



Research in Engineering Education Symposium (REES)
Regional Conference in Engineering Education (RCEE)
& Research in Higher Education (RHed)
September 29 – October 3, 2025
Johor, Malaysia



Work-in-Progress: Contextualising Graduate Outcomes for African Engineering Education

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ABSTRACT

BACKGROUND & CONTEXT

In response to a growing global emphasis on integrating relevant competencies into engineering curricula, African Higher Education Institutions (HEIs) are beginning to transform their education systems, moving from content-based curricula to Outcome-based Education (OBE).

PURPOSE OR GOAL

Successful implementation of graduate competencies in an OBE curriculum involves multiple stakeholders, including the industry, accreditation bodies, curriculum developers and teaching faculty. This study seeks to establish a framework for establishing locally-contextualised competencies.

PROPOSED METHODOLOGY

Beginning with sets of published engineering graduate outcomes, we will work with a broad range of stakeholders from local industry, universities and professional bodies to prioritise and contextualise competencies, paying attention to language diversity. We expect to collect a range of opinions and experiences from different African contexts. This will help us in characterizing the landscape and learning from each other.

CONCLUSION

It is expected that the findings of this research will aid any countries within Africa aiming to transition to OBE as they research on integrating competencies into their engineering curricula.

KEYWORDS

Outcomes-based education, graduate competencies.

Introduction

A growing global emphasis to integrate graduate competencies into Higher Education (HE) curricula has necessitated the need for African Higher Education Institutions (HEIs) to transform their education systems. Several African countries have moved from a content-based curriculum to adopt an Outcome-based Education (OBE) approach (COREN, 2020). In many countries the need to move to OBE is being discussed (e.g., Moi University, 2025) because of the need to develop engineers with the requisite skills and attributes to meet the demands of complex engineering work in a global marketplace (EduTimes Africa, 2025).

An important part of developing an OBE engineering curriculum is to articulate clear program outcomes that students need to present upon graduation. These are usually derived from the outcomes, competencies or attributes that are prescribed by national or international accreditation bodies, or from educational frameworks such as CDIO (Crawley et al. 2014). However, adopting outcomes directly from international frameworks may not be effective. Imposing outcomes on an existing curriculum without redesigning the program to be well-aligned with the chosen outcomes will not result in the desired changes in graduate skills and attributes. Importantly, the prescribed outcomes may also not align with the requirements of local industry or national priorities. For an outcome-based approach to produce results, it is important that the competencies are widely agreed upon and broadly understood in the country and community where they are applied.

This work originates from a larger project on outcomes-based curriculum for engineering education in Africa, investigating policy (Matemba et al., 2025), educational contexts, and the resources required for the effective implementation of OBE. This work is important in Africa, where engineering programs are inconsistently regulated and accredited across the continent. As African HEIs transform their education systems, benchmarking with other institutions in the continent operating within similar contexts is important to guide and improve the processes involved.

The purpose of the current work is to outline a framework for developing contextually relevant engineering graduate outcomes in Africa. In this paper we identify the types and sources of data which should be collected to define and articulate contextually relevant competencies at national and regional levels.

Literature Review

Accreditation of engineering programs in most African countries is generally not done at program level by a professional (engineering) accreditation body, but rather institutions are accredited to offer degrees by the national education accreditation body. In addition, the participation of professional bodies or communities is low despite having the mandate (Matemba 2020). While many countries are moving towards adopting Outcomes-Based Education (OBE), it is important that the outcomes for engineering graduates be aligned with international best practices.

A few countries are members of international agreements such as the Washington Accord, through the International Engineering Alliance (IEA). South Africa has been a signatory of the Washington Accord (WA) through the Engineering Council of South Africa (ECSA) since 1999, and has well-established standards for required graduate attributes, and program-level accreditation of engineering degrees. Nigeria has been a provisional signatory of the WA through the Council for Regulation of Engineering in Nigeria (COREN) since 2023, and Mauritius has been a provisional signatory of the Washington Accord through Institute of Engineers Mauritius (IEM) since 2024. For countries which are trying to become members of international agreements, the transition to OBE is mandatory.

Nevertheless, even without the pressure of international accreditation, the need to transition to OBE is inevitable for African engineering programs. Research shows that when OBE is well-implemented it improves overall education quality by promoting well-structured curriculum

planning and alignment of assessment with learning outcomes (Qadir et al., 2020). The criticisms of OBE, that it is too rigid, and that it places too many demands on educators, point to the need for a coherent strategy for developing contextually relevant outcomes and investing effort in associated curriculum review.

The importance of context in defining graduate outcomes is well-established in the engineering education literature. For instance, a study of competency deficiencies in Australian graduates found that the competence gaps in Australia were different from those reported from the UK and USA (Male, Bush & Chapman, 2010). Lucena et al. (2008) compared the re-organisation of engineering education between the US, Europe and Latin America. They observed that countries in Europe and Latin America were having conversations regionally about competencies in relation to national and regional identities and industries. In contrast, the USA established competencies that were aligned with multinational corporations, and saw global, rather than regional, integration as the priority. The re-definition of competencies is therefore not universal even for signatories of the same agreements, and depends on the history and priorities of educational institutions and regulating bodies.

It is important to note that transitioning to OBE will not solve the problem of a lack of skills without transforming curriculum and pedagogy in African HEI's. Walther and Radcliffe (2007), studying the competence gap between engineering graduates and industry needs, note that holistic competence development requires the conceptualisation of engineering education programs as complex systems. Wolff and van Breda (2024) call for the development of educators who can train students as they develop competencies holistically and relationally. Passow and Passow (2017) also note that competency development will happen in redesigned engineering programs which prepare students for the jobs outside of work.

Proposed Methodology

This section presents a framework for the process that we will follow to develop contextualised competencies for engineering graduates in African countries and HEIs. We will begin by identifying a set of engineering competencies. These notably include both technical competencies (for example, applying scientific and engineering knowledge) as well as professional competencies (for example, teamwork, business skills). To reduce contextual bias, we will synthesise this set from a range of widely used competency standards (e.g., IEA, 2021; Woodcock, Callewaert & Millunchick, 2021; Passow & Passow, 2017; Woollacott, Patil & Gray, 2009), defining a foundational set of competencies for further engagement.

We will work with a broad range of stakeholders to prioritise competencies for local contexts, and to define competencies using words and examples which are relatable. We emphasize that competencies should be defined in simple and clear terms using examples to accommodate language diversity. Using interviews and surveys we will consult advisory boards; industry partners; community representatives; recent graduates; as well as academic staff and students.

Stakeholders will be asked to define and share their insights regarding what competencies they consider critical in their specific context. We will ask questions such as “What do engineers do in this company on a day-to-day basis?”, “Can you give an example of this competency in your workplace?”, “What do you understand by...?” Additionally, existing documentation such as job postings will be reviewed to understand industry expectations. These sources will help to articulate the competencies clearly and unambiguously, and to identify the competency gaps within local contexts.

The study will begin with specific universities in a limited number of African countries, so that we can pilot the survey methodology and data analysis process. We will then share the survey more broadly, including members of the Engineering Education Research Network Africa (EERN-Africa) – a community of practice comprising engineering education researchers and practitioners from over 20 African countries.

Ethical clearance will be sought from the relevant ethical review boards at each participating university or from national governments where applicable.

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