mentioned limitations experienced with facilities such as labs, access to technology and library resources. They expressed their opinion that student success is negatively impacted by understaffing. Michael perceived his university as having a lower lecturer to student ratio than others in Tanzania. This draws attention to the importance of the diversity of economic circumstances between different universities. It is noteworthy that our participant from University B in South Africa did not comment on resource limitations to student success.

Economic factors for students

A strong emphasis among the participants was the contribution of a student's economic circumstances to their success. Financial insecurity can have a direct impact on academic performance, from the beginning of the semester, when lack of money delays registration, to the end of the semester when uncertainty about financial qualification for final exams affects students' preparation. In addition to lack of finances to pay fees, participants highlighted that some students lack the money to meet their basic needs, including adequate food, hygiene and accommodation. This impacts their wellbeing and indirectly affects their academic performance.

The financial situations of students are diverse within each university, with some students having the resources and the security of a comfortable home as well as access to convenient transport, while others lack the basics. Frida reminds us that, "While some of the ones from the challenging backgrounds will still thrive as well, but maybe their level of effort to get there is really deeper."

Educational background

The diversity of student's pre-tertiary education impacts their alignment with the expectations of engineering study at university. Lerato comments on two parallel education systems in South Africa, with a well-resourced elite sector and a large poorly-resourced public sector. She notes that for students from marginalised backgrounds it is not as easy "to assimilate into this university structure." Frida notes that, "the secondary schools that they come from matter" in Uganda, with students from "really deep, up-country village schools" lacking the exposure of students from urban schools. Michael also addresses the rural / urban divide in Tanzania, when he contrasts the expectations of students from the urban area, who "have that privilege of being ready, or at least they know what they are going for," with those of students from remote, rural areas, who "have a different sense of academic success." This misalignment was partially attributed by our participants to a lack of clear expectations of engineering. Michael points out that "...at the university we don't have a well-structured way of introducing the students to the engineering courses... We fail to prepare the students in terms of career guidance."

Students require particular language, knowledge and skills in order to succeed in their engineering studies. This includes proficiency in Maths and Science at secondary school. Our participants also identified the problems faced by students who are not familiar with computers, or who struggle with a language barrier: "... whereas they are trying to learn the language, they also have to understand the content and there's no extra room for them to be able to learn one thing and then be able to perform it very well as others" (Frida).

Social background

The social background of students, including their socio-economic class, their social beliefs around education, and the educational experiences of their communities affect their expectations of engineering and of university. In Tanzania, students may be selected for

engineering without knowing what it is, and although they have strong skills, they struggle because they do not have exposure to engineering. In South Africa, race and class are interlinked, but Lerato says that class is now becoming a bigger factor in predicting engineering student success. The children of well-educated black middle class parents have privilege both from their elite education and their cultural and social knowledge of engineering that advantage them over other black students.

Students' success will be impacted by their well-being, which is a function of many factors. We have already mentioned the impact of finances and of educational and social alignment with the university. Students also experience unique circumstances and difficulties related to their health, their personality, social problems, anxiety levels, stigma, and trauma due to life and family events which may interrupt or affect their studies. We see that a student's social background and individual circumstances determine the **cultural capital**, **social capital** and **habitus** they bring to the **field**.

Institutional support structures

Each university attempts to mitigate the impact of financial, educational, social and psychological factors on student success through a variety of strategies. These support structures vary between the three universities. University B in South Africa is able to dedicate resources to formal student support, with dedicated specialists providing psychological, academic, as well as personal services. In contrast, at University A and University C, this type of support is provided by the lecturing staff. At these universities, each lecturer mentors a certain number of students across all departments in the faculty and provides academic guidance as well as pastoral care throughout the course of their study program. Participants also spoke of informal structures such as student associations, which build leadership and interpersonal skills outside of the classroom.

Discussion

In our discussion of the results we explore and identify the ways in which Bourdieu's concepts of field, capital and habitus are important to deepening our understanding of student success.

The notion of **field** is important because it helps us to understand the student's context, as engineering students in a particular university. The university interprets and presents the language and culture of engineering education in a particular way, that is informed by the country and context in which the university is located. The students enter the field of the university from different fields, their pre-tertiary education, the community they grew up in, as well as the society in which they live. For some students, the transition between these fields is happening every day.

The field is not simply the institutional structure, but is shaped and informed by the perspectives and actions of the lecturers. For instance, the different ways in which Frida, Lerato, and Michael understand success may change the field by changing what is valued by the students, although these are in competition with other less mutable structures which also influence student values. The future field that they will enter after graduation also impacts the student perspective of success.

When we talk about the language and culture of engineering, as well as discussing what lecturers and students value, we are expressing the importance of **capital**, which includes cultural capital and social capital (Bourdieu & Wacquant, 1992). The cultural capital which is valued in the field of the engineering university includes background knowledge in science, language proficiency, technical language, norms and implicit expectations. Social capital captures the relationships that students have with the field, and with power, including the respect they receive due to financial resources, or the stigma they experience due to their lack of power or resources, or their perceived difference from the valued norm. From our high level perspective, we see that social and cultural capital are difficult to separate out, and are

transferable if you have them. Having capital that aligns with the institution is important for student success.

We do not see strong evidence of student **habitus** (agency) in our participant narratives, although it does appear in some particular examples. This is partly a consequence of the high level conversation that we engaged in, which has not allowed us to capture the ways in which the field has affected student habitus. This is an area which should be addressed in future research, through interviews with students. We have however discussed the interaction between field and habitus in talking of the influence of the habitus of our participants as lecturers in shaping the field of their universities. In future research, we need to distinguish between the habitus of the academic, which plays such an important role in the field, and the habitus of the student.

Conclusions and Recommendations

Our research has investigated student success through the perspectives of engineering educators from three different African universities, in different countries and with distinct local contexts. We have explored varying definitions of student success. We have identified factors that affect student success, adding an understanding of how local contextual details nuance the existing literature. We have demonstrated that Bourdieu's notions of field, capital and habitus can give valuable insights into these questions, and will provide an appropriate theoretical framework for the second phase of the study.

We have identified three important areas for questioning in future semi-structured interviews and focus groups: inequalities and diversity; mentoring and other formal and informal engagement between lecturers and students; and the alignment or conflict of lecturers with their university.

This preliminary research has highlighted the need to critically interrogate *inequality* in our future research. Success in engineering education is particularly sensitive to inequality because of how strongly it depends on the capital and habitus of the individual, acquired in the field of their pre-tertiary education and experience. Although the different contexts identified varying sources of diversity, the impact of socio-economic class was present in all the participant narratives. In our investigation of inequality we need to interrogate the meanings of 'rural' vs 'urban' more deeply to understand what is implied by this framing, as well as how this interacts with socio-economic class. We also believe it is important to characterise the inequalities that exist between universities in a country and in the region.

We will examine the formal and informal ways that students are *mentored*, as this is the core of the institutional strategies which our participants reported to improve student success. This will include investigating the training of mentors, and their effectiveness, as well as scrutinising the role of gender in the mentoring relationship. We will also consider the role of student associations in student development.

The habitus of the *lecturers* will be probed, in order to better understand the ways in which lecturers influence the field.

Our future research will include a broader literature review, considering multiple search avenues beyond electronic database searches. Our future research participants should include groups of participants from a single country or region, to understand the importance of different institutional contexts within a shared regional context, as well as participants from a wider range of countries to further investigate the similarities and differences between countries. We will aim for diversity in the gender of our participants, and in their relationship to formal power within the university.

References

- Adjei, M. (2019). *Hustling narratives: Navigational capacities of first-generation, low-income African students* (Doctoral dissertation). Available from ProQuest Dissertations & Theses Global database. (UMI No. 13902756)
- Ahmed, N., Kloot, B. & Collier-Reed, B. I. (2015). Why students leave engineering and built environment programmes when they are academically eligible to continue. *European Journal of Engineering Education*, 40(2), 128–144.
- Boles, W. & Whelan, K. (2017). Barriers to student success in engineering education. *European Journal of Engineering Education*, 42(4), 368–381.
- Bourdieu, P. (1977). *Outline of a theory of practice*, tr. Richard Nice. Cambridge: Cambridge University Press.
- Bourdieu, P. & Wacquant, L. J. (1992). *An invitation to reflexive sociology*. Chicago, IL: University of Chicago Press.
- Braun, V. & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101.
- Crossley, N. (2001). The Phenomenological Habitus and Its Construction. *Theory and Society*, 30(1), 81–120.
- Emmel, N. (2013). Purposeful sampling. In *Sampling and choosing cases in qualitative research: A realist approach* (pp. 33-44). London: SAGE Publications Ltd.
- Mogashana, D. G. (2015). *The interplay between structure and agency: How Academic Development Programme students 'make their way' through their undergraduate studies in engineering*. (Doctoral thesis, University of Cape Town, Cape Town, South Africa). Retrieved from <http://hdl.handle.net/11427/16601>.
- Reay, D. (2004). 'It's all becoming a habitus': beyond the habitual use of habitus in educational research, *British Journal of Sociology of Education*, 25(4), 431-444.
- Tinto, V. (2014). Tinto's South Africa lectures. *Journal of Student Affairs in Africa*, 2(2), 5–28.
- Van der Merwe, A. & Maharaj, B. (2018). *Factors affecting engineering student success*. Paper presented at the 2018 World Engineering Education Forum - Global Engineering Deans Council (WEEF-GEDC), Albuquerque, NM.
- Wuhib, F. W. (2017). *The role of residential communities for the academic and social success of undergraduate women in STEM majors: The case of a public university in Ethiopia*. (Doctoral dissertation). Available from ProQuest Dissertations & Theses Global database. (UMI No. 10270982)

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